



# **BIOLOGICAL ASPECTS OF LEAD:**

**AN ANNOTATED BIBLIOGRAPHY**

**PART 1**

**ENVIRONMENTAL PROTECTION AGENCY**



# BIOLOGICAL ASPECTS OF LEAD: AN ANNOTATED BIBLIOGRAPHY

Literature from 1950 through 1964

## PART I

### FOR REFERENCE

Do Not Take From This Room

IRENE R. CAMPBELL AND ESTELLE G. MERGARD

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## PREFACE

The Kettering Laboratory of the University of Cincinnati, where this bibliography was compiled, was founded in the mid-1920's by Dr. Robert A. Kehoe, a researcher whose primary interest was the investigation of the problems associated with the manufacture and use of tetraethyllead. An essential part of Dr. Kehoe's program was the development of a large collection of the literature on lead and its compounds, a collection from which most of the abstracts in this bibliography have been prepared. It is only fitting, therefore, that this bibliography be dedicated to him.

Systematic collection of the worldwide lead-related publications was initiated in 1932 by Nell Conway, whose background was in scientific literature and foreign languages. She also translated many of the classic works and other articles required by the members of the Kettering Laboratory in the pursuit of their investigations. In 1944, Irene R. Campbell assumed the responsibility for directing the bibliographic research program, and the preparation of abstracts - first very brief, then more informative - began shortly thereafter. With the help of Estelle G. Mergard, this bibliography, covering the years 1950 through 1964, is presented as a health information service to the scientific community.

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A work of this scope could not have been performed without the assistance of many individuals and the services of many libraries. The helpfulness and courtesy of the staffs of the following are deeply appreciated: The Medical Center Library and the other libraries of the University of Cincinnati; the Public Library of Cincinnati and Hamilton County; Lloyd Library and Museum; the libraries of the Merrell Company; Procter and Gamble Technical Information Center; Environmental Protection Agency National Environmental Research Center; National Institute of Occupational Safety and Health; Center for Research Libraries; and the Kentucky-Ohio-Michigan Regional Medical Library. Among the full-time staff of the Division of Bibliographic Research, Evelyn M. Widner, Librarian, deserves particular acknowledgment for her help in setting up references to publications other than periodicals, and in channeling requests for original material. The contributions of other members of the staff who assisted in this work are also acknowledged.

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# BIOLOGICAL ASPECTS OF LEAD: AN ANNOTATED BIBLIOGRAPHY

## INTRODUCTION

### SCOPE OF CONTENTS

Lead poisoning was recognized by the early Greeks, and, according to Flury,\* by 1930 the volume of published literature on the subject exceeded 10,000 items. As told by Flury, the physicians of ancient times and the Middle Ages relied upon the obvious signs of lead poisoning, i.e., colic, paralysis, gray skin color, and decreased urine volume. Only in the past two or three centuries were attempts made toward a systematic medical work-up. The French, particularly L. Tanquerel des Planches, are credited with describing, in the first half of the 19th century, the complete clinical picture of this disease, although progress in diagnosis and pathology did not begin until about 1870. Between 1900 and 1930, important advances were made toward the recognition of excessive absorption of lead, toward the understanding of its metabolism, and toward the treatment of poisoning; however, the most significant contributions to the study of the metabolism of lead and its physiological effects, particularly of the quantitative aspects, have been made since 1930. In view of the volume of publications since that date, it seemed desirable to restrict this publication to the more recent years, 1950 through 1964. That period was important because further refinements were made in biochemical and cytochemical techniques. In addition, the use of the newer chelating agents was significant not only in the treatment of poisoning by heavy metals, but in giving added insight into the mechanism of their action on the organism.

Although most of the references on file were annotated, many of the abstracts had to be revised to give more quantitative data with regard to conditions of exposure, or to indicate the lack of these data in the publication. This extensive revision was necessary because many references attributed bizarre diseases to exposure to, or poisoning by, lead, but provided no data to show the magnitude of the exposure. Although our collection of references included a large number of original publications, many references had to be obtained to verify information contained in them or to prepare abstracts. Published abstracts were used when original publications, particularly those of secondary interest, were not available. Most of these abstracts are from Chemical Abstracts, Bulletin of Hygiene, Biological Abstracts, Excerpta Medica, and Nuclear Science Abstracts. Use of these abstracts was with permission of the publishers, and is acknowledged at the end of the reference or abstract.

The material included essentially represents the scientific periodical literature covered by the principal abstracting and indexing services. Chapters in books

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\*Flury, F.: *Blei. Handbuch der Experimentellen Pharmakologie*, A. Heffter and W. Heubner (Eds.), Berlin, Springer, 1934, Vol. III, Pt. 3, pp. 1575-1889.

are not included; however, entire books devoted to lead and its compounds, or to proceedings of conferences and symposia, are included. Letters to editors and published items or comments that do not contribute to scientific knowledge, or that are ephemeral in nature, are excluded. Since lead is contained in many minerals, inclusion of articles on this subject has been limited to reviews, except for those articles that refer specifically to environmental contamination. Inclusion of works on analytical methodology is limited to those concerned with the determination of lead in air, biological materials, foods and beverages, drugs, and water, and to those concerned with the analysis of metabolic indicators of adverse effects (e.g., porphyrins).

The abstracts are not intended to be evaluative. They are designed to convey the conditions, procedures, and findings of the investigations, as well as the conclusions of the authors.

## ARRANGEMENT OF THE MATERIAL

A brief explanation of the contents of some of the sections may be helpful to those who use this publication. Section I includes abstracts of books, historical publications, proceedings of conferences, and general reviews. Specific reviews and discussions are included in the sections dealing with those aspects (e.g., reviews of signs, symptoms, and cases of clinical poisoning appear in Section IV, Man). Section II covers lead in the environment, including contamination of food by utensils and pesticides, and contamination of home water supplies by lead pipes, cisterns, etc. Abstracts of reports on industrial atmospheres and occupational exposure are given in Section V; related medical information (case reports, medical surveys, etc.) is covered in Section IV. Section VI includes pollution by lead of air, soil, and water, and the effects of such pollution on humans, animals, and plants under actual (field) conditions of exposure. Section VII covers legal matters, regulations, and recommendations for threshold concentrations, maximum allowable concentrations, drinking water standards, and tolerance limits for food products. Section X is confined to chemical reviews, reviews of technological developments, and works dealing with specific chemical properties and syntheses of new compounds.

The abstracts are arranged chronologically within each section by year of original publication, and alphabetically within each year by author.

Availability of published English translations, even when issued in later years, is noted together with the entry of the original publication. Transliteration from Cyrillic languages follows the form used in Chemical Abstracts. Author and subject indices are provided to facilitate the use of this bibliography.

## ABBREVIATIONS AND SYMBOLS

Å	Angstrom unit	mM	millimole
av	average	mμ	millimicron
°C	degree Celcius	MTD	minimum tolerated dose
cc	cubic centimeter	nCi	nanocurie
Ci	curie	pCi	picocurie
cm	centimeter	ppb	parts per billion
°F	degree Fahrenheit	ppm	parts per million
g	gram	sc	subcutaneous
ia	intraarterial	SD	standard deviation
im	intramuscular	SE	standard error
in.	inch	TD	tolerated dose
ip	intraperitoneal	TLV	threshold limit value
iv	intravenous	U	unit
kg	kilogram	α	alpha
km	kilometer	β	beta
LC	lethal concentration (air)	δ	delta
LD	lethal dose	γ	gamma
m <sup>2</sup>	square meter	σ	standard deviation
m <sup>3</sup>	cubic meter	μ	micron
M	mole or molar	μCi	microcurie
MAC	maximum allowable concentration	μeq	microequivalent
mCi	millicurie	μg	microgram
meq	milliequivalent	~	about, approximately
Mev	million electron volts	<	less than
mg	milligram	≤	down to or less than
mg%	milligrams per 100 g, ml	>	more than
mi	mile	≥	up to or more than
ml	milliliter	±	plus or minus
MLD	minimum lethal dose	/	per or over (in equations)
mm	millimeter	:	to (in sense of ratio)

The more common abbreviations of lengthy biological components or substances, if not first defined in abstract, are found in the Subject Index.





## I. BOOKS, MONOGRAPHS, AND PROCEEDINGS

### 1950

- 1 Agricola, G.: DE RE METALLICA. Translated from the 1st Latin Edition of 1556 by H.C. Hoover and L.H. Hoover. New York, Dover, 1950, 638 pp.

As stated in the title page, the translation is appended by Hoover with extensive annotations and appendices on the development of mining methods, metallurgical processes, geology, mineralogy and mining law from the earliest times to the 16th century. The descriptions of the various processes and operations are accompanied by a large number of illustrations. The first reference to Pb in the index (entered as "censure") states that Pb was claimed by Horace to be a "pestilential and noxious metal," for men were punished by means of molten Pb. The processes described include cupellation, melting prior to liquation, refining silver, smelting, use in assaying, washing in sluices, use of Pb ash as flux, in separating gold from Cu; Pb baths, Pb glass and granules; Pb ore assay and processing; Pb ochre. One of the illustrations (p. 474) shows a furnace for the extraction of litharge, with a man tending the furnace and another one sitting at a table. The legend states: "The foreman when hungry eats butter, that the poison which the crucible exhales may not harm him, for this is a special remedy against that poison."

- 2 Beintker, E. (Germany): Arbeitsmedizin bei Jean Paul. (OCCUPATIONAL MEDICINE, AS DESCRIBED BY JEAN PAUL.) Archiv für Hygiene und Bakteriologie 132:189-96, 1950.

Some comments to be found in the literary work of Jean Paul Friedrich Richter (1763-1825) relating to the sanitary working conditions of craftsmen and laborers are summarized. These begin with those applying to Pb, then extend to As and other metals, employment of children, and other problems. These comments give an idea of the problems which were of interest 150 yr ago.

### 1952

- 3 Gesellschaft Deutscher Metallhütten- und Bergleute e.V.: Vorträge und Diskussionen bei der Informationstagung über die Bleikrankheit. (ADDRESSES AND DISCUSSIONS PRESENTED AT THE SYMPOSIUM ON LEAD POISONING.) Frankfurt a.M., September 12, 1952, Publication No. 3. Clausthal-Zellerfeld, 1952, 121 pp.

This Symposium was sponsored jointly by the Society of German Metalworks and Mine Workers and the German Society for Work Safety. The papers presented were the following:

Feiser, J.: Eröffnung der Tagung (OPENING REMARKS), 1-2.

Fieke (Miners Union, Clausthal-Zellerfeld): Die Bleikrankheit im Spiegel der berufsgenossenschaftlichen Statistik (LEAD POISONING FROM THE POINT OF VIEW OF TRADE UNION STATISTICS), 3-17; discussion, 18-22.

Heidepriem, C. (Goslar): Vorbeugende Untersuchungen auf Bleigefährdung (MEDICAL PREVENTION OF LEAD POISONING RISK), 23-36. (The material presented was based on the publication by Heidepriem and H. Breustedt, 1952) Discussion, 37-47.

Buckup, H. (Bochum): Prophylaktische und therapeutische Massnahmen (PREVENTIVE AND THERAPEUTIC MEASURES). 48-58.

Holmqvist, I. (Skelleftehamn, Sweden): Prophylaktische Massnahmen zur Vorbeugung von Bleikrankheiten. Einige Erfahrungen von der Hütte Rönnskär der Bolidensgesellschaft in Schweden. (PROPHYLACTIC MEASURES FOR THE PREVENTION OF LEAD POISONING. EXPERIENCE IN THE RÖNNSKÄR SMELTER OF BOLIDENS COMPANY IN SWEDEN), 59-69; discussion, including Holmqvist's paper, 70-6.

Tillmann, K. (Works Physician, North-German Refinery, Hamburg): Symptome von Bleierkrankungen (SYMPTOMS IN LEAD POISONING), 77-89; discussion, 90-6.

Danielsson, A. (Skelleftehamn, Sweden): Eine Methode zur Bestimmung von Blei im Blut mittels Spektralanalyse (A METHOD FOR THE DETERMINATION OF LEAD IN BLOOD BY SPECTRAL ANALYSIS), 97-103; discussion, 104-7.

Feiser, J. (Works Director of Lead-Copper Works Oker): Betriebliche Schutzmassnahmen gegen Bleierkrankungen (PROTECTIVE MEASURES IN INDUSTRY AGAINST LEAD POISONING), 108-15; discussion, 116-21.

- 4 Kirk, R.E., and Othmer, D.F., ed: ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY. New York, Interscience, 1952, Vol. 8.

The section on Pb is reviewed as follows:

Jones, T.D. (pp 217-53): Lead. The review covers the physical and chemical properties; analysis; occurrence; smelting; Pb refining; health and safety. The latter is briefly stated as to technical measures; reference is made to the discussion on Pb poisoning.

Hack, C.H. (pp 253-66): Lead alloys. This article discusses the properties and uses of the various grades of Pb and Pb alloys and the consumption of Pb in the US by industries in 1948 and 1949.

Thompson, A.P. (pp 267-74): Lead compounds - Inorganic lead compounds. The compounds covered are: Pb acetate, basic and basic tetraacetate; arsenate; azide; halides; carbonates; chromates; formate; nitrates; oxides; silicates; sulfates.

Sturgis, B.M. (pp 274-81): Tetraethyllead.  
Princi, F. (pp 281-88): Lead poisoning. The following are reviewed: history; industrial exposure; intoxication by inorganic compounds; TEL poisoning; engineering control; medical control.

- 5 Lead Industries Association: LEAD IN MODERN INDUSTRY. MANUFACTURE, APPLICATIONS AND PROPERTIES OF LEAD, LEAD ALLOYS, AND LEAD COMPOUNDS. New York, Lead Industries Association, 1952, 230 pp.

The book starts with the history of Pb and proceeds from mining to its applications in modern society. The manufacturing processes and the various products in which Pb is used in, eg, storage batteries, cables, welding and soldering of Pb are covered, and the alloys of Pb and the oxides are described. A chapter is devoted to the safe handling of Pb; others give specifications for Pb, its alloys and products; properties of Pb and alloys, and physical constants of inorganic and organic compounds.

### 1953

- 6 McCord, C.P. (Univ. Michigan, Ann Arbor): LEAD AND LEAD POISONING IN EARLY AMERICA. BENJAMIN FRANKLIN AND LEAD POISONING. Industrial Medicine and Surgery 22:393-9 (Sept.), 1953.

A revival in medical appreciation of Pb poisoning began in Europe just before the American Revolution, probably through Benjamin Franklin who knew much about Pb poisoning. As printer, Franklin published Cadwalader's "Dry Gripes." In his own writings he mentioned his knowledge as a boy in Boston of Pb poisoning, and of the Massachusetts Law of 1723 which regulated the still heads and worms for rum distillation. He may have been the first to associate Pb poisoning with printing operations. He was mentioned by several European writers, ie, George Baker, John Hunter, Benjamin Vaughan. Though not mentioned by Tanquerel des Planches, Franklin visited La Charité Hospital in Paris, analyzed certain hospital records as to occupations and linked them with Pb exposure. The list of cases mentioned by Franklin was known to Tanquerel, and through the latter, to Rumpelt of Germany.

- 7 McCord, C.P. (Univ. Michigan, Ann Arbor): LEAD AND LEAD POISONING IN EARLY AMERICA. LEAD MINES AND LEAD POISONING. Industrial Medicine and Surgery 22:534-9 (Nov.), 1953.

The history of Pb mining in America begins in 1621 when it was known that some Pb was smelted at the Fe mine at Falling Creek near Jamestown; however, the location of this mine was kept secret and thus lost. Discoveries of Pb ores were made from 1632 on in New England, specifically, in Connecticut, New York, and Massachusetts, and in Virginia. At the beginning of the Revolution, a Pb refinery was established at Sing Sing, N.Y. As the Revolutionary War progressed, supplies of Pb became exhausted, the scant mines were depleted, and bullets had to be made from Pb cooking utensils and the various appliances made of Pb. Concerning Pb poisoning, it was assumed in those days that it attacked smelters but that miners were spared. With the

move to the West, the following landmarks in Pb mining are recounted: Fever River (later called Galena), west of Chicago became a thriving Pb mining community in 1828; the discovery in 1690 by N. Perrot of Pb deposits (galena) in the Green Bay area along the shores of the Mississippi and tributaries, with active mining begun by P. Renault in ~1720; more extensive mining during the following century in Wisconsin, Illinois, Iowa, Missouri, Arkansas. The mines in Utah, New Mexico, Nevada, Idaho, Arizona, made history through the overwhelming incidence of Pb poisoning from mining activities from 1870-1900, although in Illinois old medical records had shown Pb poisoning among miners (S. Skeel, 1838, 1840). Richards of Utah described in his book, "A History of American Mining" (1953), the conditions prevailing there, which led McCord to close this phase of Pb poisoning with a quotation to the effect that little Pb poisoning is to be expected from mining Pb sulfide, but much of it from Pb carbonate mining, especially in the early days when there were no suitable protective measures.

- 8 McCord, C.P. (Univ. Michigan, Ann Arbor): LEAD AND LEAD POISONING IN EARLY AMERICA. THE PEWTER ERA. Industrial Medicine and Surgery 22:573-7 (Dec.), 1953.

Pewter was commonplace in Europe and America in the 17th and 18th centuries, both for use as cooking utensils and tableware. In those days, pewter was either all Pb or  $\geq 50\%$  Pb was contained in it. Although the early colonial physicians knew that "dry-gripes" was a common ailment, connection with Pb was apparently not recognized. The English tinsmiths were aware of the harmful properties of the Pb content in pewter even before the colonial period and at times demanded its elimination not only for this reason but also because the quality of pewter decreased with increased content of Pb; a  $\leq 10\%$  content was thought to be harmless. Benjamin Franklin's involvement (then 16 yr old) in the dry-gripes episode in North Carolina rum drinkers, which conjecturally led to the 1723 enactment of the Massachusetts Bay Colony law prohibiting the distillation of rum through pewter stills and still heads, is recounted in detail.

- 9 Primitive Physic: COLIC FROM THE FUMES OF LEAD, WHITE LEAD, VERDIGRIS, ETC., 1947. Industrial Hygiene Digest 17:2 (Mar.), 1953.

As copied from the original: "This, some term the dry bellyache. It often continues several days, with little urine and obstinate costiveness. In the fit, drink fresh melted butter, and then vomit with warm water. To prevent or cure: Breakfast daily on fat broth, and use oil of sweet almonds frequently and largely. Smelters of metals, plumbers, etc, may be, in a good measure, preserved from the poisonous fumes that surround them, by breathing through cloth or flannel mufflers twice or thrice doubled, dipped in a solution of sea-salt or salt of tarter, and then dried. These mufflers might also be of great use in similar cases."

- 10 Richards, R.T.: OF MEDICINE, HOSPITALS,

AND DOCTORS. Salt Lake City, University of Utah Press, 1953, 266 pp.

The book, which is divided into 2 sections, provides a clear-cut picture of the dominant diseases prevalent in Salt Lake City since 1872. Pb poisoning headed the list from 1872-1892, during the period when western mining was so rapidly developing, and Chapter II of the 2nd section is devoted to Pb poisoning. The discussion is based on 2 periods: (1) 1872-1903, for which compilation all the records of St. Mark's and Holy Cross Hospitals for this period were inspected; (2) 1904-1950, estimation of this period being based on hearsay and the memories of 5 smelter officials, 9 mine and smelter physicians, and 10 mine operators.

To understand the Pb poisoning, it was necessary to inquire into the origin and development of mines and smelters and into the types of ore handled and the working conditions that accounted for the morbidity among workmen. In the days when Pb poisoning was so prevalent, the miners worked 12 hr/day underground; no baths were systematically taken for cleanliness; there was no forced ventilation to remove Pb ore dust; clothes were seldom changed. In addition to being exposed to dust, smelters were also exposed to Pb fumes. The symptoms of Pb cases treated in the Salt Lake City hospitals were anemia, paralysis of selected muscle groups, delirium, abdominal colic, and dark Pb line at junction of gums and teeth, Pb colic being the symptom that brought most Pb poisoning cases to the hospitals.

A review of >20,000 diagnoses listed in the records of St. Mark's and Holy Cross Hospitals revealed >6000 cases of Pb poisoning between 1872-1903. Since records were very incomplete, both in hospitals and in the mines and smelters, interpolation placed the number of Pb cases during this period at ~85,000. For the period 1904-1950, the estimation was 10,205. Since it was felt that there were innumerable unrecorded cases, the author estimated that there probably were >100,000 cases of Pb poisoning in Utah between 1872-1950. This deplorable prevalence of Pb poisoning in Utah was not duplicated in any other region in the US.

- 11 Rosen, G. (Columbia Univ., New York, N.Y.): OCCUPATIONAL HEALTH PROBLEMS OF ENGLISH PAINTERS AND VARNISHERS IN 1825. British Journal of Industrial Medicine 10: 195-9 (July), 1953.

This historic review is devoted to excerpts from "The Painter's and Varnisher's Pocket Manual," published in London in 1825 by an anonymous author, in which Pb poisoning is discussed most fully among the different hazards.

#### 1954

- 12 Leeper, R.W., Summers, L., and Gilman, H. (Pineapple Res. Inst., Honolulu, Hawaii): ORGANOLEAD COMPOUNDS. Chemical Reviews 54:101-67 (Feb.), 1954.

The structure, preparation, and properties of the organo-Pb compounds are reviewed. Tables give a complete listing of known organo-Pb compounds, and the poisonous nature of the alkyl-Pb compounds and symptoms of poisoning are discussed. Caution is advised in handling the alkyl-Pb's. Most of the

available data pertain to TEL, symptoms of which differ from those of chronic Pb poisoning due to inorganic Pb and its cumulative effect. The aryl-Pb compounds are less hazardous because of their much lower volatility. There is no reason to suppose that they are inherently any less toxic than the alkyl-Pb's, and suitable precautions should be observed. The organo-Pb halides of the type  $R_3PbX$  are active sternutators. Pb compounds have been suggested for pharmacological use against cancer, and organo-Pb compounds have been tested for this purpose. Research along this line is continuing, although the toxicity of the Pb compounds, and the relative insolubility of many of them in water, lead to difficulties in such applications. The largest use of TEL is as an anti-knock agent in motor fuel. In the laboratory the use of organo-Pb compounds are limited, their chief use here being as a source of alkyl or aryl radicals. (340 references)

- 13 McCord, C.P. (Univ. Michigan, Ann Arbor): LEAD AND LEAD POISONING IN EARLY AMERICA. THE LEAD PIPE PERIOD. Industrial Medicine and Surgery 23:27-31 (Jan.), 1954.

The use of Pb water pipes is reviewed from its earliest history. Although the ancients understood the poisonous nature of Pb, kettles, buckets and other domestic utensils made of Pb were used extensively in those days. Mention of Pb water piping, gutters, downspouts, flashing and Pb-lined cisterns in American goes back to ~100 yr after arrival of the 1st pioneers, and reports of illness from this source began to appear ~1800. The work of S.L. Dana in investigating the water supply of Lowell, Mass., with reference to Pb in 1848 when a serious epidemic believed to be Pb poisoning occurred, is reviewed.

The author comments that in 1952 Pb water pipes were used extensively although today it is improbable that any American city now exclusively relies on such pipes. However, Pb poisoning still occasionally arises from this source. The comment is made that it is a wonder that so few cases of Pb poisoning from Pb plumbing are detected and reported.

- 14 McCord, C.P. (Univ. Michigan, Ann Arbor): LEAD AND LEAD POISONING IN EARLY AMERICA. LEAD COMPOUNDS. Industrial Medicine and Surgery 23:75-80 (Feb.), 1954.

The author traces the history of the use of white and red Pb as cosmetics (rouge, for the removal of skin blemishes, hair washes), and in therapy as ointments, etc, from antiquity through the centuries in England (where white Pb was known as early as 1274). Although apart from medicinal use, Pb compounds and the manufacture of them were little known in Colonial life. With time, the use of cosmetics became the vogue, and although there are no records of deaths from this source, many cosmetics were injurious and caused poisoning of some degree. Pb therapy also became known in America. Aside from this, occupational exposure to Pb in the glazing of pottery (one of the 1st manufacturing enterprises in the Colonies) was recognized, as was the use of Pb in paint manufacture and in glass. Glass, a scarcity and luxury in early American times, usually had a Pb ox-

ide content up to 92% for Pb glass and 30% in flint. Pb poisoning in the users of both pottery and glass was not commonplace. Although white and red Pb were known for at least 2 millennia, they were not manufactured in the US until 1804, only imported. After 1812 this occupational exposure became one of the most serious.

- 15 McCord, C.P. (Univ. Michigan, Ann Arbor): LEAD AND LEAD POISONING IN EARLY AMERICA; CLINICAL LEAD POISONING IN THE COLONIES. Industrial Medicine and Surgery 23:120-5 (March), 1954.

Although there are no statistics, Pb poisoning in early America had to be prevalent. Over and over in writings there is the mention of "dry-gripes" (descriptive of all abdominal pains unaccompanied by fever or diarrhea) but no detailed description of it or association of its occurrence with an exact exposure such as use of pewter containers or intake of Pb medicinally. By no means were all dry-gripes Pb poisoning. The Pb poisoning of our country's 250 formative years was a "consumer affliction" rather than occupational.

The country's first doctors are not to be criticized for their inability to diagnose, for only through the astuteness of modern epidemiologists have the many diseases and illnesses of Colonial times been segregated. The majority of early physicians were not well-trained and, other than what they saw, felt, heard, or smelled, they were helpless. The situation as to Pb poisoning was no worse than for most other diseases that were not obvious. However early in the 1800's physicians began writing about Pb poisoning in a knowing manner, dispelling much of the obscurity of Pb intoxication. Yet even today there are cities and counties where records are not available in regard to occurrence of Pb intoxication whether occupational or otherwise. Most states have laws requiring the reporting of all such occupational diseases but mostly no compliance; in truth, the majority of instances of mild plumbism are never recognized by the physicians themselves.

- 16 McCord, C.P. (Univ. Michigan, Ann Arbor): LEAD AND LEAD POISONING IN EARLY AMERICA; SHOT TOWERS. Industrial Medicine and Surgery 23:169-72 (Apr.), 1954.

Small shot are poured, not molded, density and surface tension making for almost perfect spheres and size being determined by the mesh of the screen. The sorting of good shot from slugs is done with a shot tower, a sloping stairway of glass or metal with a gap between each successive pair of steps. Shot rolled down, if perfect, moving in a straight line, gain such momentum that they leap the gaps and fall into a bin at the end of the lowermost step. Imperfect shot roll slowly, drop into the open slots, and are remelted.

The first American shot-makers had no shot towers, using high bridges or cliffs and wells or mine shafts for quenching purposes. Nearly every city has described its shot towers as "the first," but it is beyond doubt that numerous shot towers arose after William Watts' original discovery in 1769 in England. Some representative ones were originated by Moses Austin, French exile John Nicholas Maclot, George Youle, and Robert McCulloch.

The present-day shot tower is but a modernization of the earliest sieve, the melting pot, the essential elevation, and the inevitable vat of water far below. Pouring and dropping (100 ft) are continuous. From the chilling process at the bottom, a chain bucket system takes the shot upward some 5 floors where after drying, polishing, sizing, and sorting proceed, the action working downward. Melting temperature is maintained at  $\sim 700^{\circ}\text{F}$ ; As and Sb content is  $\sim 1\%$  and 2-6%, respectively; some of the sieving pans have as many as 2400 perforations, the diameter of the perforations always being smaller than the diameter of the form shot. Thousands of shot are formed every second.

It can be safely concluded that in Colonial America and early US, shot towers did not produce any significant Pb poisoning. With modern shot towers, the sorting, grading, and finishing of shot may cause accumulations of settled and floating dusts, and neglect of suitable sanitary working conditions in this portion of shot towers could lead to Pb poisoning.

- 17 Meiklejohn, A. (Dept. Ind. Health, Univ. Glasgow, Scotland): THE MILL REEK AND THE DEVONSHIRE COLIC. British Journal of Industrial Medicine 11:40-4 (Jan.), 1954.

An account is given of mining Pb ore and its smelting at Leadhills in South Scotland. Since the galena, sulfide of Pb, occurs in a quartz matrix, the miners may have developed silicosis, but certainly the smelters, as well as animal and vegetable life in the neighborhood, suffered of old from Pb poisoning. Evidence is quoted that "fowls of any kind do not live many days at Leadhills; horses, cows, dogs, and cats often find ill effects and sheep suffer from browsing off the local grass." Fumes from smelting the ore was called mill-reek, and the disease they caused was well described in 1754 by a local doctor whose account is quoted. At the same time fresh fruit juices for combating scurvy if kept in earthenware vessels glazed with Pb, were found to be causing Pb poisoning. Wedgwood, the famous potter, set himself (1773) to find a Pb-free glaze. Contemporary descriptions of Devonshire colic identify it with mill-reek disease and with illness seen among Derbyshire Pb-miners and smelters. Here "belland" was described as long ago as 1678 by Dr. J. Carte. It has been always best known to the general practitioner.

## 1955

- 18 Anonymous: LEAD POISONING IN HISTORICAL FICTION. FROM "PUT YOURSELF IN HIS PLACE" (1870) BY CHARLES READE. Industrial Medicine and Surgery 24:560-1 (Dec.), 1955.

In his novel, "Put Yourself in His Place," Charles Reade describes the Pb hazard to file cutters of that time.

- 19 Stevenson, L.G. (Univ. Western Ontario, Canada): ON THE MEANING OF THE WORDS CERUSSA AND PSIMITHIUM (PSIMYTHION). Journal of the History of Medicine and Allied Sciences 10:109-11, 1955.

This brief historical sketch is on the history of Pb poisoning from the manufacture of white Pb (ceruse, blanc de plomb, Bleiweisz, or psimithium

in earlier Latin) for use as a pigment. In the process Pb is placed in a vessel containing vinegar. The objection was been frequently raised that Pb acetate would have been produced instead of white Pb.

## 1956

- 20 Darwall, J.: DISEASES OF ARTISANS WITH PARTICULAR REFERENCE TO THE INHABITANTS OF BIRMINGHAM. British Journal of Industrial Medicine 13:143-53 (Apr.), 1956.

John Darwall's thesis, presented in 1821, is published in the original Latin, together with a translation by A. Meiklejohn. Hazards to workmen engaged in processes in which white Pb is used are discussed under the heading of "chemical irritation." Reference is made to observations published by Cullen, Orfila, Van Swieten, Percival, and Baker.

- 20a Japanese Association of Industrial Medicine: PROCEEDINGS OF THE 29th GENERAL MEETING OF THE JAPANESE ASSOCIATION OF INDUSTRIAL MEDICINE. Journal of Science of Labour (Japan) 32:217-347 (Apr.), 1956.

See Abstract No. 677

- 21 Tara, S.: A propos du lisère saturnin. (THE LEAD LINE.) French translation of Burton, H.: Au sujet d'un effet remarquable sur les gencives humaines provoqué par l'absorption de plomb. (REMARKABLE EFFECT ON HUMAN GUMS INDUCED BY ABSORPTION OF LEAD.) Médecin d'Usine 18, No. 5:228-30; 233-4; 237-40, 1956.

Tara introduces a French translation of Henry Burton's classical work, presented before the Royal College of Physicians in January 1840. Tara notes that without wishing to diminish the merits of the author, the gingival Pb line was described by the Frenchman Grisolle in 1836; for this reason, it should be designated as the Grisolle/Burton line.

## 1957

- 22 Giuliano, R., and Rafanelli, M.: Lavorazioni che espongono all'azione del piombo-tetraetile. (INDUSTRIAL EXPOSURE TO TETRAETHYLLEAD.) Milan, Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro, 1957, 64 pp.

General physical and chemical properties, toxic action, and MAC of TEL are 1st described: 0.2 mg/m<sup>3</sup> produces evident symptoms in 1 hr; 0.1-0.14 mg/m<sup>3</sup> is not tolerable for repeated exposures; 0.15 mg/m<sup>3</sup> is the US limit for an 8-hr working day but must not be regarded as more than the upper limit of tolerance. In practice the atmospheric concentration should be well below this. The toxicity by inhalation and skin application in animals is reviewed. Air saturated with TEL contains ~5 mg Pb/l. The symptoms and occupations in which TEL poisoning may occur are described, which include its preparation. In the evaluation of various hazards, the general principles of safe working are illustrated by diagrams and photographs. Protective measures are described and illustrated. Great stress is laid on the provision of a daily meal of ~1700 cal; rotation of workers so that intervals of 24 hr be-

tween exposure periods are assured; routine clinical and urinary examination; immediate treatment of the least sign of intoxication; provision or protective clothing and appliances, baths, showers; washing and sterilizing work clothing; continuous chemical analysis of the air (with analytical methods given for air samples, biologic liquids and fuels). A discussion of the theory of antiknock agents and of the hazards encountered in places other than TEL factories where Pb-fuels are used is included. (From review (M.W. Goldblatt) in British Journal of Industrial Medicine 16:177-8, 1959)

- 22a Japanese Association of Industrial Medicine: PROCEEDINGS OF THE 30TH GENERAL MEETING OF JAPAN ASSOCIATION OF INDUSTRIAL HYGIENE. Journal of Science of Labour (Japan) 33:451-588 (July), 1957.

See Abstract No. 732.

## 1958

- 23 Lead Industries Association: PROCEEDINGS OF THE LEAD HYGIENE CONFERENCE. Chicago, Ill., November 6-7, 1958, New York, N.Y., 82 pp.

The Proceedings of this Conference, published separately and distributed by the Lead Industries Association, was reprinted in Industrial Medicine and Surgery 28:93-163, 1959. R.L. Ziegfeld, Secretary-Treasurer, made the introductory address, and F.E. Wormser, Vice President of the Association and of St. Joseph Lead Company, New York, gave the welcoming speech. For the papers presented, see Abstr. No. 27.

- 24 McCord, C.P. (Univ. Michigan, Ann Arbor): LEAD SHOT TOWERS IN AMERICA. OLD AND NEW. Industrial Medicine and Surgery 27:620-6 (Dec.), 1958.

See also Abstr. No. 16 for additional history.

Of all the industries that have survived 200 yr or more, shot pouring has changed least, basic principles remaining the same with only refinements in powering, sources of heating, and mechanical handling being added. Now as in the early days of shot making all that is needed are high elevation, molten Pb with added metallic As to promote fluidity, a colander, and a vat of water at the bottom for quenching. Nature's physics are the real workers. Fourteen illustrations show the towers and operations of manufacture, old and new.

More shot than ever are poured, >40,000 tons Pb/yr being used for this purpose. In the early decades every region of the country was nearly self-sufficient in meeting its needs; but better transportation, along with the manufacture of breach-loading guns, doomed the regional shot tower and old shot towers became historic monuments. The output of the 5 modern shot towers in the US (New Haven and Bridgeport, Connecticut; East Alton, Illinois; Kings Mill, Ohio; and San Francisco, California), operated by ammunition manufacturers with their marvels of mechanization, can outdo in costs, volume, and quality 100 old-time towers.

## 1959

- 25 California State Department of Public Health: THE THIRD AIR POLLUTION MEDICAL

RESEARCH CONFERENCE, Los Angeles, December 9-10, 1959, 230 pp.

Pb is included in J.T. Middleton's paper on "The Impact of Air Pollution Standards on Research," in which he reviews the history of the air pollution problem in California, and the study and research on this subject by the Department from 1955 on toward the development of standards. The areas requiring particular study at the time were photochemical complex, ethylene, ozone, CO, Pb, carcinogens, and particulates. Concerning Pb, further work is needed to determine the average blood levels for persons living in places with air pollution and with known occupational exposure and smoking history. Also, 24-hr urine samples from these same persons should be collected, to be compared with those of comparable groups living in less polluted air, as well as the Pb content in autopsy material, eg, liver, lung, brain, cortical and trabecular bone (the latter to represent relatively recent exposure) which should be determined continuously. Pb balance studies are also needed and should include sampling of the air actually breathed. First, it would be very important to estimate what fraction of the Pb in the air is retained in the body.

- 26 Horiuchi, K., ed.: CONTRIBUTIONS FROM THE DEPARTMENT OF PREVENTIVE MEDICINE AND PUBLIC HEALTH, OSAKA CITY UNIVERSITY MEDICAL SCHOOL. Vol. 1, April 1949-March 1959, 298 pp.

As stated in the preface, K. Horiuchi came to the University as executive chairman and professor of the Department of Preventive Medicine and Public Health in 1949. The scientific papers and abstracts published within the 10 yr are contained in this volume. The studies were on occupational health, gerontology, practical and theoretical epidemiology, and other subjects. The preface is followed by a brief history of the Department. The abstracts of publications concerning Pb are included in the appropriate sections under the years of original publication: Miki, M. (1952, 1958), Horiuchi, K., and Takada, I. (1954); Horiuchi, K., and Ida, N. (1953, 1955); Horiuchi, K., et al (1953, 1954, 1955, 1956, 1957, 1958, 1959); Ida, N., et al (1954); Tamori, E., and Sueknae, M. (1955); Owada, K., et al (1955); Tamori, E., et al (1955); Nakano, M. (1956); Imamura, Y. (1954); Horiguchi, S., et al (1957); Okada, A. (1957); Wada, N. (1957); Fukumura, S., and Fujisawa, Y. (1952); Yoshida, Y. (1956); Ishikawa, I. (1959).

- 27 Lead Industries Association: THE LEAD HYGIENE CONFERENCE. Chicago, Ill., Nov. 6-7, 1958. Industrial Medicine and Surgery 28:93-163, 1959.

As stated in the introduction, Mr. Bowditch, Director of Health and Safety, Lead Industries Association presided at the Conference. "Full freedom was given to the numerous speakers as to their presentations. By all it was agreed that Pb can cause catastrophe, but Pb's threat is subject to ready control. Clinical Pb poisoning on a comparative basis now has become a rarity, but the ominousness of Pb poisoning is a reality. The tar-

get of this conference, of which this is the record, was the threat - the 'what might happen.'"

For abstracts, see Sections: IV, Baetjer, A.M.; VA, Belknap, E.L.; Byers, D.H.; Frank, R.W.; Johnstone, R.T.; Kehoe, R.A.; Miller, L.H.; VB, Smith, H.D.; VII, Elkins, H.B.; VIII, Foulger, J.H.; Schrenk, H.H.; Waters, T.C.

The overall summary and discussion was presented by T.L. Shipman (pp. 162-3). He pointed out in closing that although there are areas of ignorance in the field of Pb toxicology, it is hoped that 10 yr from now there will be more precise laboratory tests for exact determination of the degree of poisoning and more will be known on the biological effects of small doses of Pb. The fact that exposures and blood and urine levels are kept below a certain point does not guarantee that damage which still cannot be determined is not being done; this also applies to fields other than Pb.

The discussions were led by W.M. Pallies, C.H. Hine, M.R. Mayers, H.E. Stokinger, K.W. Nelson, L.W. Spolyar, L.E. Hamlin, A.S. Johnson, J.J. Chisolm, Jr., H.L. Hardy, D.J. Lauer.

- 28 Legge, R.T. (Univ. California, Berkeley): L. TANQUEREL DES PLANCHES, M.D. 1809-1862. A HISTORICAL REVIEW OF HIS CLASSIC MASTERPIECE ON LEAD DISEASES. Industrial Medicine and Surgery 28:514-6 (Nov.), 1959.

In closing the brief review, the author states that Tanquerel des Planches' immortal books on Pb diseases earn this clinician and investigator a foremost place in industrial medical history. Mention is made that the books were translated by S.L. Dana under the title "Lead Diseases," which also includes the results of Dana's own investigation of Pb poisoning from Pb plumbing.

## 1960

- 29 California State, Department of Public Health: THE FOURTH AIR POLLUTION MEDICAL RESEARCH CONFERENCE, DECEMBER 7, 8, AND 9, 1960. Berkeley, California, 1960, Proceedings of the Third day, 159 pp.

The following papers on Pb were presented in the Symposium on Lead and Carbon Monoxide: 1. Preliminary Reports of Field Studies of Lead, by D.H. Hofreuter. 2. Trace Metal Patterns in Health and Disease, by E.M. Butt. 3. The Comparison of Organic and Inorganic Lead Poisoning, by J.C. Aub. The Chairman of the Symposium was H.L. Helwig, and J.R. Goldsmith led the discussion terminating the session. (See Abstracts No. 2269, 2106, 2090)

- 30 Gesellschaft Deutscher Metallhütten- und Bergleute e.V.: Vorträge und Diskussionen bei der 2. Informationstagung über die Bleikrankheit. (ADDRESSES AND DISCUSSIONS PRESENTED AT THE 2nd SYMPOSIUM ON LEAD POISONING.) Bad Oeynhausen, October 29-30, 1959. Publication No. 7. Clausthal-Zellerfeld, 1960, 188 pp.

At this Symposium, J. Feiser was moderator of Part I, dealing with technical aspects of work safety; H. Buckup moderated the presentations on the industrial medical aspects; Part II. The contents of the publication are as follows:

Kleinert, R.: Eröffnung der Tagung (OPENING RE-

- MARKS), 1-3.
- Bürger, H. (Oker): Stand der betrieblichen Massnahmen zur Verhütung der Bleikrankheit (THE STATUS OF INDUSTRIAL MEASURES FOR THE PREVENTION OF LEAD POISONING), 7-25; discussion, 25-35.
- Nützold, O. (Arnoldstein): Erfahrungen mit Feinstaubmasken auf einer Bleihütte (EXPERIENCE WITH MICRODUST MASKS IN A LEAD WORKS), 37-52; discussion, 53-64.
- Buckup, H. (Bochum): Die Bleierkrankung, ihre heutige Bedeutung sowie die Möglichkeiten ihrer Erkennung, Verhütung und Behandlung (LEAD POISONING, ITS PRESENT SIGNIFICANCE AND THE POSSIBILITIES OF ITS DIAGNOSIS, PREVENTION AND TREATMENT), 67-98; discussion, 99-114.
- Holmqvist, I. (Skelleftehamn, Sweden): Werkärztliche Erfahrungen auf einer Bleihütte, insbesondere mit der Blutbleibestimmung (MEDICAL EXPERIENCE IN A LEAD WORKS, ESPECIALLY BY DETERMINATION OF LEAD IN BLOOD), 115-44; discussion, 145-50.
- Reinl, W. (Düsseldorf): Die medikamentöse Bleitherapie und -prophylaxe mit Ca-EDTA (DRUG THERAPY IN LEAD POISONING AND PROPHYLAXIS WITH Ca-EDTA), 151-70.
- Pott, R. (Hamburg): Werksärztliche Erfahrungen mit der medikamentösen Bleiprophylaxe mittels EDTA auf einer Bleihütte (MEDICAL EXPERIENCE WITH EDTA PROPHYLAXIS IN A LEAD WORKS), 171-82; discussion, 183-6.

- 31 Seven, M.J., and Johnson, L.A., ed.: METAL-BINDING IN MEDICINE. Proceedings of a Symposium Sponsored by Hahnemann Medical College and Hospital. Philadelphia, Lippincott, 1960, 400 pp.

This book is a collection of formal papers and panel discussions from a meeting held on May 6, 7, and 8, 1959, to bring together clinicians and research workers in the trace metal fields. Since this is one of the first comprehensive collections of data on metal-binding agents, every effort was made to achieve an accurate reference source. As decided editorially, "metal-binding" means linkage between a binding agent and a metal; "chelation" was reserved for the process of metal-binding in which the metal is incorporated into a ring structure. There are 6 groups of papers, each followed by discussions moderated by G.C. Cotzias, H.A. Schroeder, H. Foreman, H. Kroll, I.H. Scheinberg, and H.M. Perry, Jr.; all include reference to Pb. Appendices include an editor's note concerning identification of the forms of chelates in the physiological pH range; formulae; periodic chart. An index of authors and a subject index which includes abbreviations of compounds completes the volume.

For papers including discussion of Pb, see: Johnson and Seven; Weinberg, in III; Foreman; Schubert and Lindenbaum; Shapiro, in IV; Brieger; Butt et al; Perry and Camel; Peters; Rieders; Schroeder; Tipton, in V; Martell, in XI.

- 32 Voinar, A.O.: Biologicheskaya Rol Mikroelementov v Organizme Zhivotnykh i Cheloveka. (BIOLOGICAL ROLE OF TRACE ELEMENTS IN THE ORGANISM OF ANIMALS AND MAN.) Moscow, Gosudarstvennoe Izdatel'stvo "Sovetskaya Nauka," 1st ed., 1953; 2nd ed., 1960, 544 pp.

Review of the occurrence and biological role of Pb is included in Chapter 14. The distribution in the human and animal body is covered at some length, with concentrations shown for various organs and fluids. Effects on enzymatic processes, the metabolism of Pb, and the toxicity of Pb are reviewed.

## 1961

- 33 Browning, E. (London, England): TOXICOLOGY OF ORGANIC COMPOUNDS OF INDUSTRIAL IMPORTANCE. Annual Review of Pharmacology 1:397-430, 1961.

A chapter on TEL is included. Its properties, hazards in manufacture, symptoms of poisoning, its fate in the organism and treatment of poisoning are reviewed.

- 34 Horiuchi, K., ed.: CONTRIBUTIONS FROM THE DEPARTMENT OF PREVENTIVE MEDICINE AND PUBLIC HEALTH, OSAKA CITY UNIVERSITY MEDICAL SCHOOL. Vol. 2, April 1959-March 1961, 276 pp.

As stated in the preface, this volume should be useful in the following research fields: (1) occupational health, (2) gerontology, (3) theoretical epidemiology, (4) air pollutants, (5) public health practice. The contents are divided into 5 categories: (I) industrial hygiene and occupational health, (II) gerontology, (III) environmental medicine, (IV) epidemiology, (V) others. The abstracts of publications concerning Pb are included in Sections I, IV, V, VI, VIII, X under the years of original publication: Tsuji, M. (1960); Noma, H. (1960); Asano, I. (1960); Hashimoto, K. (1960); Horiuchi, K., et al (1959, 1960, 1961); Ishii, Y. (1960); Miyaki, S. (1960); Noma, H., and Narita, I. (1961); Masuya, Y., et al (1961); Horiuchi, K. (1961); Nagao, Y. (1959); Horiguchi, S. (1959); Horiuchi, K., and Horiguchi, S. (1960).

- 35 Johnson, L.A., and Seven, M.J., ed.: PROCEEDINGS OF A CONFERENCE ON BIOLOGICAL ASPECTS OF METAL-BINDING HELD AT THE PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY PARK, PENNSYLVANIA, SEPTEMBER 6-9, 1960. Federation Proceedings 20, Supplement No. 10 (Sept.), 1961, 273 pp.

The papers presented during this conference, together with the discussions, are arranged under the following subjects: (1) Physical chemistry of chelation, specifically as related to metal ions of biological interest and their coordination compounds, metal chelate compounds in biological systems and role of metal binding in enzymic reactions; (2) physiologic aspects of metals; (3) pharmacology and toxicology of chelating agents; (4) applications of chelating agents in medicine.

While all papers are pertinent to Pb, abstracts have been prepared only of those which discuss the role of these agents in the treatment of Pb poisoning or other diseases, with special emphasis on BAL and CaEDTA. See Section V: Foreman, H.; Hardy, H.L.; Kehoe, R.A.; Perry, H.M., Jr.; Peters, H.A.; Rubin, M.

- 36 Passow, H., Rothstein, A., and Clarkson, T.W. (Univ. Hamburg, Germany; Univ. Rochester, N.Y.): THE GENERAL PHARMACOL-  
OGY OF THE HEAVY METALS. Pharmacological  
Reviews 13:185-224 (June), 1961.

In the introduction, the author states that the review is devoted to a discussion of predominantly theoretical aspects of metal poisoning; that no attempt has been made to give an encyclopedic survey of all available knowledge, but that he hoped to develop a group of generalizations concerning the biological factors that determine the main course of events following poisoning, and that a selected number of experiments with a few representative metals would be presented in some detail.

The following are the main headings: Chemical interactions between heavy metal ions and biochemical substances; the action on enzyme systems; interactions with surface films; action on cells; all-or-none responses ("indirect," as exerted by Au on hemolysis of red cells, and "direct," as exerted by Pb on permeability of red cells, and Hg on permeability of yeast cells, and the mechanism of such responses); action in the interior of the cell; time dependence of actions; action on epithelial tissues; action on animals; nature of metal-induced responses; general discussion and conclusions. Pb enters into discussion under virtually all headings, and in greater detail in regard to permeability of erythrocytes; citing here the work of Aub et al, 1926; Behrens et al, 1927; Clarkson et al, 1958 (2 publications); Flury, 1934; Glynn, 1957; Grigarzik et al, 1958; Joyce et al, 1954; Jung, 1947; Lindemann et al, 1960; Lovelock, 1955; Maxwell et al, 1929; Mortensen et al, 1944; Ørskov, 1935; Passow, 1961; Passow et al, 1956 (2 articles); Paul, 1950; Reddi, 1953; Vincent, 1958, 1959; Vincent et al, 1958.

In conclusion, the authors point out that because of the great variability of their action, the behavior of individual metals cannot be predicted. As an example, Hg, Cu, Pb, and Au have high affinities for sulfhydryl groups, yet sometimes they behave quite differently in biological systems. Since the metals potentially can interact with almost any accessible ligand, the location of the various binding sites within the cell, as well as the presence of diffusion barriers, decisively influences the nature and time course of metal action on cells. Thus, the structural and functional organization of the cell is the predominant factor in determining the patterns of toxicity, with inhibition of functions associated with the outer cell surface being of special importance. Additional complications arise by the nature of biological organization in tissues and whole animals, so that analyses of chemical mechanisms are very difficult. This however, is true also for other chemical agents. (130 references)

- 37 Skinner, H.L., Jr. (Staten Island, N.Y.): THE LEAD PROBLEM. AN OUTLINE OF CURRENT KNOWLEDGE AND OPINION. Journal of Occupational Medicine 3:429-35 (Sept.), 1961.

The author discusses the industrial Pb problem on the basis of exposure, the importance of air analyses, quantitative and qualitative biologic studies, metabolism of Pb, signs and symptoms of Pb intoxication, Pb palsy (various types), Pb encephalop-

athy, and other manifestations. In summary, once Pb is absorbed into the bloodstream it is distributed throughout the entire body. A normal person takes in 0.3 mg/day and rids himself of the same amount per day. With increased absorption the excess is mainly deposited in the bones. If this deposition process is too slow, toxic levels in the blood and tissues are reached resulting in symptoms of intoxication. These will occur also if, over a period of time, Pb is deposited in long bones and a period of stress occurs which causes increased quantities of Pb to be released again into the circulation. Following a brief discussion of treatment with CaEDTA, prevention is emphasized to the effect that no medical measures should be recommended in lieu of "adequate engineering measures for control of Pb exposure." In conjunction with these, removal from exposure, instruction as to diet and hygiene, and hygienic measures are suggested. In closing, the psychologic aspects to be considered are a frank approach to the problem so as to achieve better cooperation on the part of all personnel.

## 1963

- 38 Union des Sociétés de Sciences Médicales, Société d'Hygiène: Premier Congrès National d'Hygiène et de Sécurité du Travail. Rapports et Résumés des Travaux. (FIRST NATIONAL CONGRESS OF INDUSTRIAL HEALTH. ABSTRACTS OF PAPERS.) Bucarest, 1963, 304 pp.

For papers concerning Pb, see Alexeieva, Z.; Gontea, I.; Jaliu, A.; Kleinstein, I.; Mircev, M.; Mutafov, B.; Pascou, L.; Pislaru, V.; Preda, N.; Prodan, L.; and Stancev, S. (See Sections II, V, VI)

## 1964

- 39 California State Department of Health: THE SIXTH ANNUAL AIR POLLUTION MEDICAL RESEARCH CONFERENCE. Archives of Environmental Health 8:1-189 (Jan.), 1964.

Most of the papers presented at this Conference in San Francisco, Jan. 28-29, 1963, together with discussions, are published in this issue. Papers from the 1st session were published in the American Review of Respiratory Diseases. For papers concerning Pb, see Goldsmith, J.R.; Sterling, T.D.; Butt, E.M., et al; Tipton, I.H., and Shafer, J.J.; Rustagi, J.S.; Bacaner, M.; Morgan, K.Z., and Gofman, J.W., et al, in sections V and VII.

- 40 Dérot, M., Trad, J., Rautureau, J., and Fournet, P.-C. (France): Intoxication saturnine. (LEAD POISONING.) Gazette Médicale de France 71:2823-40 (Sept. 25), 1964.

This review covers the available information concerning Pb poisoning, such as causes of intoxication (criminal, occupational and accidental, such as from food and water), types of intoxication (acute, subacute, severe, chronic) clinical signs and symptoms, biological and laboratory signs, organs affected, and manifestations of chronic Pb poisoning and its diagnosis and treatment. Penetration and deposition of Pb in the organs, its excretion, chelation, cellular activity, porphyrin



metabolism in Pb poisoning and toxic effects upon the various organs as well as other aspects such as preventive measures, and treatment, are discussed in depth. (31 references)

- 41 Gerarde, H.W. (Esso Research Eng. Co., Linden, N.J.): TOXICOLOGY: ORGANIC. Annual Review of Pharmacology 4:223-46, 1964.

The review includes a survey of the literature on the toxicology of organometallic compounds, among them tri- and tetraalkyllead (pp. 240-4). Some of the physical properties of tetraethyllead (TEL) and tetramethyllead (TML) are listed in a table. As these compounds are lipid soluble, they are concentrated in the brain, body fat and liver. Because of this selective distribution, manifestations of poisoning are dominated by involvement of the central nervous system and differ from those of inorganic Pb poisoning. Signs and symptoms of TEL intoxication are reviewed. Analyses of air in many cities have shown Pb concentrations, as judged by current hygienic criteria, to be insignificant. Much of the Pb burned in gasoline is not exhausted in forms which can remain suspended in the atmosphere; about 20-30% of it is retained in exhaust system deposits and lubricating oil, and the balance is exhausted over 20,000 to 30,000-mile periods of driving. Experiments with rats showed that TML is less toxic than trimethyllead, the intraperitoneal LD-50 of the latter for rats being 25.5 mg/kg. No signs of poisoning were obtained after intravenous dosing of rats with 34 mg/kg and of rabbits with 20 and 40 mg TML, while an immediate toxic reaction was elicited in rabbits by intraperitoneal administration of 7.5 and 15 mg/kg of trimethyllead. Differences in the signs of toxic effects in rats and dogs are described. The comparative LD-50 for triethyllead in rats was 11.2 mg/kg, the intravenous LD-50 for TEL, 15.4 mg/kg. The distribution of triethyllead in the tissues of animals dosed with TEL was virtually identical with that found after injection of triethyllead; only small amounts of trimethyllead were found in the tissues of rats dosed with TML. The conversion in vivo of tetraalkyllead to trialkyllead is well established; TEL does so rapidly, while the conversion of TML to trimethyllead is much slower. The toxicity of the tetraalkyl compounds apparently depends on the rate of conversion to the more toxic trialkyl derivative. (106 references)

- 42 Gilbert, T.W. (Univ. Cincinnati, O.): LEAD. In: Kolthoff, I.M., and Elbing, P.J., ed., with the assistance of Sandell, E.B.: Treatise on Analytical Chemistry. New York, Wiley, 1964, Vol. 6, part II, pp. 69-175.

In the 1st part of this chapter, the occurrence, production, and industrial products, extraction and purification, and the toxicity of Pb and its compounds are reviewed. This is followed by a presentation of the properties, physical, chemical, and isotopic distribution of Pb; separation and isolation; detection and identification; determination by precipitation and gravimetric methods, titrimetric, polarographic, photometric activation analysis; determination of Pb in specific materi-

als; recommended laboratory procedures. (426 references)

- 43 Kettering Laboratory in the Department of Preventive Medicine and Industrial Health, College of Medicine, University of Cincinnati: SYMPOSIUM ON LEAD. Archives of Environmental Health 8:202-354 (Feb.), 1964.

In his introduction to the Symposium, R.A. Kehoe states that "for more than 30 yr members of the staff of the Kettering Laboratory have been engaged in the investigation of various aspects of the occurrence and the behavior of Pb in the external environment and the internal milieu of man. From time to time various aspects of this subject have been presented in publications. Less frequently, in symposia, much of the available information derived from our investigations and those of others has been assembled." The symposium represents an attempt to bring together certain primary and ancillary facets of the hygienic problem raised many years ago by the introduction of tetraethyllead as an antiknock additive into automotive fuel.

For abstracts, see Sections: II, de Treville, R.T.; VI, Schepers, G.W.H.; VA, Fleming, A.J.; Johnstone, R.T.; Kehoe, R.A.; Sanders, L.W.; Sterling, T.D.; Zavon, M.R.; VB, Smith, H.D.; VII, Cholak, J.; Hirschler, D.A.; Kehoe, R.A.; Larsen, R.I.; X, Cholak, J.; XI, Ziegfeld, R.L.

- 44 Stevenson, L.G. (Yale Univ., New Haven, Conn.): HISTORY OUT OF PRINT. WHAT THE HISTORIAN CANNOT LEARN FROM BOOKS. Cincinnati Journal of Medicine 45:467-75 (Nov.), 1964.

Among the subjects brought out by the author from books, manuscripts and artifacts, is that of Pb poisoning, a history of which from ancient times to the 20th century he wrote for his doctoral dissertation at Johns Hopkins. He points out that direct literary evidence that chronic Pb poisoning constituted a real problem in Greece and Rome is not plentiful, and frequently such texts as there are often give doubtful or equivocal answers. However, as in paleopathology, ancient bones may be useful. The use of  $^{14}\text{C}$  has been very helpful. Several of the many uses of Pb which gave rise to food and beverage contamination, etc., are described.



## II. ENVIRONMENTAL SURVEYS

1950

- 45 Cheftel, H. (France): Le plomb dans les aliments. (LEAD IN FOODSTUFFS.) Annales des Falsifications et des Fraudes 43:230-8, 1950.

In presenting data to the Commission for the Study of Foreign Substances in Foods, the author states that in the studies that he has reviewed, Pb solders, even when they were in direct contact with food in cans, did not constitute necessarily a source of contamination by Pb. For this reason, he has reviewed the concentrations in food reported in the literature, the "normal" and the "usual" of various commercial products. These are tabulated as to Pb contents in various organs of beef, horse, sheep, fish, mollusks; milk and other dairy products; vegetables and fruit; sugars; flour; bread; water and other beverages, and eggs. The conclusion is that Pb may be contained naturally in a large number of foods, often exceeding the maximum that is considered admissible.

- 46 Dick, J., and Pugsley, L.I. (Dept. Natl. Health and Welfare, Ottawa, Canada): THE ARSENIC, LEAD, TIN, COPPER AND IRON CONTENT OF CANNED CLAMS, OYSTERS, CRABS, LOBSTERS AND SHRIMPS. Canadian Journal of Research 28:Sec. F, 199-201 (June), 1950.

A survey (120 samples) of heavy metal content of canned shellfish and crustaceans sold on the Canadian market was made. Six cans each were taken at random from different brands available in retail stores. Pb was determined spectrographically (Cholak and Story, 1938). Means, SD's and ranges for Pb in ppm were: clams:  $0.81 \pm 1.09$ , 0.0-5.0; oysters:  $0.83 \pm 0.96$ , 0.0-2.5; smoked oysters:  $0.33 \pm 0.52$ , 0.0-1.0; crabs:  $0.17 \pm 0.24$ , 0.0-0.50; lobsters:  $1.03 \pm 3.01$ , 0.0-13.0; shrimps:  $0.48 \pm 0.50$ , 0.0-1.5. With the exception of 1 sample of clams having 5 ppm Pb and 1 sample of lobster with 13 ppm, values found were not significantly above the limits established for Pb content of foods.

- 47 Majer, V., Werner, S., Hopp, K., and Marscek, V. (Tech. Univ. Prague, Czechoslovakia): (TRACES OF MERCURY IN SOUP SEASONING.) Chem. Obzor 25:185-7, 1950.

The spice used for soup seasoning showed 9.1  $\mu\text{g}\%$ . The spice should be regarded as harmless. The concentrations at which the other heavy metals and poisonous elements become omnipresent are higher than that of Hg (Cu, Pb, As at  $10^{-6}$ , Hg at  $10^{-8}$ ). (From Chemical Abstracts 45:3958, 1951)

1951

- 48 Anonymous: LEAD AS A CONTAMINANT OF FOOD AND DRINK. INTRODUCTION OF STANDARD LIMITS PROPOSED. Chemical Age (London) 65:827-9, 1951.

While no formal limit for Pb in drinking water has been established, a recommendation by the Metallic Content Subcommittee of Food Standards Committee to limit the concentration of Pb in food was approved by the Minister of Food. It was recognized that elimination of Pb was not immediately possible. Evidence at the time indicated that 1-2 mg Pb can be ingested without toxic effect, depending on the length of time. Since consumption of 2 lb food containing 1 ppm would contribute 0.9 mg, limits have to be kept low. The recommendation provides for the following, in ppm: soft drinks, 0.2; beer and cider, 1, to be reduced to 0.5 within 12 mo; apple juice and concentrated soft drinks, 0.5; 2 ppm for foods subject to low contamination, 0.5 lower limit for staple foods (edible fats, refined sugar); colorings, 20; spices, 10; tea, 1.0; phosphates of  $\text{NH}_3$ , Ca and Na, 5; edible gelatin, 7; liquid pectin (provisional), 10; canned meats and fish, 5. Since the Pb content in crustaceans and shell fish is  $>2$ , it is recommended that any content more than the limit defined be labeled to be due to Pb natural to fish.

- 49 Armour Research Foundation of Illinois Institute of Technology: MINERAL CONTENT OF BEEF REPORTED BY ARMOUR FOUNDATION. Chemical and Engineering News 29:3868, 1951.

The ash of beef samples was analyzed spectrographically by the scientists of the Armour Research Foundation of Illinois Institute of Technology and assuming that the average US citizen will consume 60 lb of beef in 1951; they estimated that 0.00001 oz of Pb will be taken in, together with varying amounts of 18 other elements. Among the quantitative estimations, 0.204 oz Mn, 1.6 oz P, and 4.7 oz K will be ingested.

- 50 Braun, O.G. (Am. Can Co., Maywood, Ill.): PROBLEMS OF METALS IN CANNING EQUIPMENT. Canner 112:13-4, 24 (June 16), 1951.

A discussion is given of the effect of contamination by Cu, Fe, Pb, Cd, Cr, Ni, Sn, Zn, and stainless steel on canned foods. Because of its toxic effects, Pb should not be used in any form in equipment contacting food materials. However, there have been reports of discoloration of canned foods through the inadvertent use of Pb, ie, use of wooden lug boxes for peas painted with Pb base paint resulted in black discoloration of the peas where they contacted the painted surfaces and absorbed minute quantities of Pb; a pickled vegeta-

ble product prepared for brine canning in a converted Pb-glazed bath tub showed severe discoloration because the Pb glaze was soluble in the acid brine. Cu, however, has been the most consistent harmful ingredient and during the past 15 yr there has been a movement to replace Cu with more corrosive resistant stainless steels. But even stainless steel is not without hazard and it is necessary that the proper type is chosen for the specific purpose.

- 51 Emanuele, F., and Ceccherelli, E. (Canned Food Res. Sta., Parma, Italy): (THE LEAD CONTENT OF CANNED FOODS IN RELATION TO THE SOLDERING OF THE CONTAINERS.) Ind. ital. conserve 26:69-76, 1951.

The Italian law prescribes a maximum of 10% Pb in the alloys for soldering food cans. Experiments show that even with alloys containing up to 98% Pb, the Pb content of the foods was always less than the amounts tolerated by several foreign laws (ie, 2-5 mg/kg), except in the case of concentrated tomato juice, which, after 3 mo, contained 5.80-6.24 mg Pb/kg. These maxima occurred with the alloy Sn 90-Pb 10%, while with the alloy Pb 90-Sn 10%, the corresponding values were 3.24-3.70 mg/kg. (From Chemical Abstracts 45:10413, 1951)

- 52 Höggl, O., and Sulser, H. (Federal Health Dept., Bern, Switzerland): Blei, Kupfer und Zink in Trink- und Brauchwasser. 2. Mitteilung. (LEAD, COPPER AND ZINC IN DRINKING AND SOURCE WATERS. II.) Mitteilungen aus dem Gebiete der Lebensmitteluntersuchung und Hygiene 42:286-311, 1951.

The photometric method, using dithizone, as applied in this investigation, is described in detail. The concentrations found in the various waters analyzed were as follows for Pb, Cu, and Zn (in ranges and average in  $\mu\text{g/l}$ ), respectively: Open springs, 0-1, <1; 0.5-5.0, 2; 0.5-4.3, 2; enclosed springs, reservoirs, pumping stations, 1-5, 3; 0.9-4.0, 2; 3.0-10.0, 6; mineral waters, 0-14, 5; 0-272, 61; 0-28, 12; tap water (running intermittently or continuously), 1-81, 11; 1-17, 7; 10-1600, 404; stagnant tapwater, 4-260, 92; 15-340, 102; 500-5580, 2650; cistern water, 9; 18; 180; water in boilers in several homes or apartment houses, 1-86, 18; 9-180, 68; 105-2640, 641; bottled mineral waters, 14-33; 22-67; 14-240; river waters, 3-20; 6-19; 22-45; waste waters in Bern, summer and autumn, 103, 67; 7, 78; 471, 252. The authors conclude that while the source waters contain only traces of heavy metals, the concentrations in piped waters, boilers, and bottling devices increase markedly. (20 references)

- 53 Meinsma, J.J. (Commodities Insp., Leeuwarden, Netherlands): (THE ACTION OF BUTTERMILK ON THE LEAD-CONTAINING COATING OF TINNED CANS.) Chem. Weekblad 47:85-7, 1951.

Tinned vessels were filled daily with buttermilk (I). Samples of I were destroyed with  $\text{HNO}_3\text{-HClO}_4$  and the solutions extracted with dithizone- $\text{CHCl}_3$ ; the removal of interfering metals, the titration of Pb, and blank determinations are described. After a few days the Pb contents of I fell to about 100 and 300  $\mu\text{g/l}$  with coatings containing

1.1 and 5% Pb, respectively. The Pb content of the original I was 20-58  $\mu\text{g/l}$  and its acidity 74-86 ml of 0.1N solution/100 ml. (From Chemical Abstracts 45:5599, 1951)

- 54 Müller, J. (Dresden, Germany): Einige grundsätzliche Betrachtungen zur Schuttschichtbildung auf Blei und zur Bleilöslichkeit im Trinkwasser. (PROTECTIVE-COATING FORMATION ON LEAD AND SOLUBILITY OF LEAD IN DRINKING WATER.) Gas- und Wasserfach 92:39-42 (Feb. 28), 1951.

In different countries, widely varying limits of Pb in drinking water are permissible. In general, the Pb content of water is higher after standing in Pb pipes for 12 hr or more, and decreases with flow of water. Solution of Pb from the metal itself is most important with a new pipe; later, Pb compounds may also play a role. Pb solution may be decreased by the formation of tightly adherent basic Pb carbonate ( $\text{PbO} \cdot 2\text{PbCO}_3 \cdot \text{H}_2\text{O}$ ), but even this is slightly soluble. There appears to be no fixed relation between the softness of the water and Pb attack. Changes in composition of the water may cause solution of a previously deposited protective coating, and erosion of Pb compounds may also play a role. Both dissolved and suspended Pb compounds may play a role in the toxicity of Pb to human beings.

## 1952

- 55 Bartlett, J.C., Coutu, C., List, E., and Wood, M. (Food and Drug Lab., Dept. Natl. Health, Ottawa, Canada): THE COMPOSITION OF EDIBLE BONE MEAL. Canadian Journal of Technology 30:137-42, 1952.

Sixteen samples of bone meal from 3 processors were analyzed. Average values found were: Ca 33.0%, P 15.4%, total ash 87.9%, moisture 1.46%. F content was 350-770 ppm, av 572; Zn av 129 ppm; Pb, with 1 exception (20 ppm) was <10 ppm (3-8); Cu <10 ppm.

- 56 Cannon, H.L. (US Geol. Survey, Washington, D.C.): THE EFFECT OF URANIUM-VANADIUM DEPOSITS ON THE VEGETATION OF THE COLORADO PLATEAU. American Journal of Science 250:735-70 (Oct.), 1952.

The relation of plants to U deposits were studied over a period of 2 yr. The lines of investigation pursued were: the observable effects of mineralized soil on growth habits, the absorption of U and associated ore elements by plants, and the ecologic distribution of plants around the ore deposits. The physiologic signs are limited to the effects of U, which were masked by excessive amounts of V, Se, and Mo in the ore. Analyses of plants growing on U-bearing rocks and soils include the determination of Pb in soil or rock and in the ash of various plants according to the areas studied. Pb ranged in the above media from 2-40 ppm and from <10-110 ppm, respectively.

- 57 Collins, C.B., Farquhar, R.M., and Russell, R.D.: VARIATIONS IN THE RELATIVE ABUNDANCES OF THE ISOTOPES OF COMMON LEAD. Phys. Rev. 88:1275-6 (Dec. 15), 1952. Mass-spectrometer measurements of the relative

isotopic abundances of samples of Pb ores from Archean-type rocks showed larger variations than reported by Nier (1952). From the new measurements combined with existing data estimates of the time of formation of the earth's crust of 3.5 billion yr and of a maximum time of formation of the elements of 5.5 billion yr have been calculated. These values are in reasonable agreement with previous estimates. (From Nuclear Science Abstracts 7:Abstract No. 1173, 1953)

- 58 Déan Guelbenzu, M. (Inst. Physiol., Biochem. of Spain, Madrid): (DISTRIBUTION OF MINOR ELEMENTS IN THE POTATO PLANT, SOLANUM TUBEROSUM.) *Anales bromatol.* (Madrid) 4:57-61, 1952.

Using a previously described semiquantitative spectrographic technique (Déan Guelbenzu et al, 1947), the distribution of 19 less common elements was investigated in the roots, stems, leaves, tubers, etc., of *Solanum tuberosum*. Pb was either absent or found in mere traces in the roots, leaves, stems, and tubers. Although present in the ash, Pb was not detected in the soil in which the plants were raised. (From Chemical Abstracts 47:3415, 1953).

- 59 Nier, A.O.: MASS AND RELATIVE ABUNDANCE OF ISOTOPES. *Ann. Rev. Nuclear Sci.* 1: 137-56, 1952.

Isotopic masses and abundances determined in 1950 by various methods are reviewed. Mass spectrographic and mass spectrometric determinations of mass values and the electrical method for isotopic abundance values are discussed. New methods of mass measurement are described, including the omegatron, the chronotron, the synchrometer, and microwave spectra. (87 references) (From Nuclear Science Abstracts 6:Abstract No. 5820, 1952)

- 60 Vinogradov, A.P., Zadorozhnyi, I.K., and Zikov, S.I.: (ISOTOPIC COMPOSITION OF LEAD AND AGE OF THE EARTH.) *Doklady Akad. Nauk S.S.S.R.* 85:1107-10, 1952.

Mass spectrographic analysis of Pb from 32 galena samples, ranging in age from  $25 \times 10^6$  to  $1600 \times 10^6$  yr or older, was performed, with a probable accuracy of 1%. Calculation of the results is described, and the literature on the subject is reviewed briefly. If account is taken of the lack of differentiation of earth matter in early formative stages, the least age is calculated to be  $2.1 \times 10^9$  yr. (From Chemical Abstracts 47:456, 1953)

### 1953

- 61 Allan, D.W., Farquhar, R.M., and Russell, R.D. (Univ. Toronto, Ontario, Canada): A NOTE ON THE LEAD ISOTOPE METHOD OF AGE DETERMINATION. *Science* 118:486-9, 1953.

- 62 Bartlet, J.C., List, E., Page, M., and Chapman, R.A. (Food, Drug Lab., Dept. Natl. Health Welfare, Ottawa, Canada): THE HEAVY METAL CONTENT OF GELLING AND STABILIZING AGENTS. *Canadian Journal of Technology* 31:146-53, 1953.

The As, Pb, Zn and Cu contents, respectively, were

(in ppm): agar-agar <0.5-0.5, 1.5-16, <15-480, <10-10; gelatin <0.5-1.5, 1-8, <15-125, <10; carrageen (Irish moss gelose) 0.5-1, 2-15, <15-75, <10-30; Na pectate 1, 6, 130, 10; liquid pectin 1.3, 1.1, <10, <10; locust-bean gum 2.0-6.1, 0.9-3.2, 22-27, <10; Na carboxymethylcellulose <0.5, 1.7, 10, <10; methylcellulose <0.5, 0.9, <10, <10; Na alginate 0.5, 4-38, 15-20, <10; algin 1.5, 3.5, <15, <10; stabilizing mixture (agar, dextrose, carob and karaya gums) <0.5-1.4, 2.2-25, 50-54, <10; karaya gum <0.5, 1.3, 30, <10; gum arabic <0.5, 1.7, <10, <10. A sampling tool was designed to obtain representative samples from agar bales. (From Chemical Abstracts 47:8289, 1953)

- 63 Damon, P.I. (Univ. Arkansas, Fayetteville): LEAD ISOTOPIC RATIOS AND GEOLOGIC TIME. *Am. Geophys. Union Trans.* 34:906-14, 1953.

The consistency of recent data with Nier's (1952) data and with the Nier-Holmes hypothesis for the isotopic abundance of common Pb ores is examined. It can be shown that, although individual samples deviate markedly from expectation according to age alone, the data taken together are in agreement with the basic hypothesis. The deviations tend to be nonrandom. Possible causes of these deviations are discussed. One consequence of the Nier-Holmes hypothesis is that the Pb ores should have been derived from the granitic rocks of the Earth's crust rather than from a deep-seated source. The study of Pb isotopic ratios may be applied to geologic problems other than that of geologic time. (From Nuclear Science Abstracts 8:Abstract No. 4317, 1954)

- 64 Granottier, A.: (THE LEAD MINE OF DJEBEL SEMENE.) *Regence Tunis, Protect, franç., Dir. trav. publ., Ann. mines et géol.* 1953, No. 13, 49 pp.

The ores are of 2 types: replacement by galena of clay-rich beds in marl, and fracture-fillings by galena and cerussite in limestone. Reserves are estimated to be more than 500,000 tons, averaging 5.6% Pb. (From Chemical Abstracts 49:13034, 1955)

- 65 Headlee, A.J.W., and Hunter, R.G. (W. Virginia Geol. Surv., Morgantown): ELEMENTS IN COAL ASH AND THEIR INDUSTRIAL SIGNIFICANCE. *Industrial and Engineering Chemistry* 45:548-51 (Mar.), 1953.

Spectrographic analyses of 596 spot samples from 16 coal seams in W. Virginia were made for 38 elements, and enrichment ratios to earth's crust were calculated from the point of view of recovery from coal ash. Pb (av 0.048% in column analysis) was among 22 elements not present in quantities to warrant recovery; however, by comparison of cube variance ratio with the enrichment ratio, Pb is among those that might be recovered. Problems of atmospheric pollution were suggested by the finding of appreciable quantities of Sr, Ba, Ag, As, Be, Hg, Pb, Sb, and Sn in coal ash.

- 66 Horiuchi, K., and Tamori, E. (Osaka City Univ. Med. School, Japan): INDUSTRIAL LEAD POISONING. V. THE CONTENTS OF LEAD IN THE ORDINARY FOODS AND BEVERAGES OF THE JAPANESE. *Igaku to Seibutsugaku (Med. and Biol.)* 26:248-50, 1953.

Results are given for Pb contents, as determined by the dithizone method, of ~80 samples from ordinary foods and beverages. In general, canned fish and meat products contained larger amounts of Pb than did other foods. (From Chemical Abstracts 47:11308, 1953)

- 67 Just, J., and Kozirowski, B.: (INFLUENCE OF MINIMUM-PAINTED TANKS ON THE LEAD CONTENT OF WATER.) *Gaz. Woda i Tech. Sanit.* 26:315-8, 1953.

The purpose of the work was to establish whether water kept in a minimum-painted tank takes up Pb from the coating, in what degree, and for how long after painting. Experiments were conducted in Fe containers of 2-6.5-l capacity, painted with 2 layers of a minimum paint prepared by mixing 20 parts by weight of flax oil with 80 parts of minimum (96.95% PbO). Two different kinds of oil were used: a common one and one prepared in the laboratory by adding to it 0.75% MnO<sub>2</sub> and mixing for 7 hr at 250°. The experiments were done with 2 different waters: a city water and the same city water to which chlorides and nitrides were added in proportions of 250-5 mg/l Cl and 0.3-25.0 N. After rinsing, every container was filled with water and left for 74 hr at room temperature (16-25°) and every 24 hr Pb, O consumed, and smell were determined on a sample. After 72 hr the container was emptied, rinsed, and filled up again for another 72-hr cycle, the procedure being repeated 23 times for each tank. Results indicated that the amount of Pb contamination depended on the quality of oil used in the minimum paint. Pb content in city water fell down to the required standard (<0.05 mg/l) after a very long time: 22 cycles for containers painted with the coat prepared in the laboratory, and >23 cycles for those painted with the common coat. The O consumed increased (up to 2 ml or more of O) up to 16-17 cycles and then fell down; the paint smell disappeared after 8 cycles. (From Chemical Abstracts 48:14054, 1954)

- 68 Kulp, J.L., Owen, H.R., Eckelmann, W.R., and Bate, G.L.: ISOTOPIIC COMPOSITION OF SOME SAMPLES OF COMMON LEAD. US Atomic Energy Commission Document No. NYO-6197, 1953, 11 pp.

Isotopic analyses have been made on ~24 common Pb samples from various localities. Isotopic variations are consistent with those already reported. The results indicate a possible variation of 4% in the 207Pb/206Pb ratio for minerals from the same district. No observable differences were found in the isotopic composition of the Pb taken from different locations on a single crystal of galena. The 207Pb/206Pb ratio can be expressed to a greater degree of precision and is more relevant to the history of the mineral than a comparison of these isotopes with 204Pb=1.000. (From Nuclear Science Abstracts 7:Abstract No. 4119, 1953)

- 69 Leclerc, E., and Beaujean, P.: (GILEPPE WATERS. I. THE RESERVOIR WATER AND ITS QUALITIES. II. WATER AT THE CONSUMER LEVEL.) *Centre Belge Etude et Document. Eaux, Bull. Mens.* 1953, No. 37:128-34; 134-6. The water supply of the industrial city of Verviers was studied; it consisted of surface waters,

chiefly from peat bogs, drained by the Gileppe river and 12 other streams into a 3,438,000,000-gal dammed reservoir. Among the trace elements determined, <0.1 ppm Pb was found.

The treatment and quality of the drinking water in the distribution system of Verviers is described. Among problems discussed is the effect of speed of opening of the valves. More violent valve openings result in muddy waters of up to 700 ppm, suspended solids and 140 ppm Fe in complex form. The Pb content can go up to 9.0 ppm in new and sometimes old house pipes and varies with time up to equilibrium 8-10 gal wash water for a new 6-room house are needed to eliminate Pb. Corrosion of Pb has not so far been connected with variations in dissolved O and temperatures which are inimical in the house networks. (From Chemical Abstracts 48:3597, 1954)

- 70 Nagata, M. (Osaka Univ., Japan): SPECTROGRAPHIC ANALYSIS OF MINOR ELEMENTS IN TEA LEAVES. II. *J. Chem. Soc. Japan, Pure Chem. Sect.* 74:534-8, 1953.

Contents of metals in old and new tea leaves were determined by a semiquantitative spectrographic method. K, Mg, P, Ni, Na, and Cu were more abundant in new leaves, and Al, Sn, Pb, Be in old leaves. (From Chemical Abstracts 48:2839, 1954)

- 71 Opienska-Blauth, J., and Duhl, W. (Woj. Stacja Sanitarno. Epidem., Oddz. Inż. Sanit., Lublin, Poland): (LEAD IN THE WATERS OF THE LUBLIN DISTRICT.) *Roczniki Państwowego Zakładu Hig.* 1953:437-45.

Using a modified dithizone colorimetric method to determine the Pb content of 1400 samples of well waters in the Lublin district, it was found that only 4% of the samples showed a Pb content >0.09 mg/l. No relation was found between the increased Pb concentration and factors of Pb reactivity, such as pH, hardness of water, nitrate content, and oxidizability. It is concluded that there is no relation between water consumption and occurrence of chronic Pb poisoning in the Lublin district. (From Chemical Abstracts 48:7824, 1954)

- 72 Orostica, C.G. (Univ. Chile, Santiago): (DETERMINATION OF ZINC, COPPER AND LEAD IN MINERAL WATERS.) *Univ. Chile, fac. farm., Tesis quim. farm.* 5:186-200, 1953.

The Pb contents of the Chilean mineral waters Panimavida, Jahuel, Cachantun, Raris, and Chanqueahue are respectively: 25, 83, 93.7, --, and 430 µg/l. The values were determined photometrically with diphenylthiocarbazone. (From Chemical Abstracts 49:14236, 1955)

## 1954

- 73 Bertrand, D. (Inst. Pasteur, Paris, France): (DETERMINATION OF METALLIC CONTAMINANTS IN PRESERVED FOODS.) 10th Congr. Intern. Ind. Agr. y Aliment., Madrid 1954, 29-33.

Various techniques for the determination of Fe, Sb, Al, Cu, Ni, and Pb in preserved foods are proposed. (13 references) (From Chemical Abstracts 50:13317, 1956)

- 74 De Renzo, E.C. (Lederle Lab. Div., Am. Cyanamid Co., Pearl River, N.Y.): STUDIES ON THE NATURE OF THE XANTHINE OXIDASE FACTOR. *Annals of the New York Academy of Sciences* 57:905-8, 1954.

Spectrographic analysis of the ash of an active extract of rat liver residue, source material for xanthine oxidase factor, revealed the presence of many elements, including Pb (0.3%).

- 75 Deschreider, A.R., and van Coillie, L.: (TRACE METALS IN FRESH VEGETABLES.) 10th Congr. Intern. Ind. Agr. y Aliment. Madrid 1954:390-401. (From Chemical Abstracts 50:14141, 1956)

See Abstr. No. 87.

- 76 Gehrke, C.W., Runyon, C.V., and Pickett, E.E. (Missouri Agr. Exptl. Station, Columbia): A QUANTITATIVE SPECTROGRAPHIC METHOD FOR THE DETERMINATION OF TIN, COPPER, IRON, AND LEAD IN MILK AND MILK PRODUCTS. THE EFFECT OF STORAGE ON THE CONCENTRATION OF THESE METALS IN EVAPORATED MILK. *Journal of Dairy Science* 37:1401-8 (Dec.), 1954.

The spectrographic method described, claimed to be rapid, reliable, and accurate, permits the simultaneous quantitative determination of the title elements on a single sample. Graphite was added to the arcing mixture to ensure a more nearly complete volatilization of the samples and to prevent the formation of a refractory CaO bead. The precision of the method was from  $\pm 5$  to  $\pm 8\%$ . The concentration of Sn, Fe, Cu, and Pb were determined in 5 cases of evaporated milk in electrolytically plated cans and 4 cases of milk in hot-dipped cans, stored at room temperature and at 37°C for up to 1 yr. The concentration of Sn increased rapidly in milk stored in both types of cans, increasing from 20-215 ppm after 340 days of storage. Fe content increased from 6.5-16.5 ppm in the same period of time; Cu and Pb concentrations did not increase significantly. The mean values were 0.68 ppm for Cu and 0.35 ppm for Pb (av for 35 cans). (22 references)

- 77 Goto, T. (Tohoku Univ., Sendai, Japan): (FOOD ELEMENTS AND COOKING. I. SPECTRO-CHEMICAL ANALYSIS OF MICROQUANTITIES OF INORGANIC ELEMENTS IN ORDINARY FOODS.) *Eiyô to Shokuryô* 7:69-71, 1954-55.

Pb was widely distributed in vegetable foods, but it was rare in animal foods. (From Chemical Abstracts 53:7448, 1959)

- 78 Goto, T. (Tohoku Univ., Sendai, Japan): MICROELEMENTS DISSOLVED FROM COOKING VESSELS DURING COOKING. *Tohoku J. Agr. Research* 4:263-9, 1954.

Elements dissolved from Fe, Al, and Cu vessels during cooking are significant in hygiene and nutrition. Water, NaCl, NaHCO<sub>3</sub>, AcOH, tartaric acid and citric acid solutions were used as the cooking solutions. After varying boiling times, the solutions were analyzed for Fe, Al, Cu, Zn, Pb, Co, and Mn. All the elements increased with length of boiling time.

Al was found in greater concentration in alkaline solutions; all other elements were dissolved in acidic solutions. (From Chemical Abstracts 49:11907, 1955)

- 79 Grip, E. (Bolidens Mines, Ltd., Boliden, Sweden): (THE LEAD ORE AT LAISVALL (NORTHERN SWEDEN), ITS GEOLOGY, AND A COMPARISON WITH SOME FOREIGN DEPOSITS.) *Geol. Fören. i Stockholm Förh.* 76:357-80 1954.

Disseminated galena, with sphalerite, pyrite, barite, calcite, fluorite, and sericite, occur in Eocambrian sandstones at Laisvall. The deposit is compared with Pb-Zn deposits from other countries. (15 references) (From Chemical Abstracts 50:4730, 1956)

- 80 Kulp, J.L., Bate, G.L., and Broecker, W.S. (Lamont-Shussky Geol. Observatory, Bloemfontein, South Africa): PRESENT STATUS OF LEAD METHOD OF AGE DETERMINATION. *American Journal of Science* 252:345-65, 1954.

From an evaluation of the available results on the age of radioactive minerals as determined by the various isotopic ratios, and probable sources of error, the authors conclude that the <sup>207</sup>Pb/<sup>235</sup>U and <sup>206</sup>Pb/<sup>210</sup>Pb ages are the most reliable over the greater range of geologic time. The <sup>206</sup>Pb/<sup>238</sup>U age is generally correct to 5-10% and supersedes the <sup>207</sup>/<sup>235</sup> age in accuracy for young minerals. The <sup>208</sup>Pb/<sup>232</sup>Th age is considered usable for minerals high in Th content. The <sup>207</sup>/<sup>206</sup> age is the least reliable of all. (18 references)

- 81 Larkin, D., Page, M., Bartlett, J.C., and Chapman, R.A. (Food and Drug Lab., Ottawa, Canada): THE LEAD, ZINC AND COPPER CONTENT OF FOODS. *Food Research* 19, No. 2: 211-8, 1954.

Although the above-mentioned elements occur naturally in many products, they may find their way into food in other ways, ie, from insecticide sprays, piping, food processing equipment. However, since there has been a marked change in insecticide sprays and processing techniques, the authors felt a survey of Pb, Zn, and Cu contents of foods under present conditions was warranted. Food samples (171) were analyzed spectrographically. Results were based on single determinations except for repeated analyses because of high results, ie, >2 ppm Pb in solid foods or 0.2 ppm in liquids. Results (ranges) for Pb in ppm were: meat, dairy products, lard, shortening, <0.5-4.0; flavorings and beverage powders, 0.04-3.3; dessert powders and cake mixes, <0.5-2.0; cereal products, <0.5-2.4; spices, condiments, dressings, <0.5-17.0; canned fruits, fruit juices, jams, jellies, <0.5-2.6; beverages, <0.01-1.6; miscellaneous products, <0.5-9.3. The 4.0 found in meat was probably due to contamination from the can since the container was very etched and the sample showed some surface material. Two samples of beverage powders (lime and lemon) showed excessive amounts of Pb (2.7 and 3.3 ppm respectively). A number of spices (cinnamon (4.5 ppm), ginger (4.2 ppm), turmeric (2.4, 6.8, 2.9, 2.2 ppm) and curry powder (17.0, 14.3, 4.3 ppm)) had high Pb contents. The

source of contamination in these products was not known. Raspberry jam with a Pb value of 2.6 was also high as was cocoa (2.8 ppm) and dried hops (9.3 ppm). However, it was concluded that, in general, the Pb content of the processed foods examined was satisfactory.

- 82** Szymczyk, F., and Kolankiewicz, J.: (NATURAL ARSENIC AND LEAD CONTENT OF POLISH GRAINS.) *Roczniki Państwowego Zakładu Hig.* 5:53-9, 1954.

No Pb was found in samples of grains harvested in different areas in Poland. (From Chemical Abstracts 48:8974, 1954)

- 83** Truffert, L., and Jans, V. (Soc. Expert Chemists, France): Les dangers de l'eau de Seltz et le saturnisme hydrique. (THE DANGERS OF SELTZER WATER FROM THE POINT OF VIEW OF LEAD POISONING.) *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 15:385-9 (June 21), 1954.

Generally, the Pb content in drinking water does not exceed 0.1 mg/l and Pb poisoning from drinking water is rare. In its last session, the Supreme Council of Public Health in France set the maximum allowable level at 0.05 mg/l. The authors studied the Pb content in various samples of Seltzer (carbonated) water by a combination of the dithizone and polarographic methods in numerous areas supplied by rivers, grouping the samples according to whether the water used came from "aggressive" or "non-aggressive" water regions. Pb content of the 1st type ranged from 0.03-4.6, and of the 2nd, from 0.03-0.20 mg/l. The results obtained demonstrated the hazards of drinking certain types of Seltzer water. Spanish authors are cited who reported Pb intoxications due to drinking Seltzer water.

The authors believe that the siphons, with a high Pb level in the siphon heads, used for the distribution of Seltzer water, are obsolete and should be modified to prevent contact of this water with any material containing either Pb or other toxic metals. The need is stressed for the elimination of Pb from materials used for containers of food products, particularly carbonated beverages, and for the replacement of the seltzer water siphons by other, more hygienic, receptacles such as are used for other beverages.

## 1955

- 84** Chamberlain, G.T. (E. African Agr. Forestry Res. Organ., Kikuyu, Kenya): THE MAJOR AND TRACE-ELEMENT COMPOSITION OF SOME EAST AFRICAN FEEDS. *E. African Agr. J.* 21:103-7, 1955.

Tables are given showing the content of 21 elements, including Pb, in barley, beans, blood meal, bran (coarse), bran (fine), bulrush millet, cottonseed cake, groundnut cake, linseed cake, lucerne, lupin seed, maize, meat meal, molasses, oats, pollards, rumenal contents, and yeast. (From Chemical Abstracts 50:5190, 1956)

- 85** Czajka, J., and Pietrzykowa, A.: CLASSIFICATION OF FRUIT PRODUCTS IN REGARD TO

## QUANTITATIVE CONTENT OF ARSENIC, LEAD, AND COPPER. *Ann. Univ. Mariae Curie-Sklodowska Sect. D*, 10:345-58, 1955.

The mean values for As content were: fruit wine 55-110 µg/l, liquid fruit products 86-208 µg/l, marmalades and jams 44-75 µg/kg; for Pb content: musts 125-507 µg/l, fruit wines 125-550 µg/l, marmalades and jams 700-1120 µg/kg; for Cu content: liquid fruits 1.05-3.28 mg/l, fruit wines 0.85-1.40 mg/l, marmalades and jams 5.0-6.0 mg/kg. (From Chemical Abstracts 51:6905, 1957)

- 86** David, D.J., Wark, D.C., and Mandryk, M. (C.S.I.R.O., Canberra, Australia): LEAD TOXICITY IN TOBACCO RESEMBLES AN EARLY SYMPTOM OF FRENCHING. *J. Australian Inst. Agr. Sci.* 21:182-5, 1955.

A comprehensive spectrochemical analysis was carried out on the above-ground portions of 6 tobacco-plant samples. Mn, Mo, Al, and Pb showed concentration relations conforming with the state of health of the plants. It is suggested that Pb may be a contributory factor in frenching of tobacco. (From Chemical Abstracts 50:2744, 1956)

- 87** Deschreider, A.R., and van Coillie, L.: (THE TRACE METALS IN FRESH VEGETABLES.) *Ministère Affaires Écon. et Classes Moyennes (Belg.) Lab. Central*, Publ. No. 135, 12 pp. (not dated).

The sum of the values for Fe, Zn, Cu, Pb, and As in fresh spinach, endives, leeks, chicory, skirret and sometimes tomatoes exceeded the legal maximum of 200 mg/kg of dry matter set by some countries for canned vegetables. (From Chemical Abstracts 49:13547, 1955)

- 88** Heide, F., and Lertz, H. (Univ. Jena, Germany): (THE GEOCHEMISTRY OF LEAD.) *Chem. Erde* 17:217-22, 1955.

The mean Pb content of 12 samples from Muschelkalk and Upper R8th in Steudnitz near Jena was 7.9 g/ton. Only the sparry apatite with 11.5 g/ton and the platy limestone with 14 g/ton varied much from the mean value. The mean Pb content for the argillaceous rocks of R8th in G8schwitz near Jena was 20.8 g/ton. (From Chemical Abstracts 49:10812, 1955.)

- 89** Kawashiro, I., Fujii, S., and Harada, M.: COMPARISON OF THE LEAD CONTENTS OF CANNED FOODS WHEN LOW-LEAD AND HIGH-LEAD SOLDERS ARE USED. *Bull. Natl. Hyg. Lab., Tokyo* 1955, No. 73:213-22.

As determined by the dithizone method (A.O.A.C., *Methods of Analysis*, 7th ed, 1950), in 8 Japanese samples, the Pb content was usually <1 ppm, rarely 1-1.5 ppm. The Pb content was somewhat greater in samples preserved at 37° than in those preserved at room temperature. A minute difference (0-0.3 ppm) was found between samples with low Pb (Pb:Sn = 60:42) and those with high Pb (Pb:Sn = 98:2) solders. (From Chemical Abstracts 50:6697, 1956)

- 90** Kulp, J.L. (Columbia Univ., New York, N.Y.): ISOTOPIC DATING AND THE GEOLOGIC TIME SCALE. *Geol. Soc. Amer., Spec. Paper* 62, 609-30, 1955.

A table is given of ages determined by the Pb iso-



tope method. Rb-Sr ages by isotope dilution appear to be 15-20% higher than the Pb ages; the accepted figure for the half-life of  $^{87}\text{Rb}$  may be in error. (41 references) (From Chemical Abstracts 49:12233, 1955)

- 91 Markovic, T.: (CORROSION OF LEAD IN DISTILLED WATER.) *Werkstoffe u. Korrosion* 6: 133-5, 1955.

The effect of the diffusion velocity of O on the corrosion of Pb was studied in distilled water by means of potential-time measurements. With increasing depth of immersion the potential of the Pb electrode becomes more noble. By means of Hickling's method (1937) the origin and nature of various Pb hydrides, such as  $\text{Pb}_2\text{H}$ ,  $\text{PbH}$ , and  $\text{PbH}_2$ , could be verified. These compounds are to be observed as chemical or physical adsorption compounds at the Pb electrode. (From Chemical Abstracts 49:12257, 1955)

- 92 Nunes de Oliveira, J.: (TRACE ELEMENTS IN CORN AND FISH MEAL.) *Anais da Faculdade de Farmacia do Porto* 15:5-31, 1955.

Trace elements in Portuguese cornmeal and sardine meal were identified spectrographically, with F being determined chemically in the amount of 7-9 mg%. The presence of B and Co was not determined. The elements identified in the 2 meals were Al, Ca, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Si, and Ti with Sr in the cornmeal and V in the fishmeal. (From Chemical Abstracts 52:11310, 1958)

- 93 Paiva Netto, J.E. de, and Nascimento, A. C.: (SOME CLAYS OF SÃO PAULO STATE.) *Ceramica (São Paulo)* 1955, No. 2:50-77.

Chemical analyses are given of representative samples, all of which contained Pb. (22 references) (From Chemical Abstracts 54:10697, 1960)

- 94 Patterson, C., Tilton, G., and Inghram, M. (California Inst. Technol., Pasadena; Carnegie Inst., Washington, D.C.; Univ. Chicago, Ill.): AGE OF THE EARTH. *Science* 121:69-75 (Jan. 12), 1955.

A new method for estimating the age of the earth is described. It consists of calculating a  $^{207}\text{Pb}/^{206}\text{Pb}$  age from the observed differences between the isotopic composition of recent Pb isolated from the surface of the earth where appreciable concentrations of U exist and the isotopic composition of Pb isolated from Fe meteorites where insignificant concentrations of U are found.

- 95 Rankine, B.C. (Waite Agr. Res. Inst., Adelaide, S. Australia): THE LEAD CONTENT OF SOME AUSTRALIAN WINES. *Journal of the Science of Food and Agriculture* 6:576-9, 1955.

The Pb content of 55 Australian wines varied 0.04-0.86 ppm, mean 0.23 ppm. White, red, sweet, dry, fortified, and unfortified wines for home consumption and export were analyzed. The results are discussed in relation to the legal limit of 1 ppm in wine introduced by the British Minister of Food. The literature relating to the Pb content of wines is reviewed.

- 96 Schlink, F.J. (Consumers' Res. Inc., Wash-

ington, N.J.): LEAD POISONING. Letter to the Editor. *Journal of the American Medical Association* 157:78, 1955.

Prof. H.H. Uhlig, a corrosion expert at Massachusetts Institute of Technology, Department of Metallurgy, has reviewed the item in the *Journal* (1953). He takes exception to the implied connection between Pb poisoning and Cu ground wires stated in the review of the work of Desoille and Albahary. Uhlig holds that electric current flowing through a pipe has no effect on internal corrosion of the pipe material and thus that Pb poisoning can easily occur independently of any grounding system of which the Pb pipes are a part. This is not to imply that flow of current is not often a cause of corrosion on the external surface of pipes, but, rather, that in the circumstances described the current flow was not a cause of increased corrosion of the pipe internally. The ground wire may and often does cause increased galvanic corrosion near the external pipe area where it makes contact with the outside of the pipe.

- 97 Wedepohl, K.H. (Univ. Göttingen, Germany): (HEAVY-METAL CONTENTS IN THE CALCAREOUS SKELETONS OF SOME MARINE ORGANISMS.) *Nachr. Akad. Wiss. Göttingen, Math.-physik. Kl., IIa*, 1955:79-86.

By using average limestones (93 samples) with Mn 300, Zn 25, Pb 9, Sn 5, and Cu 2 ppm and shells of recent mollusks, cephalopods, and algae with about Mn 30, Zn 3, Pb 1, Sn 1, and Cu 2 ppm as a basis of comparison, 5 composite samples of recent foraminifera are investigated. The foraminifera samples contain appreciable amounts of Mn, Pb, Cu and Sn compared with the above-mentioned recent calcareous shells. (From Chemical Abstracts 52:16997, 1958)

## 1956

- 98 Burger, E. (Univ. Heidelberg, Germany): (LEAD CONTENT OF TORULA DRY YEAST FROM SULFITE LYE.) *Z. Lebensm.-Untersuch. u.-Forsch.* 104:434-6, 1956.

The Pb content of 48 samples was 0.7-3.0 mg/kg yeast; av 1.2 mg/kg. The data are discussed with regard to possible Pb intoxication caused by the use of the yeast in livestock feeds. The results are well within the tolerated limits. (From Chemical Abstracts 51:6907, 1957)

- 99 Deschreider, A.R., and van Coillie, L. (Ministry Econ. Affairs, Brussels, Belgium): Les oligoéléments dans les fèves de cacao. (TRACE ELEMENTS IN COCOA BEANS.) *Revue Internationale de la Chocolaterie* 11, No. 9:374-84, 1956.

Cocoa beans, such as are used in the manufacture of chocolate, and their shells were separated, homogenized, and examined for their content of trace elements. Only those elements included in Thatcher's classification were analyzed. The various types of beans examined were Kongo, Lomé, Carenero, Arriba, Trinidad and Accra. Cocoa beans contained no Bi or Hg and only minute traces of Pb (determined by colorimetric method), 0-0.32 ppm in the beans and 0.57-1.75 ppm in the shells.

There were no differences in Pb values among the various types of beans examined. The average F content (by Willard-Winter method) (beans, 0.95-2.28 ppm; shells, 0.19-2.26 ppm) was close to that usually found in plants, as was As (beans, 0.15-0.46 ppm; shells, 0.47.1-1.71 ppm). Mo content was low, 0.1 ppm. Al, was localized in the shells and varied in content from sample to sample. Fe content in the beans was ~30 ppm, more abundant in the shells. Some types of beans are richer in Fe than others.

The authors note that the relatively high trace element contents of the various types of cocoa beans can contribute significantly to human nutrition, especially by providing elements such as Cu, F, Fe, Mn, Mo and Zn.

- 100 Goto, T. (Tohoku Univ., Sendai, Japan): FOOD ELEMENTS AND COOKING. I. SPECTRO-CHEMICAL ANALYSIS OF MICROQUANTITIES OF INORGANIC ELEMENTS IN ORDINARY FOODS. Tohoku J. Agr. Res. 6:279-84, 1956.
- Spectrochemical analyses of 30 kinds of representative Japanese foods showed the presence of 21 inorganic elements, P, Ca, Mg, K, and Na being present in greatest amounts. Cu, Fe, Zn, Si, Al, and Mn are also common elements and are found in almost all the foods. In general, vegetable foods contain a larger number of elements than animal foods; Mn, Pb, Sb, Sn, V, and Ba are practically limited to vegetable foods. (From Chemical Abstracts 50:13317, 1956)

- 101 Jacquemain and Bénard: (THE PRESENCE OF LEAD IN CISTERN WATER.) Ann. Sci. Univ. Besançon Chim. (2), No. 2:3-11, 1956.
- Following a case of Pb poisoning, attributed to the drinking of cistern water, J. and B. investigated various factors affecting the solution of Pb in water. The amount of Pb in solution was determined by the dithizone method. In order to determine the Pb content of rain water 2 conditions were necessary: (1) The unknown, as well as the rain water used to prepare standard solutions should be degassed. (2) Two standard solutions should be used, one with a slightly higher and the other with a slightly lower titer than that of the unknown (after rough estimation). Rain water rapidly reacts with exposed Pb. This corrosion is enhanced by galvanic effects but is slowed down or stopped by the formation of a loose protective coating. The latter becomes detached on exposure to the air and corrosion resumes when the water level rises. (From Chemical Abstracts 53:2513, 1959)

- 102 Koch, G.S., Jr. (Colonia San Antonio, San Francisco del Oro, Chihuahua, Mexico): THE FRISCO MINE, CHIHUAHA, MEXICO. Econ. Geol. 51:1-40, 1956.
- The ore is polymetallic, averaging 0.5 g Au/ton, 150 g Ag/ton, 5% Pb, 8% Zn, and 0.6% Cu. (From Chemical Abstracts 50:13668, 1956)

- 103 Kunaev, D.S.: (GENESIS OF LEAD-ZINC DEPOSITS IN THE CENTRAL PART OF THE KARATAU RANGE.) Vestnik Akad. Nauk Kazakh. SSR 12, No. 6:47-60, 1956.

A detailed account of the mineralogical and geo-

logical factors which bear on Pb-Zn deposits in the Karatau range in Kazakh, SSR. (From Chemical Abstracts 50:15354, 1956)

- 104 Lardereau, M.P., and Berthier, P.: (QUALITATIVE SPECTROGRAPHIC ANALYSIS OF ROUSSILLON GRAPE JUICE AND ATTEMPTS TO DETERMINE MANGANESE.) Congr. Groupe. Avance. Méthodes Anal. Spectrog. Prod. Mét. 19th Congr. 1956:301-7.

Among other metals Pb was found in the ash of grape juice. (From Chemical Abstracts 53:2504, 1959)

- 105 Lawrence, L.J. (N.S. Wales Univ. Technol., Sydney, Australia): NATIVE LEAD FROM THE REDCAP MINE, CHILLAGO. Proc. Roy. Soc. Queensland 68:21-3, 1956.

The Redcap Mine in North Queensland was studied. The specimen consists essentially of coarsely cleaved galena coated with earthy Mn oxide. A central core of readily identifiable metallic Pb occurs in the granular cerussite of the galena. Very small patches of red and yellow waxy oxides of Pb (minium and massicot) are also discernable in the specimen. (From Chemical Abstracts 52:3597, 1958)

- 106 Lounamaa, J. (Finland): (TRACE ELEMENTS IN PLANTS GROWING WILD ON DIFFERENT ROCKS IN FINLAND. A SEMI-QUANTITATIVE SPECTROGRAPHIC SURVEY.) Ann. Bot. Soc. Zool. Bot. Fennicae "Vanamo" 29, No. 4:196 pp., 1956.

The occurrence of Pb in wild plants growing on outcrops of different rocks as well as in their substrata is discussed. (From Chemical Abstracts 53:5418, 1959)

- 107 Queries and Minor Notes: TRACES OF LEAD IN FOODS. Journal of the American Medical Association 161:1033, 1956.
- The question of whether dry or powdered milk contains enough Pb to make it unsafe for consumption is answered. Powdered milk has been found to contain 0.4 ppm of Pb, which approximates 0.18 g Pb/lb of dry milk. This same amount has been reported to occur in many other foods and beverages. However, since 1.5 mg Pb may safely be taken in daily without the appearance of recognizable Pb poisoning, the quantity reported in the powdered milk should not be regarded with alarm.

- 108 Rogick, F.A., Teixeira e Silva, H.M., and Sousa, J. de A. (São Paulo, Brazil): (LEAD IN MILK CONSUMED IN SÃO PAULO, BRAZIL.) Bol. Ind. Animal (São Paulo) 15, No. 1:87-92, 1956.

Analyses of shipped milk supplies showed from 0.005 to 0.4 mg% of Pb, derived from metal cans that were found to have inner coatings containing 46.5% Pb. (From Chemical Abstracts 52:3187, 1958)

- 109 Runnels, R.T., and Schleicher, J.A. (Kansas Geol. Survey, Lawrence): CHEMICAL COMPOSITION OF EASTERN KANSAS LIMESTONES. State Geol. Survey Kansas Bull. 119:81-103, 1956.

Quantitative spectrographic determinations of 288

samples are given for 13 elements, including Pb. Trace elements were highest in the impure lime-stones. (From Chemical Abstracts 50:13675, 1956)

- 110 Tauson, L.V., and Kravchenko, L.A. (V.I. Vernadskii Inst. Geochem. Anal. Chem., Acad. Sci. Moscow): (CHARACTERISTICS OF DISTRIBUTION OF LEAD AND ZINC ACCORDING TO MINERALS OF THE CALEDONIAN GRANITOIDS OF THE SUSAMYRSK BATHOLITH, CENTRAL TIEN SHAN.) *Geokhimiya* 1956, No. 1:81-9. Study of distribution of Pb and Zn in 3 facies of Caledonian granitoids, viz, earliest porphyritic granodiorites, coarse-grained biotitic granites, and leucocratic medium-grained granites. All determinations of Pb and Zn were made by the dithi-zone method, with specifically purified reagents. Mineralogical and chemical tabulations are provided. (From Chemical Abstracts 50:15354, 1956)

- 111 Turekian, K.K., and Kleinkopf, M.D.: ESTIMATES OF THE AVERAGE ABUNDANCE OF Cu, Mn, Pb, Ti, Ni, AND Cr IN SURFACE WATERS OF MAINE. *Bulletin of the Geological Society of America* 67:1129-32 (Aug.), 1956.

A semiquantitative emission spectrographic method was used to analyze 439 samples of streams and lake waters over the State of Maine to test the feasibility of large-scale geochemical prospecting in unexplored areas, but the data are applicable to basic geochemical problems. The average abundance of Cu, Mn, Pb, Ti, Ni and Cr in these surface waters was found to be 1.16, 0.40, 0.26, 0.20, 0.02 and 0.02 ppb. The fact that the dominant crystalline rocks in Maine are granitic is reflected generally in the low Ni and Cr values and the high Pb value.

- 112 Vinogradov, A.P.: LEAD ISOTOPES AND THEIR GEOLOGICAL SIGNIFICANCE. In Conference of the Academy of Sciences of the USSR on the Peaceful Uses of Atomic Energy, July 1-5, 1955. US Atomic Energy Commission Document No. AEC-tr-2435 (Pt. 2), 1956, pp. 187-206. (From Nuclear Science Abstracts 10:Abstract No. 4039, 1956)

### 1957

- 113 Anonymous: QUALITY OF SURFACE WATER IN CALIFORNIA. 1955-1956. Calif. Dept. Water Resources, Bull. No. 65:1-411, 1957. Monthly analyses of water from 150 sampling points include Pb in the list of substances investigated. (From Chemical Abstracts 55:1971, 1961)

- 114 Babakhodzhaev, S.M.: (GEOLOGY OF THE NEW ORE DEPOSITS IN THE TAKOB RIVER BASIN.) *Trudy Instituta Geologii Akademii Nauk Tadzhikskoi SSR* 1957, No. 2:255-81. Analyses of Pb, Zn, Cu, Cd, and F on 5 ore-bearing rocks of the polymetallic Pb-hematite deposits of Burmagol-Pshamba and 8 modal analyses of ore-bearing porphyritic biotite granites and Pb, Zn, As, Sn, Cd, and F analyses on 9 ore samples from the Piezdara Pb-Zn-fluorite deposits are given. (From Chemical Abstracts 54:15114, 1960)

- 115 Bergner, K.G., and Schikorr, G. (Chem. Landesuntersuchungsanstalt, Stuttgart, Germany): (HYGIENIC IMPORTANCE OF WINE BOTTLE CAPS MADE OF TINNED LEAD.) *Zeitschrift für Lebensmittel-Untersuchung und-Forschung* 106:132-41, 1957.

Pb contamination of wines in corked bottles which were capped with tinned Pb caps was studied. During aging there was corrosion of caps. The Pb corrosion products were found in and around the mouths of the bottles and were soluble in wine. It is recommended that Pb caps for beverage bottles be coated to at least 3  $\mu$  with Sn. (From Chemical Abstracts 52:649, 1958)

- 116 Broussy, G., and Pitet, G.: (SPECTROGRAPHIC RESEARCH ON THE SULFUR WATERS AND GLAIRINS OF CAUTERETS.) *Cong. Soc. Pharm. France*, 9<sup>e</sup>, Clermont-Ferrand 1957, 1963-6. Pb was found in both water and bacterial glairins. (From Chemical Abstracts 53:22627, 1959)

- 117 Bugelski, Yu.Yu.: (SOME PECULIARITIES IN THE MOVEMENT OF ZINC, LEAD, AND COPPER IN THE GROUND WATERS OF THE POLYMETALLIC DEPOSITS OF CENTRAL KAZAKHSTAN.) *Geochemistry*, Moscow, 1957, 84-90.

Samples of ground water from 5 main deposit areas of the metals indicated that Pb had traveled the least distance in water. (From Water Pollution Abstracts 34:Abstr. No. 366 (Feb.), 1961)

- 118 Costa, R.L., and Molíns, R.: (COLORIMETRIC DETERMINATION OF LEAD IN MYTILUS EDULIS AND IN THE SEA WATER OF THE VIGO ESTUARY.) *Bol. Inst. Españ. Oceanog.* No. 84, 1957, 13 pp.

Mussels taken at various stations showed a greatly increased Pb content in comparison with sea water. The average factor of enrichment was 38.5. This increase in concentration might be an index of the amount of water passing through the tissues of the mussel. (From Chemical Abstracts 53:7445, 1959)

- 119 Gilewska, C.: (CONTENTS OF SOME TOXIC METALS IN PAPER WRAPPINGS FOR FOODS IN POLAND. DETERMINATION OF LEAD, ARSENIC, AND COPPER.) *Roczniki Państwowego Zakładu Hig.* 8:469-80, 1957.

Samples of wrappings used for food packaging in Poland contained, on the average, Pb 2, As 1, and Cu 30 mg/kg. Polish cellophane and printed wrappings contained, on the average, Pb 1000, Cu 62, and As 24 mg/kg. (From Chemical Abstracts 52:7551, 1958)

- 120 Grazhdan, P.E.: (SOME RESULTS OF THE STUDY OF THE CHEMICAL COMPOSITION OF THE UNDERGROUND WATERS OF THE BALKHANY REGION OF SOUTHWEST TURKMENISTAN.) *Trudy Turkmen. Sel'skokhoz. Inst.* 9:485-92, 1957.

Microquantities of Pb were found. (From Chemical Abstracts 54:11341, 1960)

- 121 Marshall, R.R. (Univ. Chicago, Ill.): ISOTOPIC COMPOSITION OF COMMON LEADS AND CONTINUOUS DIFFERENTIATION OF THE CRUST OF THE EARTH FROM THE MANTLE. *Geochimica et Cosmochimica Acta* 12:225-37, 1957.

The ratios  $^{238}\text{U}/^{204}\text{Pb}$  and  $^{232}\text{Th}/^{238}\text{U}$  have been

calculated from 207 analyses of nonanomalous common leads. These are the values which would be present today in the Pb ore-producing reservoirs in the crust, and they vary systematically with their "model" lead-lead ages.

- 122 Millman, A.P. (Imperial Coll. Sci. Technol., London, England): BIOGEOCHEMICAL INVESTIGATIONS IN AREAS OF COPPER-TIN MINERALIZATION IN SOUTH-WEST ENGLAND. *Geochimica et Cosmochimica Acta* 12:85-93, 1957.

For the determination of Cu, Sn, Zn, Pb, and Ag in the leaves and twigs of a variety of trees growing in an area of Cu-Sn mineralization the semiquantitative methods of spectrographic analysis were employed. An oak tree and a birch (~20 ft in height and 8 ft apart near the Hingston Down Consols mine) were examined for variations in metal content in the leaves and twigs. Three 15-25 g-samples were obtained, and particular care was taken to avoid contamination. Sn, Cu, Zn, and Ag appeared to be preferably concentrated in the leaves. Pb showed a 3-fold concentration in the twigs. The author considers these findings of great interest because previous workers believed that Pb, entering a plant, was concentrated in the roots, and variations of the Pb content in both twigs and leaves were therefore considered unlikely. The Pb values found in the leaves, twigs and soil were for the birch tree and the oak, respectively, in ppm in dried sample: 5.9, 16, 20 and 3, 9.3, 10.

The analytical results of 62 samples of *Quercus* sp, 28 *Betula* sp, and 19 *Fagus* sp, showed that the range of values, as presented in a table (for Pb respectively, <1-6, 1-9, <1-6) are characteristic of background or "ore-negative" contents of metal in the Gunnislake area. The data for 15 different species in Nigeria and Rhodesia, as presented in the same table, show that the background content of Pb is generally higher in trees from SW England. Also presented are the analytical results of 14 representative twig-samples of *Quercus*, *Salix*, *Fagus*, and *Betula* and the corresponding soil-sample. It was apparent that the Pb and Cu contents of the twigs were comparable in magnitude. Over the range 20-100 ppm Cu and up to 10 ppm Pb in the soils, the metal content of the plants was 1.6-12 ppm Cu and 1.1-13 ppm Pb, thus showing a tendency for a larger proportion of Pb to enter the plants. (20 references)

- 123 Nagy, Z., and Pólyik, E. (TRACE ELEMENTS IN HUNGARIAN WATERS.) *Hidrol. Közlöny* 37:166-7, 1957.

Pb was among the trace elements most frequently revealed in spectrographical analyses of water samples. (From Chemical Abstracts 55:856, 1961)

- 124 Oestreich, W.: (HYDROGEOCHEMICAL INVESTIGATIONS ON GALLERY AND MINE WATERS OF THE FREIBERG ORE DISTRICT.) *Geologie* (Berlin) 6:453-4, 1957.

The metal contents of the waters are discussed in relation to the situation of the vein and the quantity of moisture. Analyses of samples taken monthly show interesting relations between Fe and Mn, abundant variation of the heavy metals, especially Pb and Ag. Abundant moisture supports the

migration of the metals. Pb was among other elements determined spectrochemically. (From Chemical Abstracts 51:17657, 1957)

- 125 Oliver, J.H. (London, England): ARSENIC AND TOBACCO. (Letters to the Editor.) *Lancet* 2:603 (Sept. 21), 1957.

The Pb and As content of some brands of tobacco as it varied from 1951 to 1957 is as follows for these years, respectively, in ppm: pipe-tobacco, 96 Pb, 32 As, 4.8 Pb, 2.5 As; a popular cigarette, 143 Pb, 68 As, 5.1 Pb, 2.0 As; Havana cigar, 414 Pb, 170 As, for 1956, 260 Pb, 128 As, and for 1957, 36 Pb, 24 As.

- 126 Rankine, B.C. (Waite Agr. Res. Inst., Adelaide, S. Australia): FACTORS INFLUENCING THE LEAD CONTENT OF WINE. *Journal of the Science of Food and Agriculture* 8: 458-66, 1957.

Winemaking procedures, materials and equipment were examined for their influence on the Pb content of wine.

Unwashed grapes contained from <0.01-0.98 ppm of Pb (mean 0.13 ppm), depending on the extent of surface contamination which was partly due to Pb arsenate spray residue. Grapes, washed with acid to remove surface contamination, contained from <0.01-0.10 ppm (mean 0.05 ppm). Fermentation removed from solution 11-45% (mean 30%) of the Pb present in the grape juice. Fining agents, fortifying spirit and acids normally added to wine did not significantly alter the Pb content, nor was it lowered by the Mueslinger blue fining, which is used in some countries to remove Cu and Fe. Brass winery equipment and rubber wine hoses were found to be sources of contamination, but stainless steel, plastic, and glass equipment and a filter pad examined were not. Maturation of young wine produced a slight decrease but refrigeration and ion-exchange treatment produced no significant alteration in Pb content. Contact with various types of cask wood, paraffin wax, bottle corks and also wine analyzed before and after shipment to England led to no significant change.

The influence of wine type and composition on the extent of Pb contamination was examined. Contamination was not found to be related to SO<sub>2</sub> content, titratable acid or pH but was higher in sweet fortified wines than in dry wines, and in these wines added SO<sub>2</sub> and tartaric acid produced a further increase. The influence of Pb bottle capsules was not investigated as these are known to be a major source of contamination. The method of determination of Pb is given. (From author's summary)

- 127 Stewart, R.M.: LEAD. In *Mineral Commodities of California: Geologic Occurrence, Economic Development, and Utilization of the State's Mineral Resources*. California Department of Natural Resources, Division of Mines Bulletin 175:281-92, 1957. (From Chemical Abstracts 52:7959, 1958)

- 128 Szarski, P. (Inst. Przemysłu Mięsnego, Poland): (THE PASSING OF LEAD FROM SOLDERS INTO CANNED MEAT.) *Prace Inst. Przemysłu Mięsnego* 1:137-62, 1957.

Solders containing 60-70% Pb, instead of 37%, are suitable for soldering cans for corned beef or luncheon meat. The Pb contents of the meats stored over 9 mo were far below 2 mg/kg. (From Chemical Abstracts 53:7452, 1959)

- 129 Umemoto, S.: RELATION BETWEEN THE CONTENTS OF RADON AND RADIUM B IN SEVERAL RADIOACTIVE MINERAL SPRINGS. Bull. Chem. Soc. Japan 30:421-7 (June), 1957.

The contents of RaB ( $^{214}\text{Pb}$ ) and other related components were determined immediately after issue in order to disclose the relationship between the contents of Rn and RaB. The measurements were made at Hamamura (Kachimi) Hot Springs, Misasa Hot Springs, and Sekigane Hot Springs, Tottori Prefecture, Japan. (From Nuclear Science Abstracts 12:Abstr. No. 2324, 1958)

- 130 Zyka, V.: (DISTRIBUTION OF THE TRACE ELEMENTS IN MINERAL WATERS OF MORAVIA.) Rudy 5, No. 11:1-6, 1957.

By spectral analyses, trace amounts of Cu, Mn, Pb, among other elements, were detected in the residue on evaporation of the mineral waters; their associations are summarized. (From Chemical Abstracts 56:1300, 1962)

### 1958

- 131 Anonymous: ARSENIC AND LEAD ON APPLES. Lancet 1:959 (May 3), 1958.

Public-health inspectors of Coventry found traces of Pb and As on the skins and stems of apples from Lebanon. The contamination was thought to be caused by a pesticide spray. It is stated that washing all fruit before eating is adequate protection from any hazard; peeling and coring provide an additional safeguard.

- 132 Babinets, A.E.: (PECULIARITIES IN HYDRO-GEOCHEMISTRY OF UNDERGROUND WATERS OF THE LIMITED WATER EXCHANGE OF THE SOUTHWESTERN PART OF THE RUSSIAN PLATEAU. Geol. Zhur., Akad. Nauk Ukr. R.S.R. Inst. Geol. Nauk 18, No. 2:16-29, 1958.

Carboniferous waters are V bearing and contain Co, and Pb in some cases, and show an increased I content. (27 references) (From Chemical Abstracts 53:1598, 1959)

- 133 Borozenets, A.S.: (MINERAL COMPOSITION OF SCHIZANDRA CHINENSIS GROWN IN DIFFERENT LOCALITIES.) Materialy k Izuchen. Zhen'shenya i Limonnika, Leningrad, Sbornik 1958, No. 3:141-4; Referat. Zhur. Khim., Biol. Khim. 1958, Abstr. No. 30730.

Spectrographic analysis indicated the presence of trace elements. Cu, Mn, Ni, Mo, Ag, Pb, and Zn were permanent components of the fruit. Accumulation of trace elements, such as Cu, Mn, Ni and Zn predominated in the seeds, Ti and Ag in the fruit juice. (From Chemical Abstracts 53:8320, 1959)

- 134 Duric, D. (Inst. Medicinska Istrazivanja, Zagreb, Yugoslavia): Otapanje olova iz glazura zemljanog posuda. (EXTRACTION OF LEAD FROM LEAD-GLAZED POTTERY.) Arhiv za Higijenu Rada i Toksikologiju 9:297-303,

1958.

Pb-glazed pottery is widely used in this country, and is responsible for numerous Pb poisonings both among peasants and town people. In a series of cases the analysis of the content of Pb-glazed pottery and the test of extraction with acetic acid were carried out. The results are discussed as regards the factors influencing Pb extraction. Special attention is paid to the influence of temperature, pH, and the effect of various organic and inorganic acids. It is pointed out that Pb-glazed pottery should not be used for storing any food or drink containing organic acids, nor should such a content be warmed up or boiled. (From author's summary)

- 135 Fischer, H.J.: SIXTY-FIRST REPORT ON FOOD PRODUCTS AND 49th REPORT ON DRUG PRODUCTS, 1956. Connecticut Agricultural Experiment Station, Bull. 617, 1958, 86 pp.

This report summarizes examination of foods, drugs, cosmetics and miscellaneous materials submitted by the Food and Drug Commissioner and the Commissioner of Agriculture during the calendar year 1956, as well as like materials analyzed for the US Geological Survey, the State Department of Health, the State Supervisor of Purchases, local health departments, police and others.

On pp 64 and 65, spray residues are listed. Of 95 samples of apple bark, apple juice, apples, chrysanthemums, juniper branches, lettuce, maple leaves, muck from a pond, peaches, rose bushes, shrubs, soil, spinach, turf, wine and yew, tested for pesticidal residues, no residue was found on 34 samples while 61 samples gave positive reactions. The following Pb contents were found: 7.7 ppm in 2 samples of apples and 8.9 ppm in another one. The stem bark of juniper contained 50 and 25 ppm Pb; shrubs, 50-100 ppm; soil, 25 ppm; turf from 13th Green, Yale Golf Course, 1-, 2-, and 3-in depth, good turf, 20, 50 and 15 ppm, respectively, and wilted turf, 50, 50 and 10 ppm, respectively.

- 136 Goldberg, E.D., Patterson, C., and Chow, T. (Scripps Inst. Oceanography, La Jolla, Calif.): IONIUM-THORIUM AND LEAD ISOTOPE RATIOS AS INDICATORS OF OCEANIC WATER MASSES. US Atomic Energy Commission Document No. A/Conf.15/P/1980, 1958, 7 pp.

The Io-Th ratios and isotopic composition of Pb in Mn nodules and in deep-sea sediments from the Pacific and Atlantic Oceans have been studied using  $\alpha$ -spectrometric and mass spectrometric techniques, respectively. The Mn nodules are concretionary accumulations of oxides of Fe and Mn with appreciable concentrations of such trace metals as Co, Pb, the rare earths, Zn, Cu, Ni, and Th. These deposits are unique to the deep-sea floor and the Fe-Mn phases apparently form from chemical species in solution in oceanic waters. The deep-sea sediments analyzed in this study had as principal constituents clay minerals (mainly illites), detrital quartz and feldspars, biogenous opal and phillipsite. Both the isotopic composition of the Pb and the Io-Th ratios in surface samples from the sediments and nodules showed distinct variations between oceans and also possessed characteristic values for different localities within the Pacific Ocean. These results can be interpreted on the

basis that the deep oceanic water masses, which are in contact with the sediment surfaces, furnish these isotopes to the sediments. The isotopic compositions of Pb and Th in these different circulating water masses probably reflect the previous histories of the waters in the accumulation and loss of products from the major sedimentary cycle. Such isotopic analyses in samples from the deep-sea floor can compliment the classical methods of study of deep-oceanic circulation which are based on the distribution of temperature and the concentrations of dissolved constituents in the water under consideration or on direct measurement of the velocities of the water masses. Further, the possibility of studying the character and behavior of deep oceanic waters in past ages presents itself in the depth distribution of these isotopes in deep-sea cores. Finally, the validity of rates of accumulation of deep-sea sediments based upon Io-Th ratios is considered. Two critical assumptions of the method are: the bulk of the Io and Th enter the sediments from a dissolved form in oceanic waters, and the Io/Th ratio in seawater has been constant over the time period that is being studied. Certain aspects of the latter assumption are considered on the basis of residence times of elements in the oceans and the chemical and mineralogical compositions of deep-sea sediments. (From Nuclear Science Abstracts 12:Abstr. No. 14806, 1958)

- 137 Hyvärinen, L. (Geol. Tutkimuslaitos, Otaniemi, Finland): (GEOCHEMICAL PROSPECTING FOR LEAD ORE IN KORSNÄS (FINLAND).) Geol. Tutkimuslaitos, Geotekn. Julkaisuja 1958, No. 61:7-22.  
Investigation of erratic boulders was used to evaluate the movements of the Pleistocene ice shield. Research yielded data on the CaO and Pb content. (From Chemical Abstracts 52:16990, 1958)

- 138 Kefford, J.F. (Food Preservation Research Lab., Homebush, N.S.W., Australia): THE LABORATORY EXAMINATION OF CANNED FOODS. XV. DISSOLVED COPPER AND LEAD. Food Preservation Quarterly 18:25-9, 1958.  
The significance of the occurrence of Cu and Pb in canned foods and methods for the determination of these metals are reviewed. (From Chemical Abstracts 52:20709, 1958)

- 139 Masuda, A. (Nagoya Univ., Japan): ISOTOPIC COMPOSITION OF PRIMEVAL LEAD OF THE EARTH.) Geochimica et Cosmochimica Acta 13:143-52, 1958.  
Based on the variation of isotopic composition of Pb ores, the age of the earth is estimated to be 4.55 billion years. Utilizing 2 radioactive elements, Th and U, a self-consistent primeval Pb is obtained, with  $^{204}\text{Pb}$ :  $^{206}\text{Pb}$ :  $^{207}\text{Pb}$ :  $^{208}\text{Pb}$ =1:9.05:9.81:29.45. These values demonstrate that the isotopic composition of earth's primeval Pb does not differ essentially from that of meteorites or troilite.

- 140 Mucciolo, P., Campos, M.M., and Buccheri, A. (Inst. Nutr., Rio de Janeiro, Brazil): (PERCENTAGE OF LEAD IN MILK STORED IN METAL CONTAINERS.) Arquiv. Brasil. Nutr.

14, No. 2:49-58, 1958.

Milk was stored in cans lined with Sn containing 22.2-50.2% Pb, for 5-109 hours. Greatest contamination occurred in cans containing most Pb, but it was not directly proportional to the amount of Pb. Increasing acidity of the milk caused greater contamination, particularly in cans with the higher percent of Pb. Pb in the milk ranged from 0.032-0.280% of the milk ash. (From Dairy Science Abstracts 23:238, 1961; Chemical Abstracts 57:11609, 1962)

- 141 Nishimura, M. (Hokkaido Univ., Sapporo, Japan): (CHEMICAL INVESTIGATIONS OF HOT SPRINGS IN JAPAN. XXXVII; XXXVIII. SPECTROGRAPHIC STUDIES ON MINOR METALLIC CONSTITUENTS IN HOT SPRING WATERS OF HOKKAIDO. 1; 2.) Nippon Kagaku Zasshi 79:172-82; 183-7, 1958.

Residues on evaporation from the waters of 107 hot springs (from 52 localities) in Hokkaido were examined by direct current arc-spectrographic analysis. Al, B, Ca, Fe, Mg, Mn, Si, and Cu were detected in all the samples. The following elements were also detected: Li (in 86% of all the springs), Ti (76), Ba (72), V (69), Pb (62), Ag (41), Mo (33), Ge (21), Cr (19), P (14), Ni (14), Ga (12), As (7), W (5), Sb (5), and Zr (4). Approximate limits of detection of these elements are given.

Approximate contents of Ge, Pb, and Sb in residues from hot spring waters were determined. Relatively high Ge is found in strongly alkaline and simple springs containing  $\text{H}_2\text{S}$ . Ga is found not only in this type of springs but in strongly acid waters. Average Pb concentration is  $\sim 10$ -3% with respect to residue on evaporation. The spring that gives positive lines of Sb always shows the presence of As. Cr and Ni are detected in the springs located in the circumference of the ultra basic rock zone of central Hokkaido. (From Chemical Abstracts 52:14037, 1958)

- 142 Penchev, N.P., Pencheva, E.N., and Bonchev, P.R.: (SPECTROGRAPHIC INVESTIGATION OF THE TRACE ELEMENTS IN BULGARIAN MINERAL WATERS.) Compt. Rend. Acad. Bulgare Sci. 11:375-7, 1958.

A table is presented which shows the temperature of the various mineral waters, their pH values, and the spectrographic analyses for Cu, Zn, Pb, Sn, Sb, Fe, Mn, V, Cr, Ni, Co, Mo, W, Ag, Ti, Al, Ga, In, Ge, Sr, Ba, Li, As, B, and Be. (From Chemical Abstracts 53:17380, 1959)

- 143 Savul, M., and Ababi, V.: (THE COPPER, ZINC, AND LEAD CONTENT OF SEVERAL TYPES OF ROMANIAN COAL.) Acad. rep. populare Romine, Filiala Iasi, Studii cercetari stiint., Chim. 2:251-69, 1958.

The content of trace elements in the coals was Cu 1.87-14.68, Zn 1.63-48.31, and Pb 0.10-13.45 g/ton. The amount increased up to Cu 128, Zn 158, and Pb 51 g/ton in the ash. The amount in the ash was comparable to that in clays and sedimentary rocks. The specific surface and adsorption isotherms were determined for several coals. The coals had appreciable adsorptive capacity, and the elements were adsorbed if their solutions circu-

lated through the coal layers. (From Chim. et ind. (Paris) 83:107, 1960; Chemical Abstracts 55: 15884, 1961)

- 144 Szarski, P.: (CHANGING THE COMPOSITION OF SOLDER IN FOOD CANS.) *Przemysł Spożywczy* 12:11-3, 1958.

The amount of Pb penetrating into canned food after 1 yr of storage was not more than 2 ppm irrespective of the composition of the soldering material used (ratio of Pb to Sn varied from 70: 30-37:67). (From Chemical Abstracts 52:20711, 1958)

- 145 Tarantola, C., and Libero, A (Univ. Turin, Italy): (MICROELEMENTS IN WINE. II. LEAD.) *Riv. Viticol. e Enol. (Conegliano)* 11:47-60, 1958.

A Pb content of 0.15 mg/l was found in white wine and 0.21 mg/l in red wine. Six Vermouth samples contained 0.11-0.22 mg Pb/l. It was found that during fermentation 29-67% Pb was eliminated from must, according to the various yeasts used. (From Chemical Abstracts 53:5582, 1959)

- 146 Uzumasa, Y., and Akaiwa, H. (Hokkaido Univ., Sapporo, Japan): (CHEMICAL INVESTIGATIONS OF HOT SPRINGS IN JAPAN. XL. FLUCTUATION OF MINOR CONSTITUENTS OF HOT SPRING WATERS OF JOZANKEI, HOKKAIDO.) *Nippon Kagaku Zasshi* 79:1021-4, 1958.

The fluctuations of Pb were investigated in 2 hot springs of Jozankei. (From Chemical Abstracts 53: 1599, 1959)

- 147 Vuorinen, J. (Agr. Research Center, Helsinki, Finland): THE AMOUNTS OF MINOR ELEMENTS IN FINNISH SOILS. *Maataloustieteellinen Aikakauskirja* 30:30-5, 1958.

The average Mn and Pb content of Finnish soils, as determined by spectrographic analysis was 617 and 16 ppm, respectively. (From Chemical Abstracts 52:14049, 1958)

- 148 Williams, H.A.: LEAD AND ARSENIC POISONING WITH SPECIAL REFERENCE TO THE TOXICITY OF LEAD ARSENATE SPRAY RESIDUES. *Royal Society for the Promotion of Health Journal* 78:732-40 (Nov.-Dec.), 1958.

Analyses of 64 samples of 2 varieties of apples imported in London, England, showed a Pb content of 0-31 (av 10) ppm, and an As content of 0-16 (av 3.5) ppm. In contrast to popular opinion only 25% of the total amount of spray residue was found around the core, calyx and stalk. Less than 1% of the total As and Pb was detected in the flesh from peeled fruit while the wrapping papers averaged 600 ppm Pb and 210 ppm As. When the peel from some apples bearing heavy spray residues was digested for 2 hr at 37°C in a solution containing 0.13% HCl and some pepsin, 1/4 of the Pb and 2/3 of the As dissolved, whereby it has to be realized that this experiment reflects only part of the digestive system. On this basis the approximate daily intake in vivo from 2 apples would be 0.5 mg Pb and As each. A review of Pb poisoning in children and adults is presented and permissible limits for Pb in food are discussed. There is little reliable evidence of a synergistic effect of Pb and As. In

comparing the toxicity of Pb and As it appears that taken frequently over a short period the effects of As are more harmful but if taken occasionally over a long period the effects of Pb are more serious. Legal limits for the As content in food and drinks are proposed. (40 references)

- 149 Young, E.G., and Langille, W.M. (Natl. Res. Council, Halifax; Nova Scotia Agr. Coll., Truro): THE OCCURRENCE OF INORGANIC ELEMENTS IN MARINE ALGAE OF THE ATLANTIC PROVINCES OF CANADA. *Canadian Journal of Botany* 36:301-10, 1958.

Specimens of numerous marine species of green, red, and brown algae from the Atlantic coast of Canada were analyzed for various inorganic elements. The ranges in concentration were Na 1.6-4.7, K 2.3-7.1, Ca 0.9-2.3, Si 0.5-2.0% of dry matter; I 20-2490, Zn 35-97, Cu 6-62, Mn 20-50, As 2-75, F 2-22, Pb 0.8, Ni 0.3-2, Co 0.1-0.7, and Mo 0.2-1.4 ppm. No seasonal variation was detectable in the concentration of trace elements in *Chondrus crispus*. Differences in concentration were observed between frond and stipe in 2 species of *Laminaria*. (From authors' summary; 33 references)

#### 1959

- 150 Antonov, Yu, G.: (TRACE ELEMENTS IN THE SOILS OF THE STANISLAV REGION OF THE USSR AND ENDEMIC GOITER.) *Invest. Akad. Nauk SSSR, Ser. Biol.* 1959, No. 2:193-205.

The Pb concentrations in the mountainous parts, foothills and plains were, respectively, 100, 100, 65 ppm. (From Chemical Abstracts 54:11353, 1960)

- 151 Borisova, E.N.: (LEAD CONTENT OF SOIL AND FOOD PRODUCTS.) *Kazansk. Med. Zh.* 40, No. 4:88-90, 1959.

Pb content of soil and food products was determined by the dithizone complex method in those of Armenia and the Tartar Republics. In Armenian Pb-bearing soils Pb varied from  $5 \times 10^{-3}$  to  $2 \times 10^{-1}$  and in Tartar soils from  $4 \times 10^{-4}$  to  $3 \times 10^{-3}$  dry weight. Food products in Armenia showed  $3 \times 10^{-4}$  to  $1 \times 10^{-3}$  dry weight Pb, or 2-10 times that in Tartar food ( $4 \times 10^{-6}$  to  $3 \times 10^{-4}$ ). Mean (mg/100 g solids) for Tartar and Armenia, respectively, were: rye 0.0252, 0.1320; wheat 0.0217, 0.2210; corn 0.0040, 0.0070; potato 0.0609, 0.3710; carrots 0.1050, 0.4060; onions 0.0047, 0.0530; onion greens 0.1210, 1.1610; tomatoes 0.1250, 1.0600; beets 0.1020, 0.4810; cabbage 0.1000, 0.4890, and apples 0.0890, 0.1200. Significant amounts of Pb were also found in pears and peaches. Of patients in a high-Pb settlement, 21.5% exhibited nervous system disorders. (From Chemical Abstracts 58:4965, 1963)

- 152 Boyle, R.W. (Geol. Surv. Canada, Ottawa): SOME GEOCHEMICAL CONSIDERATIONS ON LEAD-ISOTOPE DATING OF LEAD DEPOSITS. *Econ. Geol.* 54:130-5 (Jan.-Feb.), 1959.

The validity of age determinations based on the Pb-isotope ratios of galena or other Pb minerals in deposits is questioned. A few simple examples are given to show that fractionation of Pb isotopes in geochemical processes is probable. The geochemical processes through which Pb has passed

must be considered in detail before an age can be assigned to a Pb deposit. (From Nuclear Science Abstracts 13:Abstract No. 9870, 1959)

- 153 Chamberlain, G.T. (East African Agr. Forestry Res. Org., Kikuyu): TRACE ELEMENTS IN SOME EAST AFRICAN SOILS AND PLANTS. I. COBALT, BERYLIUM, LEAD, NICKEL, AND ZINC. E. African Agr. J. 25:121-5, 1959.

East African soils were found to have a Pb content of 0.60 ppm. (From Chemical Abstracts 54:6002, 1960)

- 154 Deschreider, A.R. (Ministry Econ. Affairs, Brussels, Belgium): Les oligoéléments et l'hygiène alimentaire. (THE OLIGOELEMENTS AND ALIMENTARY HYGIENE.) Bulletin de la Société Scientifique d'Hygiène Alimentaire et d'Alimentation rationnelle 47, No. 4-6: 124-36, 1959.

The author discusses the occurrence of trace elements in foods and environment and their absorption through the alimentary canal. The origins of contamination such as fungicides and pesticides, detergents, disinfectants, atmospheric pollution, transportation and storage, corrosion, artificial flavoring, coloring, and machinery, utensils and packaging materials used in the manufacture and processing of food products are described in some detail. Among the elements discussed are Sb, As, Cd, Br, F, Pb, Se, radioactive fallout (Sr), Ni, Fe, Cu, Al, Zn and Sn. The toxicologic conditions caused by some of these elements and their effect upon certain enzymes and vitamins are described from the literature. The survey includes foods such as fruits and vegetables (fresh and canned), beverages (water, beer, fruit juices, wine), and fats, oils, milk and butter. The author concludes that despite the progress made in the production and processing of foods, as well as in the use of packaging materials, pesticides, etc, the problem of contamination of food products still exists. To remedy the situation, the author suggests elimination of inferior preservation and packaging materials, wise and minimal use of metals or their elimination, and education of the consumer concerning the hygiene of food production and packaging for his own protection. (58 references)

- 155 Eristavi, D.I., and Salukvadze, E.D.: (THE LEAD CONTENT OF CARBON DIOXIDE MINERAL WATERS OF GEORGIAN SSR.) Tr. Gruz. Politekhn. Inst. 1959, No. 4:11-3.

Chemical (idometric) and spectral analyses were made for Pb content of mineral waters of the Georgian SSR. Pb was not found in mineral waters of Borzhomi, Nabeglavi, and Sairme. Traces of Pb were found only by spectral analysis in mineral water of the Zvare deposit. (From Chemical Abstracts 57:4479, 1962)

- 156 Gayun, K.G.: (FORMATION OF SUBSURFACE WATERS IN THE REGION OF THE TRUSKAVETS HEALTH RESORT.) Trudy Vsesoyuz. Nauch.-Issledovatel. Inst. Galurgii, Ministerstvo Khim. Prom. SSSR 1959, No. 35:331-9.

Waters from the Miocene formations of Truskavets contained, among other trace elements, somewhat

increased amounts of Pb and Mn. (From Chemical Abstracts 55:7711, 1961)

- 157 Gilbert, E., and Grohmann, H. (Chem. Untersuchungsamt Speyer/Rh, Germany): (A SIMPLE QUANTITATIVE POLAROGRAPHIC DETERMINATION OF LEAD IN GRAPE JUICE AND IN WINE.) Deut. Lebensm.-Rundschau 55:300-3, 1959.

Pb content of the ash of wine and grape juices was 0.0-0.17 mg/l. (From Chemical Abstracts 54:10233, 1960)

- 158 Hem, J.D.: STUDY AND INTERPRETATION OF THE CHEMICAL CHARACTERISTICS OF NATURAL WATER. U.S. Geological Survey, Water-Supply Paper 1473, 1959, 269 pp.

Water sampling and analysis followed standardized procedure. Traces of Pb, along with B, Ti, Cr, Ni, Co, Cu, Sn, Cd, and Hg, were widespread. Many natural waters were radioactive due to Ra and Rn.

- 159 Imanishi, N. (Univ. Kochi, Japan): (IN-ORGANIC CHEMICAL CONSTITUENTS OF SEA FISHES.) Records Oceanog. Works Japan, Spec. No. 3:135-9, 1959.

Pb and Mn were among the elements detected by spectrographic analysis in ashes of deep-sea fishes. (From Chemical Abstracts 55:4810, 1961)

- 160 Isojima, H.: (IDENTIFICATION OF MATCHES BY DETERMINATION OF MANGANESE AND LEAD. II.) Kagaku to Sosa 12:170-4, 1959.

Contents of Cr, Fe, Pb, and Mn in 12 kinds of match stick heads are listed. (From Chemical Abstracts 54:15083, 1960)

- 161 Jones, D.J.C. (Ministry Agr., Fisheries & Food, Trawscoed, England): STUDIES OF THE CHEMICAL COMPOSITION OF KALES AND RAPES. III. THE MINOR ELEMENTS. Journal of Agricultural Science 53:151-5, 1959.

Pb was 1 of the elements determined in leaf, stem and whole plant samples of varieties of marrow stem and thousand headed kales and varieties of rapes, using the colorimetric method. Contents in leaves ranged from 0.4-0.8 ppm dry matter; in stems, trace-0.4; in whole plant, trace-0.6.

- 162 Khetchikov, L.N., and Konstantinov, R.M. (Far Eastern Section of Siberian Branch Acad. Sci. USSR, Vladivostok): (THE DISTRIBUTION OF ZINC, LEAD, AND COPPER IN THE COUNTRY ROCKS OF THE FAR EASTERN LEAD DEPOSITS.) Geol. Rudn. Mestorozhdenii 1959, No. 4:127-33.

Variations in Cu, Pb, and Zn are not regular in ore bodies: increase in 1 element is not necessarily followed by increase of the others. This is almost never true for Pb. (From Chemical Abstracts 54:22188, 1960)

- 163 Kittl, E.: (NEW GEOCHEMICAL DATA ON ZINC AND LEAD.) Rev. Minera, Geol. y. Mineralo., Soc. Arg. Minería y Geol. 24: 41-8, 1959.

Wedepohl's theory concerning the concentration of Pb by magmatic processes is disputed. (From Chemical Abstracts 54:11890, 1960)



- 164 Klose, J. (Rudolstadt, Germany): Über das Vorkommen von Blei im Trinkwasser, (THE PRESENCE OF LEAD IN DRINKING WATER.) Zentralblatt für die Gesamte Hygiene mit Einschluss der Bakteriologie und Immunitätslehre 5, No. 1:58-63, 1959.  
It is demonstrated that in towns and villages the Pb content of drinking water is often considerably higher than has been assumed heretofore. The hygiene of drinking water and the entire field of medicine may find in these facts the basis for explaining certain diseases the genesis of which is now obscure.
- 165 Merkeschina, L.G.: (COMPARATIVE MINERAL COMPOSITION OF MILK IN REGIONS OF ENDEMIC GOITER AS DETERMINED BY SPECTRAL ANALYSIS.) Sbornik Nauch, Rabot. L'vov. Med. Inst. 17:146-7, 1959.  
In endemic goiter regions, the general mineral content of milk was lower than in regions where goiter was less prevalent: Pb was among the elements showing the lowest values, while Mn was found in higher than usual amounts. (From Chemical Abstracts 54:19994, 1960)
- 166 Milazzo, G. (Inst. superiore sanita, Rome, Italy): (THE SOLUBILIZATION OF ARSENIC, LEAD, AND ANTIMONY CONTAINED IN TIN.) Chim. e Ind. (Milan) 41:128-31, 1959.  
The possible toxic effect of Pb contained in the lining of food tins was examined by testing the reactivity of alloys of Sn-Pb (Pb:Sn=1.87-0.50) with 0.1N sulfuric, tartaric, citric and oxalic acids. Pb was found to pass into solution under these conditions. (From Chemical Abstracts 53:22551, 1959)
- 167 Milazzo, G.: (SOLUBILIZATION OF ARSENIC, LEAD AND ANTIMONY ULTIMATELY DERIVED FROM TIN.) Rend. Ist. Super. Sanita 22:397-406, 1959.  
Alloys of Sn with 0.166% As, 0.15% Sb, and 0.50-1.87% Pb were prepared from specially purified Sn. Neither As or Sb appeared to go into solution when the Sn-As and Sn-Sb alloys were exposed to 0.1N H<sub>2</sub>SO<sub>4</sub>, tartaric acid, citric acid, oxalic acid, and NaOH for 30 days. The Sn-Pb alloys, in a mixture of citric, lactic, malic, and tartaric acids (each 0.9%) with 1% NaCl, showed an apparent tendency for Pb to go into solution in proportion to its % in the alloy. The data are considered too limited to allow conclusions. (From Chemical Abstracts 53:21523, 1959)
- 168 Nishida, S.: (SPECTROCHEMICAL ANALYSIS OF CIGARET ASHES.) Kagaku to Sosa 12:226-7, 1959.  
Mn was found in 9 kinds of Japanese cigaret ashes tested; only 2 of them contained Pb which was derived from printing ink for printing the name of the cigaret on the paper. (From Chemical Abstracts 54:15848, 1960)
- 169 Ohio River Valley Sanitation Commission: WATER QUALITY AND FLOW VARIATIONS. OHIO RIVER AND TRIBUTARIES - 1956-57. Cincinnati, 1959, 168 pp.  
The following constituents were determined at Monitor Stations at 44 locations over a distance of ~950 mi along the Ohio River and 17 major tributaries. The Pb concentrations ranged from 0.00-0.03 ppm.
- 170 Pelissonnier, H.: (A GENERAL GEOLOGIC CONTROL OF LARGE STRATIFORM DEPOSITS OF LEAD, ZINC, AND COPPER: "PALEOINSULAR" STRUCTURE.) Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences 248:1691-4, 1959.  
The occurrence of stratiform deposits of Pb, Zn, and Cu on and around paleoinsular or buried-hill structures is explained by subterranean leaching by vadose water which ascends in artesian beds into the buried domes.
- 171 Rabinovich, A.V., and Baskova, Z.A. (All Union Sci.-Res. Inst. Geol., Leningrad, USSR): (DISTRIBUTION OF LEAD IN SOME GRANITIC ROCKS OF EASTERN TRANSBAIKAL.) Geokhimiya 1959, pp. 546-9.  
Rocks studied were of different ages. Pb contents were determined chemically, and results showed that 37-70% of the Pb of the rocks was concentrated in the feldspars. The amount of Pb decreased on passing from granitic rocks of the polymetallic zones to those of the Mo and Sn zones. The reverse was true for Pb entering into galena. (From Chemical Abstracts 54:7462, 1960)
- 172 Sudarev, P.M., Boiko, V.S., and Arnavtov, N.V.: (THE CONTENT OF SOME TRACE ELEMENTS IN THE SOILS AND IN THE CROP ASH OF THE NOVOSIBIRSK REGION.) Izvest. Sibir. Otdel. Akad. Nauk SSSR, 1959, No. 11:93-5.  
The Pb and Mn content in different types of soil and different crops (alfalfa, maize) is tabulated. (From Chemical Abstracts 54:9181, 1960)
- 173 Sveshnikov, G.B. (Vestnik Leningrad Univ. USSR): (AN EXPERIMENT TO INVESTIGATE OXIDATION-REDUCTION POTENTIALS OF WATERS OF SOME POLYMETALLIC DEPOSITS OF RUDNYĖ ALTAI.) Vestnik Leningrad. Univ. 14, No. 12; Ser. Geol. i Geograf. 1959, No. 2:59-67.  
Pb was found in the waters from ore deposits. (From Chemical Abstracts 53:22632, 1959)

## 1960

- 174 Catanzaro, E.J., and Gast, P.W. (Columbia Univ., New York, N.Y.): ISOTOPIC COMPOSITION OF LEAD IN PEGMATITIC FELDSPARS. Geochimica et Cosmochimica Acta 19:113-26, 1960.  
The concentration of Pb in 25 feldspars was 20-500 ppm, and the highest values were found in pure white feldspar. (From Chemical Abstracts 54:18230, 1960)
- 175 Chernyakohov, V.B.: (BASIC TRACE ELEMENTS IN SOILS AROUND THE CITY OF NAL'CHIK.) Uch. Zap., Kabardino-Balkarsk. Gos. Univ., Ser. Sel'skokhoz. 1960, No. 8:87-90.  
In 2 soil samples taken (meadow chernozem, gray forest), it was found that the amounts of Cu, Pb, and Zn were many times higher than normal (in the

Central Russian Plain). The elements are concentrated in the illuvial layer and their levels were inversely proportional to humus content. (From Chemical Abstracts 57:11584, 1962)

- 176 Dobrovolskii, G.V., and Yakushevskaya, I.V. (State Univ., Moscow): CERTAIN CHARACTERISTICS OF TRACE ELEMENT DISTRIBUTION IN RIVER VALLEY SOILS. Vestnik Moskov. Univ., Ser. VI 15, No. 5:57-70, 1960.

The amount of Pb and Mn were determined by emission spectroscopy. (From Chemical Abstracts 55:14782, 1961)

- 177 Gilewska, C. (State Inst. Hyg., Warsaw, Poland): (INVESTIGATION OF THE CONTAMINATION OF FOODS BY TOXIC METALS (LEAD, ARSENIC, AND COPPER) FROM PAPER WRAPPINGS.) Roczniki Państwowego Zakładu Hig. 11:163-72, 1960.

Butter, cheese, marmalade, and candy kept for 3-10 mo in 22 types of paper and cellophane wrappings containing up to 1300 ppm Pb showed no >2 ppm Pb which is the accepted standard in Poland. (From Chemical Abstracts 55:5794, 1961)

- 178 Gillberg, M.: (A LEAD-BEARING VARIETY OF PARGASITE FROM LÅNGBAN, SWEDEN.) Arkiv Mineral. Geol. 2:425-30, 1960.

An amphibole containing 2.12% PbO has been discovered from Långban. The Pb amphibole is regarded as a variety of pargasite. (From Chemical Abstracts 54:13998, 1960)

- 179 Ginzburg, I.I., Mukanov, J.M., and Poluzerov, N.P. (Inst. Geol. Ore Deposits, Petrog., Mineral, and Geochem., Acad. Sci., Moscow, USSR): (COPPER AND LEAD IN SOILS OF THE USPENSK COPPER DEPOSIT IN CENTRAL KAZAKHSTAN.) Geokhimiya 1960:339-44.

A study of biogeochemical prospecting for Cu at the Uspensk deposit revealed Pb in only 15 of the 42 soil cross sections. Its concentration ranged from 50-80 ppm. (From Chemical Abstracts 55:15239, 1961)

- 180 Godt, K.J., and Sommermeyer, K. (Univ. Freiburg/Breisgau, Germany): (THE RaD CONTENT OF PLANTS OBTAINED BY A  $\gamma$  SPECTROSCOPIC METHOD.) Atomkernenergie 5:282-5 (July-Aug.), 1960.

The various kinds of radioactive compounds in plants are not only of interest from the science point of view but the knowledge is also required for critical judgment of questions regarding radiation protection. The RaD-content in plants, after all, is quite considerable as it can be measured by  $\gamma$ -spectrographical methods, whereby the 46.5 kev-line can be regarded as proof. (From Nuclear Science Abstracts 14: Abstr. No. 21219, 1960)

- 181 Hansen, R.O., Vidal, R.D., and Stout, P.R. (Kearney Foundation of Soil Sci., Univ. Calif., Berkeley): RADIOISOTOPES IN SOILS: PHYSICAL-CHEMICAL COMPOSITION. In R.S. Caldecott and L.A. Snyder, eds.: A Symposium on Radioisotopes in the Biosphere. Minnesota, University of Minnesota Center

for Continuation Study of the General Extension Division, 1960, pp. 23-36.

The physical-chemical composition of radioelements in soils as reviewed by the authors is said to be as complicated as soil chemistry itself, but with the added features of radioelements being transformed continuously into new elements. Soil chemistry is considered from the point of view of a 3-phase system: gas, liquid, solid. Of these, the liquid phase represents every kind of radioelement occurring in nature along with all of the essential mineral elements which plants must extract from soils in order to grow. Pb, of which the 210 isotope is included in the review, is one of the nonessential elements which is nonetheless absorbed by plants and has analogous chemical reactions to essential elements.

- 182 Holtzman, R.B.: THE RaD CONTENT OF SOME POTABLE WATERS IN ILLINOIS. In Argonne National Laboratory Radiological Physics Division Semiannual Report, Appendix III. US Atomic Energy Commission Document No. ANL-6199, 1960, pp. 115-8.

Water samples (1-2 l) were obtained from 15 different locations in Illinois to determine the RaD ( $^{210}\text{Pb}$ ) content of some potable waters. The results of the measurements are presented in a table and show a correlation between  $^{226}\text{Ra}$  and RaD contents ( $-0.09-0.39 \mu\text{Ci/l}$ ) of the samples except in Peoria 2 and LaSalle where they were somewhat higher and those from Cuba which were low.

- 183 Idzikowski, A., and Trzebiatowski, W.: OCCURRENCE OF CERTAIN TRACE ELEMENTS IN THE ASHES OF UPPER SILESIAN BITUMINOUS COALS. I Bull. Acad. Polon. Sci., Sér. Sci., Chim., Géol. et Géograph. 8:225-33, 1960.

A report is given of Mn, V, Cr, Ni, Co, Pb, Zn, and Ge contents in the ashes of bituminous coals from various seams of the coal pits Radzionkow and Julian. The Zn and Pb contents are up to 1 and that of  $\text{GeO}_2$  0.08, the average of 60 samples from 1 coal seam being 0.04%. The determinations were made by spectrographic methods. (From Chemical Abstracts 55:15244, 1961)

- 184 Isojima, F.: ANALYSIS OF THE COMPONENTS OF MATCH-HEADS AND DIFFERENTIATION OF MATCHES. III. Kagaku Keisatsu Kenkyousho Hokoku 13:50-4, 1960; Chemical Abstracts 55:14755, 1961.

- 185 Kashkai, M.A., and Askerbeili, E.K. (Azerbaijani State Univ., USSR): (MINERAL WATER DEPOSIT IN ADZHİKEND IN THE KHANLAR-SKII DISTRICT.) Uch. Zap. Azerb. Univ., Ser. Geol.-Geogr. Nauk, 1960, No. 5:3-18.

Pb was detected spectrally in water from Adzhikend springs. (From Chemical Abstracts 57:1992, 1962)

- 186 Kick, H. (Univ. Bonn, Germany): (THE USE OF COMPOSTS FOR SOIL IMPROVEMENT AND INCREASE OF YIELDS.) Trans. Intern. Congr. Soil Sci., 7th, Madison, Wisc. 1960, 3: 321-8. (Pub. 1961)

When additions of 50 tons of fermented composts/hectare are made, the availability of Cu, Pb, Zn, Ge, Mn, and B amounts to but a few hundred g/

hectare. Detrimental effects to man are not likely. (From Chemical Abstracts 57:6346, 1962)

- 187 Lafon, K., Couillaud, P., Caumeil, M., and Marche, M.: (LEAD CONTENT OF COGNAC BRANDY.) Ann. Inst. Nat. Recherche Agron., Ser. E 9:109-16, 1960.

Most cognacs have less than 0.2 mg Pb/l, thus meeting British import regulations. Some very old cognacs contain 0.3 mg/l Pb. Such levels may be due to contact with Pb solder in the bottling plant, or, if the cork is not paraffined, in the bottle seal, or to keeping in crystal glass. (From Chemical Abstracts 55:18004, 1961)

- 188 Makarochkin, B.A., and Udenich, D.M.: (MINERALS IN HONEY.) Pchelovodstvo 37, No. 11:34, 1960.

Chemical analysis of the ash of honey (raspberry-fireweed) showed: Si 24.57, Al 13.41, Mg 8.36, P 4.61, Mn 2.14, Fe 1.97, Ti 0.08, Mo 0.02, Cu 0.01%. Spectrographic analysis showed the presence of Be, Mn, Pb, Sn, Si, Ga, Fe, Al, V, Ti, Cu, Ni, Zr, Ag. An increased content of Mo, Cu, and Ti can indicate their presence in the soil; such analyses can help in detecting the presence of such minerals in the soil. (From Biological Abstracts 38:Abstr. No. 9086, 1962)

- 189 Medvedeva, I.V. (Nutr. Lab. Novosiber. Sci.-Res. San. Inst., USSR): K voprosu o sodержanii svintsa v pechenochnykh konservakh. (CONTENT OF LEAD IN CANNED LIVER PRODUCTS.) Gigiena i Sanitariya 25:105-7 (Aug.), 1960.

The analysis by the standard method, of canned liver products (meat pies) after storage for up to 10 yr revealed Pb in 15 of 22 samples, while Pb was not found in the product before canning. The transfer of Pb from the cans was not connected with the duration of storage and was not related to the Sn content (eg, 1 sample contained 10.4 mg/kg Sn and 1.33 mg/kg Pb, another, 13.4 Sn and 1.67 Pb, and still another (9-yr storage), 111.8 Sn and no detectable Pb.) The author concludes that at normal conditions of storage, liver products may be stored 9-10 yr without change in organoleptic or chemical properties. (11 references)

- 190 Nagy, Z., Porcsalmy, I., Andrassy, K., Dezső, I., Kovacs, E., and Polyik, E. (Med. Univ., Debrecen, Hungary): A hajdúszoboszlói hőforrások kémiai elemzése. (CHEMICAL ANALYSIS OF HAJDÚSZOBOSZLÓ THERMAL SPRINGS.) Hidrológiai Közlemény 40:300-3, 1960.

Analysis of the Hajdúszoboszló thermal springs gave a Pb content of 18-48 µg/l.

- 191 Radkevich, E.A., Lobanova, G.M., Tomson, I.N., Borodaev, Y.S., Mozgova, N.N., Khetchikov, L.N., Aleksandrov, A.I., Solyanikov, V.P., and Smirnov, S.I.: GEOLOGY OF THE LEAD-ZINC DEPOSITS OF THE MARITIME TERRITORY. Trudy Inst. Geol. Rudnykh Mestorozhden., Petrog., Mineral. i Geokhim. 34:5-326, 1960.

The geology of the Ol'ga-Tetyukhe region is de-

scribed, and analyses of galena are included in the data presented. Water samples, taken at various depths from the surface down to 90 m, show increase in Zn, Cu, and Pb at 10-20 and 20-30 m depth; at 20-40 m levels, the concentrations of these elements decrease strongly; the decrease is less pronounced at still greater depths. (From Chemical Abstracts 55:15238, 1961)

- 192 Russell, R.D., and Farquhar, R.M.: LEAD ISOTOPES IN GEOLOGY. New York, Interscience Publishers, 1960, 243 pp.

As stated in the preface, the prime object of the monograph by the Canadian authors was to draw together the various ideas which they had earlier expressed on the subject, and to present them as a coherent statement. The isotopes of common Pb is the main concern and the dating of U and Th is dealt with in less greater detail. Included in the book are a number of tables of useful functions made with the cooperation of the Computation Centre, University of Toronto, which are found invaluable in carrying out calculations from measured Pb isotope ratios. Several hundred isotopic analyses of common Pb are included in an appendix, some of them derived from earlier literature, while others represent Toronto analyses and are published here for the 1st time. (106 references.)

- 193 Uzumasa, Y., and Akaiwa, H. (Hokkaido Univ., Sapporo, Japan): (CHEMICAL INVESTIGATIONS OF HOT SPRINGS IN JAPAN. LV. HOT SPRINGS OF NARUGO, MIYAGI PREFECTURE.) Nippon Kagaku Zasshi 81:567-70, 1960.

Studies on 6 hot springs showed that Pb and Mn were among the elements found mostly in waters with low pH. (From Chemical Abstracts 55:3882, 1961)

- 194 Yakushevskaya, I.V. (State Univ., Moscow, USSR): (THE TRACE ELEMENTS IN SEVERAL SOILS OF OPOL'YA.) Pochvovedenie 1960, No. 6:92-6.

The soil samples contained, among other elements, 700-1700 mg Mn and 19-24 mg Pb/kg soil. (From Chemical Abstracts 54:21577, 1960)

## 1961

- 195 Balks, R. (J.-Koenig-Inst., Munster/Westf., Germany): (LEAD CONTENT OF SOIL.) Kallibriefe, Fachgeb. 1, No. 11:1-7, 1961.

Analysis of 70 soil samples from Westfalen-Lippe showed on crop land an average Pb content of 29.5 mg/kg. The average Pb content in soils of grassland was 33.7 mg/kg. A relation of clay content to Pb content was observed. Due to a former mining of Pb ore near the village of Boenkhausen the soils of a small-brook area contained >0.5% Pb and caused toxic symptoms in livestock. (From Chemical Abstracts 57:1295, 1962)

- 196 Belvakova, E.E.: (LAWS GOVERNING THE WATER MIGRATION OF COPPER, LEAD, AND ZINC AND THEIR SIGNIFICANCE IN PROSPECTING.) Sovet. Geol. 1961, No. 1:98-108.

Data on the distribution of Cu, Pb, and Zn in mineral waters of different metallogenic zones are given. The concentration of Pb is lowered in

neutral and weakly alkaline waters. The role of sorption in the water migration of the three elements is discussed. (From Chemical Abstracts 55: 15239, 1961)

- 197** Durum, W.H., and Haffty, J.: OCCURRENCE OF MINOR ELEMENTS IN WATER. U.S. Geological Survey, Circular No. 445, 1961, 11 pp. A composite is presented of 3 studies with the use of separate spectrographic methods for the determination of minor elements in natural water. The mechanics of each of the methods are briefly described. The major study updates basic information in Clarke's "Data of Geochemistry," and provides current data on rates of continental chemical losses to the oceans. In this study, water samples obtained from the lower reaches just above the tide of selected rivers were quantitatively analyzed for a variety of the most frequently found minor metals: Sr, Ba, Li, Rb, Cr, Ni, Cu, Pb, B, Ti, Mo, Mn, and V. The 2nd study relates to the presence of Sr.

Pb ranges in  $\mu\text{g/l}$  for locations along the selected rivers in the US and Canada were: Apalachicola River, State Highway 20, near Blountstown, Fla., 2.1-6.2; Atchafalaya River, railroad bridge, US Highway 190, Krotz Springs, La., 1.1-11; Colorado River, bridge, US Highway 80, Yuma, Ariz., <8.0-16; Columbia River below the Dulles Dam,  $\sim 3$  mi above The Dalles, Ore., 1.2-5; Hudson River at Ford Motor Co. power plant at Green Island, N.Y., 2.9-11; Mississippi River, above bridge on US Highway 190 near Baton Rouge, La., 4.0-9.4; Mobile River, Mount Vernon Landing, Ala., 1.2-15; Sacramento River, tower bridge on Capital St., Sacramento, Calif., 0-4.5; Susquehanna River, at hydroelectric plant spillway, Conowingo, Md., 1.1-7.2; Yukon River, Mountain Village, Alaska, 1.5-8.6; Churchill River, east of island off Drachm Point, 8 mi south of Churchill, Manitoba, Canada, 2.5-4.3; Fraser River, Mission City, British Columbia, Canada, <0.62-3.9; MacKenzie River,  $\sim 3$  mi upstream from separation, at Arctic Red River, Northwest Territory, Canada, 2.9-7.6; Nelson River, near Amery, Manitoba, Canada, upstream at Kelsey powersite, 0-22; St. Lawrence River, water works plant, Levis, Quebec, Canada, 3.2-55.

- 198** Filipovic, Z., Stankovic, B., and Dusic, Z. (Univ. Belgrade, Yugoslavia): DISTRIBUTION OF Cu, Pb, Zn, Ni, AND Co IN SOIL IN RELATION TO SOIL pH CHANGES. Soil Science 91:147-50 (Feb.), 1961.

Polarographic analyses of certain Yugoslavian surface soils (0-4 in) and subsoils (4-12 in) for Cu, Pb, Zn, Ni, and Co (colorimetrically) were made along with pH values. Pb was evenly distributed throughout the samples, the surface soil being richer in Pb than the subsoil. As Pb content decreased, pH increased. Changes in trace element content were also accompanied by corresponding changes in pH values. Further research is suggested. The Pb analyses were on samples from Trepca and Ajvalija, the 1st being near a Pb mine. In 3 samples from Trepca surface soil Pb content was 516, 500, and 452 ppm with pH of 6.75, 6.91, and 6.91, respectively; in subsoil, 126, 84, and 133, with pH 6.65, 6.65, and 6.75. Ajvalija topsoil, 24 and 82 with pH 6.05 and 6.10; subsoil,

10 and 17 with pH 5.85 and 5.50.

- 199** Helliwell, T.M. (California Inst. Tech., Pasadena): OSCILLATOR STRENGTHS OF LEAD AND THE LEAD ABUNDANCE IN THE SUN. Astrophys. J. 133:566-71 (Mar.), 1961.

The oscillator strengths of 4 transitions in neutral Pb were calculated and compared with recent experimental results. The method of calculation is described. These values are used to investigate the problem of Pb abundance in the sun, which is compared with the abundance predicted by the theory of stellar nucleosynthesis. (From Nuclear Science Abstracts 15: Abstr. No. 16272, 1961)

- 200** Horiguchi, S.: LEAD CONTENT OF FOODS: A REVIEW. Rodo no Kagaku 14, No. 10:665-71, 1959. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 2, April 1959-March 1961, p. 57.

- 201** Kulik, A.A., and Barabash, T.P.: (CONTENT OF TRACE ELEMENTS IN GORNYI ALTAI APPLES.) Tr. 1-oi (Pervoi) Vses. Konf. po Biol. Aktivnym Veshchestvam Plodov i Yagod, Sverdlovsk 1961:119-24.

Pb was found in 2 of 7 varieties of upper foothill apples; traces of Pb were present in 38 of 140 varieties of lower foothill apples. (From Chemical Abstracts 59:6725, 1963)

- 202** Legatowa, B.: (TOXIC SUBSTANCES FROM LEAD-TIN PACKAGES USED IN THE COSMETIC INDUSTRY.) Roczniki Panstwowego Zakladu Hig. 12:329-38, 1961.

Tin plate prevents the migration of metals to acidic and highly basic cosmetics by stabilizing the Pb cathode. Tin plating has to be accurate; otherwise microbatteries are formed, and deep corrosion of Pb occurs resulting in large amounts of Pb dissolving in the cosmetic. (From Chemical Abstracts 55:27784, 1961)

- 203** Novikova, E.P. (Med. Inst., Lvov, USSR): (TRACE ELEMENTS IN THE DRINKING WATER OF THE LVOV DISTRICT AND ENDEMIC GOITER.) Gigiena i Sanit. 29, No. 9:80-2, 1961.

Pb, Al, Fe, and Mn were present in about equal concentrations in regions of endemic goiter and in those without it. (From Chemical Abstracts 56: 7059, 1962)

- 204** Rama, K.M., and Goldberg, E.D. (Univ. California, La Jolla): LEAD-210 IN NATURAL WATERS. Science 134:98-9 (July 14), 1961.

The distribution of  $^{210}\text{Pb}$ , which enters the oceans subsequent to its production in the atmosphere by  $^{222}\text{Rn}$  decay, shows an increase with depth in sea water. By use of a simplified two-layer model of the ocean, a residence time of Pb in the upper mixed layer of <2 yr is derived. It is suggested that the marine biosphere is responsible for the conveyance of Pb from surface to deeper waters. The distribution of  $^{210}\text{Pb}$  in the Colorado River indicated rapid removal along the path from its

origin in the feed waters to the reservoir at Lake Mead. (authors' summary)

**205** Rankine, B.C. (Australian Wine Res. Inst., Adelaide): LEAD CONTENT OF AUSTRALIAN BRANDIES. *Journal of the Science of Food and Agriculture* 12:194-6, 1961.  
Analysis of 37 Australian brandies revealed 0.01-0.06 ppm Pb, mean 0.029 ppm. One sample contained 0.25 ppm. No correlation was found between the Pb content and the age, type of still, or total acidity. The significance of the results, in view of the proposed British limit of 0.5 ppm, is discussed.

**206** Stebbins, A.K., III.: SECOND SPECIAL REPORT ON THE HIGH ALTITUDE SAMPLING PROGRAM (HASP). Technical Analysis Report. US Atomic Energy Commission Document No. DASA-539B, 1961, 243 pp.  
Progress is reported in the High Altitude Sampling Program (HASP). A study of natural radionuclides in the stratosphere is included. This assisted in measurement of stratospheric processes. Elements studied include  $^{14}\text{C}$ ,  $^3\text{H}$ ,  $^{210}\text{Pb}$ ,  $^7\text{Be}$ , and  $^{32}\text{P}$ .  $^{210}\text{Pb}$  and  $^{32}\text{P}$  concentrations in the stratosphere were about that expected from cosmic ray production.  $^{210}\text{Pb}$  in the stratosphere may partially result from equatorial bomb tests. Comments are presented on surface fallout measurements which corroborate the HASP measurements. Seasonal and latitudinal effects were noted. Contributions of French tests were calculated. Hazard of radioactive fallout was assessed by nuclide and dose type. The 30 yr genetic or whole body dose in the US from  $^{137}\text{Cs}$  and elements of shorter  $1/2$  life is shown to be <100 mrem or <3% of the natural background. Lifetime, 70 yr, somatic bone dose to children in the US, is shown to be ~200 mrem of which  $1/2$  is from  $^{90}\text{Sr}$ . This is <2% of the population MPD. U-2 operational scenes, constants and conversion factors, and a summary of nuclear detonations are included. (From Nuclear Science Abstracts 15:Abstr. No. 3279, 1961)

**207** Tew, R.P., Sillibourne, J.M., and Silva-Fernandes, A.M. (East Malling Res. Sta., Kent, England): PESTICIDE RESIDUES ON FRUIT. V. HARVEST RESIDUES OF CODLING MOTH INSECTICIDES ON APPLES. *Journal of the Science of Food and Agriculture* 12:666-74, 1961.  
Persistence and harvest residues of various insecticides used to control codling moth on apples were examined. Pb arsenate left undesirable residues under some conditions of application. Since the ratio of Pb to As in  $\text{PbHAsO}_4$  is 2.77:1, but higher ratios are found when aged residues are analyzed, Pb constitutes as serious a health hazard as As, and for this reason the authors suggest the need for limits.

**208** Tugarinov, A.I., and Zykov, S.I.: (LEAD ISOTOPES IN ORE DEPOSITS OF THE CAUCASUS AND CENTRAL ASIA.) *Byull. Komissii po Opredelen. Absolyut. Vozrasta Geol. Formatsii, Akad. Nauk SSSR, Otdel. Geol.-Geograf. Nauk* 1961, No. 4:66-76.  
The isotopic composition of Pb was determined in Pb deposits of Central Asia in mineralizations of Variscan and Alpidian ages. Pb from the Alpidian deposits has a very variable isotopic composition.

(From Chemical Abstracts 56:208, 1962)

**209** Udodov, P.A., and Parilov, Yu.S. (Polytech. Inst., Tomsk, Russia): (SOME REGULARITIES IN THE MIGRATION OF METALS IN NATURAL WATERS.) *Geokhimiya* 1961:703-7.  
A hydrogeochemical study was conducted in 15 regions in Siberia from which waters were analyzed for their ore components. Pb was grouped with those metals which migrate in natural waters. (From Chemical Abstracts 57:8357, 1962)

**210** Uzumasa, Y., and Akaiwa, H. (Hokkaido Univ., Sapporo, Japan): (CHEMICAL INVESTIGATIONS OF HOT SPRINGS IN JAPAN. LX. MINOR METALLIC CONSTITUENTS OF HOT-SPRING WATERS.) *Nippon Kagaku Zasshi* 82:834-7, 1961.  
In 72 water samples of hot springs, Pb showed a positive correlation with pH and sulfate and a negative correlation with hydrogen sulfate and  $\text{Cl}^-$ . (From Chemical Abstracts 56:4531, 1962)

## 1962

**211** Buraeva, M.I.: (SALT COMPOSITION OF DRINKING WATER FROM VARIOUS SOURCES IN THE ALEKSANDRO-ZAVODSK AND BALEI AREA OF THE CHITA REGION.) *Voprosy Gigieny v Vostochnoi Zabaikal'e, Chita, Sbornik* 1962:67-9.  
Subsurface waters from drill holes and mine shafts in the Aleksandro-Zavodsk area had a low content of Pb while water from other sources had elevated concentrations. In the Balei area, water from springs and mine shafts was of good quality, but that from drilling and deep wells was not, because of high Pb and As contents. (From Ref. Zh., Geol. 1964: Abstr. No. 6E51; Chemical Abstracts 61:11748, 1964)

**212** Cannon, H.L., and Bowles, J.M. (US Geological Survey, Denver, Colo.): CONTAMINATION OF VEGETATION BY TETRAETHYL LEAD. *Science* 137:765-6 (Sept. 7), 1962.  
The Pb content of vegetation growing along the highways was determined in 3 areas: Denver, Colo., Canandaigua, N.Y., and Washington County, Md. In the Denver area, plant ash contained 100-700 ppm Pb in samples collected within 5 ft of the highway, and <5-50 ppm in samples collected 500-1000 ft from the highway. Grass collected at an intersection which carries a heavy volume of traffic contained 3000 ppm Pb. Effect of wind direction on Pb content of vegetation was shown in samples collected along a highway which has a traffic volume of 4300 cars/day; grass that contained >50 ppm extended 100 ft east from the highway but for only 10 ft to the west against the prevailing winds. Analysis of homegrown vegetables in Canandaigua, N.Y., collected <50 ft from the street showed <10-700 ppm Pb (av 115) in contrast to an expected value of <5-20 ppm Pb. Soil samples averaged 515 ppm Pb. A similar relationship was found in Washington County, Md. Samples collected within 25 ft of any road contained 80 ppm Pb (av), but samples collected >500 ft from a road contained only 20 ppm Pb (av).

**213** De Jager, C., and Neven, L. (Observatory, Utrecht, Netherlands): THE ABUNDANCE OF LEAD IN THE SUN. *Bull. Astron. Inst.*

Neth. 16:307-11, 1962.

On dry days at the Jungfrauoch Observatory, when the amount of water in the atmosphere was very low, a faint line was observed in the sun's spectrum at 7229.036 Å, which is in good agreement with the wavelength of a Pb line at 7229.008 Å. From an equivalent width of 0.26 mÅ, measured for the solar line, a value of  $1.4 \times 10^{-11}$  relative to H was derived for the abundance of Pb in the sun, in good agreement with the terrestrial abundance. (From Chemical Abstracts 58:10857, 1963)

- 214 Fijinaga, T., Morii, F., and Kanchiku, Y. (Univ. Kyoto, Japan): (CHEMICAL STUDIES ON THE OCEAN. XC. CHEMICAL STUDIES ON SEAWEEDES 15. SIMULTANEOUS POLAROGRAPHIC DETERMINATION OF ZINC, COPPER, AND LEAD IN SEAWEEDES.) Nippon Kagaku Zasshi 83: 1033-5, 1962.

A sample of seaweed was decomposed by nitric acid and perchloric acid. Zn, Cu, and Pb were extracted with dithizone in carbon tetrachloride at pH 9.0 in the presence of citrate; the ions were back extracted into 6N HCL. Polarographic determination was made in 2 different supporting electrolytes; 0.1M ammonium acetate + 0.025M KSCN + 0.1% gelatin and 0.5M ammonium acetate + 0.1M tartaric acid + 0.1% gelatin. Five samples of *Eisenia bicyclis* contain Zn 109-127, Cu 11-24, Pb 7-16 µg/g of sample dried at 105°. (From Chemical Abstracts 58:14442, 1963)

- 215 Grant, C.L., and Pramer, D. (Rutgers Univ., New Brunswick, N.J.): MINOR-ELEMENT COMPOSITION OF YEAST EXTRACT. Journal of Bacteriology 84, No. 4:869-70, 1962.

The ash of yeast extract showed on analysis 6.8 µg Pb/g of dry weight.

- 216 Kee, N.S., and Bloomfield, C. (Rothemsted Expt. Sta., Harpenden, England): THE EFFECT OF FLOODING AND AERATION ON THE MOBILITY OF CERTAIN TRACE ELEMENTS IN SOILS. Plant and Soil 16, No. 1:108-35, 1962.

Fe, Co, Ni, Zn, Pb, V, and Mo were mobilized when soils were flooded and incubated anaerobically with plant material. Chromite was unreactive under these conditions, but Cr was mobilized in a soil of normal composition. Among the reactions described, flooding and redrying increased the extractability of Fe and trace metals; Pb was immobilized to a certain extent with respect to water and neutral ammonium acetate, probably because Pb carbonate was formed. In general, reoxidation decreased the amount of material extractable by water, but this decrease was partly offset by corresponding increases in the acetate fractions. (From authors' summary; 23 references)

- 217 Los, L.I., and Pyatnitskaya, L.K. (Div. Public Hyg., Saratov Med. Inst., USSR): Soderzhanie medi, margantsa, molibdena, nikelya i svintsa v nekotorykh pishchevykh produktakh rastitel'nogo proiskhozhdeniya saratovskoi oblasti. (CONTENT OF COPPER, MANGANESE, MOLYBDENUM, NICKEL AND LEAD IN SOME FOOD PRODUCTS OF PLANT ORIGIN IN THE SARATOV REGION.) Voprosy Pitaniia 21:82-

3 (Nov.-Dec.), 1962.

The spectrographic method was used for the determination of the title elements in food products collected in 1960. The Pb contents were as follows: white cabbage (not determined); rye, 0.012, wheat, 0.011, and potatoes, 0.039 mg%.

- 218 Lüthi, H. (Swiss Exptl. Station, Wädenswil): Toleranzen für Schwermetalle in Fruchtsäften. (Empfehlungen der Internationalen Fruchtsaftunion.) (TOLERANCES FOR HEAVY METALS IN FRUIT JUICES. RECOMMENDATIONS OF THE INTERNATIONAL FRUIT JUICE UNION.) Schweizerische Zeitschrift für Obst- und Weinbau 71:412-15, 445-8; Flüssiges Obst. 29, No. 10, X:11-4, 1962.

The metal content of processed fruit juices and the necessity of establishing tolerance limits is discussed. The metals considered here are Cu, Pb, and Zn. On the basis of the literature, the daily ingestion of 0.7-1 mg Pb may have toxic effects on man.

For reasons of comparison, the content of these metals in some Swiss drinking water supplies is listed. In the case of Pb, it ranged from 0.001-0.081 mg Pb/l; stagnant tap water may contain as much as 0.26 mg Pb/l. Apples contain 0.01-0.16 mg Pb/kg, grapes 0.01-1.22; commercial apple and grape juice, 0-0.3 (av 0.06) and 0.1-1.22 (av 0.5) mg Pb/l, respectively. Considering the fact that fruit juices are consumed for health and dietetic purposes, their Pb content should not exceed 0.5 mg/l. (25 references)

- 219 Lyubofeev, V.N., Balitskii, V.S., and Cherkasov, M.I.: (A BIOGEOCHEMICAL METHOD.) Tr. po Geol. i Polezn. Iskopaemykh Sev. Kavkaza 1962, No. 2:281-7.

Experimental biogeochemical investigations were conducted in areas of known polymetallic deposits in the mountainous forested part of the northwest Caucasus. Biogeochemical samples were taken at intervals of 20-30 m along profiles 50-70 m from each other and transverse to the strike of silica-sulfide veins and zones. Two to five varieties were selected at each point to get typical indicator plants. Most of the samples were eastern beech and Caucasian fir. A slab of bark 5 x 10 cm was cut from these trees (tree diameter 0.4-1.0 m) 1.5 m above the thick end; the sample weight was 200 g. The samples were burned in the field in a closed container, and then reduced to ash in muffle ovens in the laboratory and analyzed spectrally. Pb and Cu were much better assimilated by the trees than Zn. Fir, pine, and ferns were the best accumulators of Pb. A chart of Pb and Zn distribution was constructed from these results; on this chart a metal content in plants 50-100 times greater than the background concentrations indicates the presence of mineralization. Because of the high sensitivity of the method, small as well as large ore streaks can be located. This biochemical method can be used successfully for prospecting for polymetallic ore shows in wooded areas with deep porous deposits, where metallogeny does not give the required effect. (From Ref. Zh., Geofiz. 1963, Abstr. No. 7D42; Chemical Abstracts 60:7805, 1964)

- 220 Michelson, I., Thompson, J.C., Jr., Hess, B.W., and Comar, C.L. (Consumers Union of U.S., Mt. Vernon, N.Y.): RADIOACTIVITY IN TOTAL DIET. *Journal of Nutrition* 78:371-83 (Dec.), 1962.  
Exposure of the human population to radiation from nuclear debris occurs predominantly from ingestion of radionuclides in food and water. Total diet samples collected in 1961 from 10 to 25 major cities in the United States were analyzed for radionuclides ( $^{90}\text{Sr}$ ,  $^{137}\text{Cr}$ ,  $^{144}\text{Ce}$ ,  $^{239}\text{Pu}$ ,  $^{65}\text{Zn}$ ), for natural radioactivity ( $^{226}\text{Ra}$ ,  $^{210}\text{Pb}$ ,  $^{40}\text{K}$ ) and for the stable nuclides of Ca and K. Average daily intakes of  $^{210}\text{Pb}$  were found as  $4\mu\text{Ci}$ .
- 221 Mirchev, Sv.: (CHEMICAL INVESTIGATION OF THE SOILS OF SMOLYAN HEMATURAL REGION.) *Izv. Nauchnoizsled. Inst. Pochv. Agrotekhn. "Nikola Pushkarov," Akad. Selskostopansk. Nauki Bulgar.* 4:229-37, 1962.  
The soils in this region are acidic and poor in the assimilated forms of N and P and available forms of K and Mg. Content of Pb was 23.3-42.2; Co, 1.6-3.3; and Mo, 0.07-0.21 mg/kg. (From *Chemical Abstracts* 60:1059, 1964)
- 222 Paces, T. (Central Geolog. Inst., Prague, Czechoslovakia): (A CONTRIBUTION TO THE GEOCHEMICAL STUDY OF MINERAL WATERS AT KARLOVY VARY (WEST BOHEMIA.)) *Casopis Mineral. Geol.* 7:418-27, 1962.  
Pb among other trace elements was detected spectrographically in the granite waters of the Karlovy Vary mineral springs. (From *Chemical Abstracts* 58:2267, 1963)
- 223 Polevaya, N.I., and Panteleev, A.I.: (POSSIBILITY OF USING THE LEAD ISOTOPIC METHOD FOR DETERMINING THE AGE OF GLAUCONITE.) *Inform. Sb., Vses. Nauchn.-Issled. Geol. Inst.* 1962, No. 54:31-6.  
The absolute age of a glauconite was determined by using the Pb isotope method. The Pb separated from the glauconite consisted of 1.4%  $^{204}\text{Pb}$ , 25.81%  $^{206}\text{Pb}$ , 21.07%  $^{207}\text{Pb}$  and 51.72%  $^{208}\text{Pb}$ . Polarographic determination of Pb showed that heating glauconite for 3 hr at  $950^\circ$  resulted in the separation of only 60% of the Pb present.  $^{206}\text{Pb}$ ,  $^{207}\text{Pb}$  and  $^{208}\text{Pb}$  which accumulate in the mineral during its existence were calculated. Corrections for the presence of the radiogenic Pb affected noticeably the ages determined from the  $^{206}\text{Pb}/^{204}\text{Pb}$  ratio, ie, 475 compared to 300 million yr without correction. Further development of the method is suggested. (From *Chemical Abstracts* 64:6346, 1966)
- 224 Porutskii, G.V., Golovchenko, V.P., and Cherednichenko, S.V.: (CONTENT OF TRACE ELEMENTS IN VARIOUS PLANT ORGANS.) *Dokl. Akad. Nauk SSSR* 146:1223-6, 1962.  
Examination of trace element content (Fe, Sr, Ti, Cu, Ni, V, Co, Cr, Pb, Be, Mo, and Sn) in leaves and roots of typical plants (apple tree, pear tree, potato, cotton, and ragweed) showed that the greatest amount of these elements may be located in the plastids; much smaller amounts are in the fluid proper. Appreciable differences in retention of the various metals by plants of different species were noted and tabulated. (From *Chemical Abstracts* 58:2652, 1963)
- 225 Radmic, S., and Maksimovic, M. (Univ. Belgrade, Yugoslavia): (QUANTITATIVE DETERMINATION OF ARSENIC, LEAD AND METHANOL IN WINES.) *Arhiv Farm. (Belgrade)* 12, No. 3:163-9, 1962.  
The Pb content of 22 Yugoslav wines of different origin was 0.0-0.120  $\mu\text{g/l}$ . The presence of Pb is attributed to the insecticides used on the grapes. (From *Chemical Abstracts* 58:10692, 1963)
- 226 Sanz Pedrero, P., and Fernandez de Valderama, E. (Univ. Madrid, Spain): (POLAROGRAPHIC DETERMINATION OF THE LEAD CONTENT OF CARBONATED BEVERAGES.) *Anales Bromatol. (Madrid)* 14, No. 1:9-24, 1962.  
Pb was determined in the contents of metal-topped siphon and ordinary bottles. With 27 siphon bottles, only 5 had  $<3$  ppm. The lowest levels appeared in 3 ordinary bottles (0.04, 0.07, and 0.65 ppm). The various polarographic methods for the determination of traces of Pb in carbonated beverages were reviewed. (From *Chemical Abstracts* 58:877, 1963)
- 227 Sillanpää, M. (Helsinki, Finland): ON THE EFFECT OF SOME SOIL FACTORS ON THE SOLUBILITY OF TRACE ELEMENTS. *Maatalouden Tutkimuskeskus Maantutkimuslaitos, Agroteologia Julkaisuja* No. 81, 1962, 24 pp.  
The effects of the total amounts, soil pH, texture, organic matter content and C/N ratio on the amounts of acid ammonium acetate-soluble Co, Cu, Mn, Ni, Pb and Zn in 217 Finnish soils were studied by means of multiple regressions. The total contents of trace elements (kg/ha) generally decreased in the order  $\text{Mn} > \text{Zn} > \text{Ni} > \text{Cu} > \text{Pb} > \text{Co}$ .
- 228 Sillanpää, M. (Agr. Res. Center, Helsinki, Finland): TRACE ELEMENTS IN FINNISH SOILS AS RELATED TO SOIL TEXTURE AND ORGANIC MATTER CONTENT. *Maataloustieteellinen Aikakauskirja* 34, No. 1:34-40, 1962.  
A study was conducted to evaluate the relation of the total content of Co, Cu, Mn, Ni, Pb, and Zn to soil texture and organic matter content. Single and multiple regressions were calculated for both variables. When the regression and correlation coefficients were compared, it was found that in contrast to the other metals tested neither the texture nor the organic matter content of the soil have any significant effect on the amount of Pb.
- 229 Suetin, Y.P.: (METAL CONTENT OF NATURAL WATERS IN THE HIGH-FOOTHILL ZONE ON THE NORTH SLOPE OF THE ALAI RANGE.) *Kirgiz SSR. Upravlenie Geologii i Okhrany Nedr. Trudy (Soviet Ministerstvo)* Sb. 1962, No. 2:93-6.  
More than 20 ore elements, among them Pb, were found in varying quantities in natural waters of the high-foothill zone on the north slope of the Alai Ridge. (From *Chemical Abstracts* 60:299, 1964)
- 230 Sveshnikov, G.B., and Shen, C.-L.: (HYDROCHEMICAL SURVEY IN THE IRTYSH ORE PROV-

INCE.) Uch. Zap. Leningr. Gos. Univ. No. 303, Ser. Fiz. i Geol. Nauk 1962, No. 13: 301-19.

Content of Cu, Pb, Zn, Cd, and that of Ca, Mg, Na + K, SO<sub>4</sub>, Cl, HCO<sub>3</sub>, and pH were determined in surface, subsurface, and soil waters. The results are given in numerous tables, hydrochemical maps, and profiles. The normal background for Cu, Pb, Zn was determined as (av for 1957-58) 4, 4, and 20 µg/l, respectively, by statistical processing of chemical analyses of water. The background content of Cu, Pb, and Zn is a subject of yearly variation and depends on climatic changes. In addition to Cu, Pb, and Zn the samples of some waters contained As, Sn, Bi, Mo, Ni, and Ag. Ag and Mo are good indicators of a possible presence of polymetallic deposits. The hydrochemical anomalies were observed in every area containing known ore deposits. (From Chemical Abstracts 60:13011, 1964)

- 231 Tyurina, G.I., and Shchibrik, V.I.: (A BIOGEOCHEMICAL STUDY OF A SECTION OF A POLYMETALLIC DEPOSIT IN CENTRAL KAZAKHSTAN.) Tr. Tsentr.-Kazakhstansk. Geol. Upr., Min. Geol. i Okhrany Nedr. Kaz. SSR 1962, No. 2:44-8.

Pb concentrates in leaves and stems of plants growing over the ore bodies. Pb content in plants is greater in summer than in fall. (From Chemical Abstracts 58:1250, 1963)

- 232 Vinogradova, Z.A., and Kovaljskii, V.V.: (ELEMENT COMPOSITION OF THE BLACK SEA PLANKTON.) Dokl. Akad. Nauk SSSR 147:1458-60, 1962.

Pb in a concentration of 0.2-0.3 x 10<sup>-2</sup>% is among a considerable number of elements found in Chaetoceras curvisetus. Some copepods (Calanus helgolandicus, Anomalocera and Pontella) contain Pb, among other elements, in large amounts. (From Chemical Abstracts 58:14441, 1963)

- 233 White, W.H., and Northcote, K.E. (Univ. Brit. Columbia, Vancouver, Can.): DISTRIBUTION OF METALS IN A MODERN MARINE ENVIRONMENT. Economic Geology 57, No. 3:405-9, 1962.

The purpose of the investigation was to determine whether base metals, Fe, and S are being concentrated preferentially in near-shore marine sediments, and whether their distribution patterns are random or explainable in terms of environment. Analysis of samples of sediments of the tidal flats at Mud Bay, at the eastern end of Boundary Bay, British Columbia, taken at high tides led to the conclusion that generally metals tend to accumulate preferentially in fine-grained sediment. In the case of Pb, no preferential concentration could be detected; the concentrations found were very low, usually 1 or 2 ppm.

- 234 Zyka, V.: (CONTRIBUTION TO THE GEOCHEMISTRY OF BOHEMIAN RIVER WATERS.) Sb. Geol. Ved, Technol. Geochemie 1962, No. 1:75-137.

Most waters in Bohemian (Czech) rivers are of mixed or intermediate type (CaHCO<sub>3</sub>, CaSO<sub>4</sub>, MgHCO<sub>3</sub>, MgSO<sub>4</sub>, NaHCO<sub>3</sub>, and NaSO<sub>4</sub>). Their mineral content

varies from several to 9394 (mostly ~500) mg/l. The average of 170 waters is a CaCO<sub>3</sub> type with a concentration of 165.5 mg/l. This is higher than the average of USSR waters (123.0 mg/l). On the average, Bohemian river waters contain Fe 1.2, Mn 0.255, Cu 0.012, Zn 0.094, Pb 0.035, Cr 0.083, Ni 0.018, and Sb 0.090 mg/l. Spectral analysis detected various amounts of additional 35 elements. The biggest Bohemian river, the Labe (Elbe), carries from Czechoslovakia 2.1 x 10<sup>6</sup> tons of various salts, among them Fe 6.842, Mn 2.531, Zn 547, Cu 136, and Pb 136 tons/yr. (21 references) (From Chemical Abstracts 59:310, 1963)

## 1963

- 235 Abernethy, R.F., and Gibson, F.H.: RARE ELEMENTS IN COAL. U.S. Bureau of Mines, Information Circular 8163, 1963, 69 pp.

Published information since 1944 on the occurrence of rare elements in coal is summarized. (This review is based on 114 references on rare and minor elements, 114 on germanium and gallium, and 82 on U.) The following data are given for the occurrence of Pb in ash (%): United States 0.01-0.13; Nova Scotia 0.0572 (av); England 0.02-0.08; Germany 3.1 maximum. PbS was found associated with certain Missouri coals. Nineteen out of 20 pyrite samples contained 0.0001-0.0461% Pb which demonstrates that atmospheric dust from coke works carries enough Pb compounds to contaminate the neighboring pastures.

- 236 Andriescu, E., Ancusa, M., Telegut, M., Roscovanu, A., and Cutui, M.: TRACE ELEMENT CONCENTRATION IN THE SECASENI AREA (BANAT) WATER SUPPLIES. International Symposium on Endemic Nephropathy, Sofia 1963: 196-7.

Preliminary studies of the concentrations of Cu, Zn, Pb, B and Ni and the ethiopathogeny of endemic nephritis were inconclusive. (From Chemical Abstracts 65:14126, 1966)

- 237 Dobrovol'skii, V.V.: (DISTRIBUTION OF TRACE ELEMENTS BETWEEN THE SOIL-FORMING GROUND LAYER, SOIL, AND VEGETATION UNDER CONDITIONS OF THE MOSCOW REGION.) Nauchn. Dokl. Vysshei Shkoly, Biol. Nauki 1963, No. 3:193-8.

By spectral analysis the contents of Ti, Mn, Cu, Pb, Zn, Ni, Co, Mo, Ag, Sn, V, Zr, Ga, Sr, and Ba in the soil-forming ground layers (fluvoglacial (a) and alluvial (b) sands), in the genetic horizons A<sub>g</sub> - D of a soddy podzol, and in the ash of the covering vegetation (herbs, grasses, coniferous needles and bark, and green mosses) were determined. Among the findings, the Pb and Zn concentrations rise in the illuvial and humus horizons. Mn, Zn, Cu, Pb, Sn, Mo, and Ag have a coefficient of biological accumulation (CBA) >1, calculated from the grassy vegetation as well as from the coniferous needles. (From Chemical Abstracts 60:1064, 1964)

- 238 Durum, W.H., and Haffty, J. (US Geol. Surv., Washington, D.C.): IMPLICATIONS OF THE MINOR ELEMENT CONTENT OF SOME MAJOR STREAMS OF THE WORLD. Geochimica et Cosmochimica Acta 27:1-11, 1963.



Most trace elements in river waters have concentration ranges  $\leq 100 \mu\text{g/l}$  and median values of  $10 \mu\text{g}$  or less. Only Al, Fe, Mn, Ba, and Sr range much over  $100 \mu\text{g/l}$ . Atlantic Coast river waters are slightly enriched in Ag, Cr, Mn, Mo, Ni, Sr, and Ti, and slightly deficient in Ba and Li as compared with median continental values. Gulf Coast rivers exceed continental values for Al, Ba, Cu, Fe, Li, Rb, and Ti; Cr, Pb, and Sr are lower. Pacific Coast rivers are slightly enriched in Mo and Pb and deficient in Cr, Rb, and Ti. Al, Ba, Cu, Pb, Mo, and Ag in North American runoff are of the same order as the world average for ocean waters. Hydrologic and geochemical significance of the data are discussed. (From authors' summary; 16 references)

- 239 Fang, C.-L., Sung, T.-C., and Yeh, B.: (TRACE ELEMENTS IN THE SOILS OF NORTH-EASTERN CHINA AND EASTERN INNER MONGOLIA.) T'u Jang Hsueh Pao 11, No. 2:130-42, 1963. Spectrographic analyses of 360 soil samples from 111 profiles gave the following average contents of trace elements: Mn 840, Ti 6500, Cu 22, B 46, Cr 103, Zn, 85, Mo 2.2, Co 23, Ni 51, V 92, Sr 270, Ba 570, Pb 26, and Sn 6 ppm. (From Chemical Abstracts 60:9048, 1964)

- 240 Hayakawa, T. (Nat'l. Bur. Inspection Fertilizers Feeds, Tokyo, Japan): (LEAD CONTENT IN FISH MEAL.) Igaku To Seibutsugaku 66, No. 4:207-9, 1963.

Pb in fish meal was determined by treating the sample with nitric, perchloric or sulfuric acid and measuring Pb in the dithizone-carbon tetrachloride extract colorimetrically or polarographically. The average Pb content of 24 kinds of fish meal tested was  $0.306 \pm 0.08 \mu\text{g/g}$ . (From Chemical Abstracts 63:12230, 1965)

- 241 Holman, R.H.C.: REGIONAL GEOCHEMICAL RECONNAISSANCE OF STREAM SEDIMENTS IN THE NORTHERN MAINLAND OF NOVA SCOTIA, CANADA. Canada, Department of Mines and Technical Surveys, Geological Survey of Canada, Paper 63-23:1-19, 1963.

Concentrations of Zn, Pb, and Cu in Nova Scotia stream sediments are not random, but fall into regions (low, medium, or high), definite enough to be used for geochemical mapping. Mean concentrations of Zn (80) and Pb (18) agree with Vinogradov's general crustal abundances, but the Cu concentration (7 ppm) is much lower.

- 242 Iordanov, N., and Povlova, M.: (GEOCHEMISTRY OF LEAD IN SOILS.) Izv. Inst. po Obshcha i Neorgan. Khim., Bulgar. Akad. Nauk 1:5-14, 1963.

The forms of Pb in soils were determined as (1) Pb as a part of absorbed complex, (2) Pb in independent minerals, and (3) Pb as inclusions in soil minerals. Experiments made with Ca humate and kaolin (considered as representatives of the absorbing complexes) proved that Pb is retained by the Ca humate and kaolin at pH 5, and fully liberated from them at pH 1.5. A small part of the Pb, evidently, is in the form of pyromorphite. Most of the Pb is included in the Fe and Al hydroxide minerals and in  $\text{CaCO}_3$ . The content of Pb

in 52 samples of soils of 12 types is 0.00n%. This is 2-3 times the Pb content in the Earth's crust. The maximum Pb content was observed in the upper soil horizons. (From Ref. Zh., Geol. 1964, Abstr. No. 1V70; Chemical Abstracts 61:1655, 1964)

- 243 Jaliu, A., Spînu, S., Dinu, I., and Zucman, I. (Dept. Hyg. Occup. Dis., Bucharest, Romania): La pollution de l'eau carbonatée gazeuse par le plomb. (CONTAMINATION OF CARBONATED WATER BY LEAD.) In Union des Sociétés de Sciences Médicales, Société d'Hygiène: Premier Congrès National d'Hygiène et de Sécurité du Travail. Rapports et Résumés des Travaux (First National Congress of Industrial Health. Abstracts of Papers.) Bucharest, 1963, pp. 252-3.

Ninety-two samples of carbonated mineral water were analyzed for Pb. The original tap water contained  $26-67 \mu\text{g Pb/l}$ . Seventeen samples taken from the vessels in which the water was mixed with  $\text{CO}_2$  contained  $100-410 \mu\text{g Pb/l}$ ; 16 samples of the mineral water obtained after mixing contained  $>100 \mu\text{g/l}$ ; 36 samples taken out of metal bottles in which the water was distributed to workers contained from  $70-1108 \mu\text{g/l}$ , while the Pb content of samples collected out of bottles that had been tinned under supervision, did not exceed  $100 \mu\text{g/l}$ .

- 244 Kvashnevskaya, N.V., and Shablovskaya, E.I.: (STUDY OF CONTENT OF ORE ELEMENTS IN SUSPENSIONS OF A RIVER SYSTEM.) Dokl. Akad. Nauk SSSR 151, No. 2:426-9, 1963.

Determination of content of Mo, Pb, Cu, Zn, As, Sb, Co, Ni, Cr, W, Sn, Hg, Mn, Ga, Ag, and Tl in suspension in Caucasian and Central Asian rivers showed a considerable amount of these elements. (From Chemical Abstracts 59:12506, 1963)

- 245 Marchesini, D., Barbieri, G., Milanese, G., and Rosso, S. (Offic. Cevolani, Bologna, Italy): ((PHYSICAL) BEHAVIOR OF ELECTROLYTIC-TIN CANS SOLDERED WITH ALLOYS CONTAINING VARIOUS AMOUNTS OF LEAD.) Mostra Int. Ind. Conserve Aliment., Congr. 18:97-105, 1963.

A series of mechanical tests, including solubility tests, were made on tins soldered with alloys containing varying amounts of Pb. The 8 Sn-Pb alloys used, were chosen in such a way as to explore the whole range of possible compositions, and to include alloys commonly used by can manufacturers. Alloys consisting of Sn 37-Pb 63% and Sn 2-Pb 98% were not taken into consideration. The preferred alloy contains 98% Pb. (From Chemical Abstracts 71:Abstr. No. 115950, 1969)

- 246 Marshall, R.R., and Feitknecht, J. (Nat'l. Aeron. Space Admin.): PRIMITIVE LEAD FROM IRON METEORITES. National Aeronautics and Space Administration Document N63-15726, 20 pp., 1963.

The Odessa and Toluca Fe meteorites were shown to contain primeval Pb. Pb from samples of the Odessa meteorite has unusually large amounts of  $^{206}\text{Pb}$ . A sample of the Pinon Ni-rich ataxite, within the limits of error, contained no detectable Pb. Octahedrites can contain as much as 0.25

ppm Pb. (From Chemical Abstracts 60:9055, 1964)

- 247 Mavlyanov, G.A., and Mirzaeva, K.Kh.: (CONTENT OF TRACE ELEMENTS IN THE UZBEKISTAN NATURAL WATERS.) Doklady Akademii Nauk Uzbekskoi S.S.R. 20, No. 6:40-2, 1963.

The Uzbekistan waters are characterized by an elevated content of trace elements. Their Pb content was found to range from 0.0001 to 0.003%. (From Chemical Abstracts 59:13687, 1963).

- 248 Minami, E. (Univ. Tokyo, Japan): HOKUTO-LITE OF TAMAGAWA HOT SPRINGS. Geochem. Tamagawa Hot Springs 1963:108-28.

Analyses of Hokutolites from various regions showed a Pb oxide content ranging from 1.46-21.96%. Radioactivity measurements indicated that they contained more  $^{206}\text{Pb}$  and  $^{208}\text{Pb}$  and less  $^{204}\text{Pb}$  and  $^{207}\text{Pb}$  than does commercial tetramethyllead. (From Chemical Abstracts 64:9440, 1966)

- 249 Petkevich, A.N., and Viller, G.E.: (DISTRIBUTION OF TRACE ELEMENTS AT VARIOUS DEPTHS OF THE NOVOSIBIRSK RESERVOIR.) Razvitie Ozerom Rybnom Khozyaistve Sibiri, Novosibirsk, Sbornik 1963:163-8.

Semiquantitative spectral analysis of surface and near-bottom waters of the Novosibirsk Reservoir gave a Pb content of 0.00n%, based on the dry residue. (From Ref. Zh., Geol. 1964: Abstr. No. 7V229; Chemical Abstracts 61:11749, 1964)

- 250 Podkorytov, F.M.: (CONTENT AND DISPERSION OF TRACE ELEMENTS IN SOILS OF THE POTAPOV EXPERIMENTAL FARM.) Tr. Krasnoyarsk. Sel'skokhoz. Inst. 16:104-11, 1963.

Trace elements play an important role in the fertility of soil. The content and the dispersion of Co, Zn, Ni, Mo, V, Pb, and Sn in various horizons are given and discussed. (From Chemical Abstracts 62:14375, 1965)

- 251 Potter, P.E., Shimp, N.F., and Witters, J. (Illinois State Geol. Surv., Urbana): TRACE ELEMENTS IN MARINE AND FRESH-WATER ARGILLACEOUS SEDIMENTS. Geochimica et Cosmochimica Acta 27:669-94, 1963.

The trace elements B, Co, Cr, Cu, Ga, Ni, Pb, V, and Zn were studied in 66 samples of both modern and ancient marine and fresh-water argillaceous sediments to determine their value as environmental discriminators. Samples of each group were widely scattered geographically and represented widely varying source areas, climates, tectonic conditions, and rates of sedimentation. Concentrations of Pb found in modern marine specimens ranged from 8-32 ppm; of fresh-water, 8-83, or averages of 20.8 and 21.2, respectively. In the ancient marine sediments, Pb ranged from 4-52 ppm; in fresh water sediments, 7-24; av 13.3 and 12.7 ppm, respectively. (51 references)

- 252 Pryakhin, A.I., Chekhovskikh, M.M., and Shchegunayeva, I.A.: (TRACE ELEMENTS IN SUBSURFACE WATERS OF THE UPPER AMUR REGION.) Izv. Vysshikh Uchebn. Zavedenii, Geol. i Razvedka 6, No. 1:90-8, 1963.

Mn, Ti, Cu, Ag, Zn, Pb, Cr, Ni, Co, V, Ga, Sb, Zr,

and Sr are typical trace elements in subsurface waters of the Upper Amur Region. This variety of trace elements is caused by presence in the region of a large variety of rocks of variable lithological type. According to the amount of trace elements the subsurface waters in the Upper Amur Region are subdivided in 12 water-bearing complexes. They vary widely in trace elements: Sb 0.003-0.03, Mn 0.0003-0.3, Pb traces-0.01, Ga traces-0.003, V traces-0.006, Ti traces-0.03, Cu traces-0.3, Ag traces-0.06, Zn traces-0.6, Ni traces-0.03, Zr traces-0.03, Sr 0.001-0.03, Cr traces-0.06, Co traces-0.003, Mo 0.00-0.003, and In 0.00-0.003%. (From Chemical Abstracts 59:1374, 1963)

- 253 Rasmussen, G.K., and Henry, W.H. (US Dept. Agric., Orlando, Fla.): EFFECTS OF LEAD ON THE GROWTH OF SWEET ORANGE SEEDLINGS IN NUTRIENT SOLUTION CULTURES. Soil and Crop Science Society of Florida Proceedings 23:70-4, 1963.

When Pb arsenate is sprayed on grapefruit trees in Florida to lower the acidity of the fruit, much of the Pb eventually is washed to the soil by rain where it remains soluble for a certain time and may influence the growth of plants. Therefore a study was undertaken to determine the effects of Pb, at 3 levels of pH, on the growth of sweet orange seedlings in solution cultures. Two small sweet orange seedlings were grown for 10 mo in nutrient solutions containing 0, 0.05, 0.25, 1.25, 6.25 and 31.25 ppm Pb as nitrate or acetate, at pH levels of 4.5, 5.5 and 6.5, respectively. At harvest time, growth, Pb and citric, malic, and total water-soluble organic acid contents of leaves and roots were measured. The Pb source had no significant effect on growth of roots or shoots. In the pH 4.5 and 5.5 solution cultures, root growth was stimulated by intermediate levels of Pb and inhibited by the highest levels. Shoot growth increased when a good root system was present at these pH levels. Root and shoot growth were inhibited by all but the lowest level of Pb in solution cultures adjusted to pH 6.5. The Pb content of the roots increased as the Pb content of the solution cultures increased and was highest in the 6.25 and 31.25-ppm Pb solutions at pH 6.5. The organic acid content of the leaf tissue was not influenced by either Pb or pH levels. Malic and total water-soluble organic acids in the root tissue decreased slightly when Pb was increased in the solution cultures. A slightly higher amount of organic acids was present in the root tissue at pH 4.5 than at the other pH levels. Citric acid content of the root tissue was not affected consistently though the amounts were generally lower in the high-Pb solutions except for the 6.25-ppm Pb treatment. Pb inhibited water absorption; the sweet orange seedlings were wilted often, particularly those grown in the high-Pb solutions.

- 254 Sokolova, V.Yu., and Yatsyuk, M.D.: (CERTAIN TRACE ELEMENTS IN FOOD PRODUCTS WITH HIGH CONCENTRATIONS OF PROTEINS, FAT, AND CARBOHYDRATES.) Mikroelementy v Zhizni Rast., Zhivotn. i Cheloveka, Akad. Nauk Ukr. SSR, Inst. Fiziol. Rast., Tr. Koordinats. Soveshch. 1963:276-9.

Three groups of food products of high fat content, high protein content, and high carbohydrate content, respectively, were analyzed spectroscopically. Products containing 28-70% fat contained more Zn and B, products containing 5.5-34% protein more Fe, Cu, Mn, Mo and Ni, and products containing 7.8-70% carbohydrates more Ti and Pb. (From Chemical Abstracts 64:1328, 1966)

- 255** Still, G.W., and Fahey, J.E.: INSECTICIDE RESIDUES ON GRAPES AND IN WINES. US Dept. Agr., ARS 33-81, 1963, 7 pp.

Three applications of Pb arsenate to grapes after bloom resulted in excessive residues of Pb and arsenous oxide on the grapes at harvest; practically all Pb and about 75% of As were lost in the process of wine-making. Filtering the wine did not remove any Pb or As residues but there was no Pb or As in excess of the tolerance. (From Chemical Abstracts 58:9596, 1963)

- 256** Stovbun, A.T., Sokolova, V.Yu., and Yatsyuk, M.D.: Mikroelementy v Sel'skom Khozyaistve i Meditsine. (ACCUMULATION OF CERTAIN TRACE ELEMENTS IN VEGETABLE FOOD PRODUCTS.) (Kiev: Gos. Izd. Sel'skokhoz. Lit. Ukr. SSR) Sbornik 1963:643-7.

The content of some trace metals (among them Pb) was determined in cabbage, onions, carrots and other vegetables grown in different districts. It is pointed out that, in establishing dietary requirements for groups of population, variations in trace-metal content due to varietal and soil differences should be taken into account. (From Referativnyi Zhurnal, Biologiya 1964: Abstract No. 15N107; Chemical Abstracts 62:1012, 1965)

- 257** Viller, G.E., and Khrapov, V.S.: (CONTENT OF TRACE ELEMENTS IN SOILS OF THE BARABA AREA IN NOVOSIBIRSK REGION.) Mikroelementy v Sibiri, Inform. Byul. 1963, No. 2:3-5.

Analysis was made of 43 soil samples taken in various parts of the Baraba area. The Baraba loamy soils contained: Si 5, Al 3.0-5.0, Mg 0.5-5, Ca 1-5, Fe 3, Mn 0.5-0.08, Ni 0.001-0.006, Co 0.001-0.003, Ti 0.5-2, W 0.01, Cr 0.01-0.03, Cu 0.001-0.003, Zr 0.007-0.01, Pb 0.001-0.003, Zn 0.007-0.01, Ga 0.003-0.005, Sc 0.003, P 0.01, Sr 0.01-0.1, and Ba 0.01-0.05%. (From Ref. Zh., Geol. 1964, Abstr. No. 12V31; Chemical Abstracts 62:10249, 1965)

- 258** Warren, H.V. (Univ. of British Columbia, Vancouver, Canada): TRACE ELEMENTS AND EPIDEMIOLOGY. Journal of the College of General Practitioners 6:517-31 (Nov.), 1963.

The author believes that geochemistry plays an important part in determining the causes of some of the more newly recognized diseases, such as the coronary, cancers, and multiple sclerosis. He then illustrates how geochemical and medical knowledge can be integrated advantageously by citing some recent investigations linking the excess absorption of Pb with some of the above diseases.

In discussing the biogeochemistry of Pb, on the

basis of the literature and own analyses, the usual Pb concentration of the ash of most recent vegetation is estimated to range from 50-100 ppm, and that of growth of the previous year, 25-50 ppm; that growing over soil or rock rich in Pb may contain in ash up to 1000 and even 3000 ppm. Also, vegetation may acquire Pb from chemical sprays, smelter fumes, or automobile exhausts. Pb concentrations in the ash of leaves and twigs exposed to different concentrations of automobile exhausts, made available to the author from London, Brussels, and Helsinki, ranged from 30-930 ppm, compared with 7-100 ppm in those from rural areas nearby.

Comparison of the epidemiologic reports of cancer in several parts of Cornwall, Devonshire, and Sussex with his analyses of soils and vegetables for Pb, although no direct association could be found, leads the author to conclude that the evidence of a relationship is suggestive. This comparison includes an unpublished report (Howe, 1962) implicating Pb-Zn polluted water as the cause of gastric cancer. The association with Pb of the prevalence of multiple sclerosis in Sweden, Northern Ireland, Cornwall, and Derbyshire is made on the basis of reported geologic formations in the areas concerned, or on that of analysis of soil and vegetable samples sent to the author. The author's investigations in Canada have revealed certain areas where the soil and vegetation have abnormally high Pb contents and areas where the prevalence of multiple sclerosis is high.

In summarizing, the author states that these "facts have been brought forward not to prove that Pb was the cause of some cancers and multiple sclerosis, but to demonstrate that there is evidence that this assumption might well be taken as a working hypothesis." He also suggests that epidemiologic data be plotted against biogeochemical provinces rather than against political divisions. (36 references)

- 259** Westoo, G. (Sweden): (COPPER, ZINC, CADMIUM, AND LEAD CONTENT OF SOME CANNED FOODS.) Var Foda 15, No. 10:73-8, 1963.

The Pb content of apple, grapefruit, and pineapple juice was <0.05 mg/kg, and tomato juice from 0.05-0.3 mg/kg, Cd, Cu, and Zn content 0.05, 0.3-1.1, and 1.3-8.6 mg/kg, respectively. Anchovy fillets packed in lobster sauce contained Pb <0.05-0.2, Cd <0.05, Cu 0.9, and Zn 9-11 mg/kg, Cd, Cu, and Zn content of Swedish, Norwegian, and Portuguese sardines in tomato sauce or olive oil was <0.05-0.3, 0.7-4.2, and 9-50 mg/kg, respectively. The Pb content of Portuguese sardines in tomato sauce was, in some cases, very high, up to 6.5 mg/kg. The other brands met Swedish standards. Pb content varied from <0.05-0.5 mg/kg. The Pb content of canned sardines increased with storage time. However, the Pb content of same brand varied in different cans tested. (From Chemical Abstracts 61:7599, 1964)

- 260** Youssef, M.S., and El-Kahwagy, A.S. (Geol. Surv. UAR, Cairo, Egypt): GEOPHYSICAL AND GEOCHEMICAL INVESTIGATIONS AT UNM GHEIG AREA, EASTERN DESERT. U. Arab Repub., Min. Ind., Geol. Surv. Miner. Res. Dep., Paper No. 33:1-12, 1963.

Geochemical prospecting tests for Pb and Zn were useful in delineating ore deposits. (From Chemical Abstracts 70:Abstr. No. 117022, 1969)

## 1964

- 261 Ahmad, S., Haq, A., and Faruqi, F.A. (West Regional Lab., Lahore, Pakistan): TOXIC PROPERTIES OF INDIGENOUS EARTHENWARE. *Pakistan Journal of Science* 16:9-14 (Jan.), 1964.

The quantity of acid-soluble Pb in glazes of 16 samples of earthenware of which 10 were indigenous, 3 laboratory-made and 3 imported (2 British, 1 Japanese), was determined. The earthenware samples were subjected to a "mild" test in 5% acetic or 0.5% citric acid and a "drastic" test in 10% citric acid. Pb was determined spectrophotometrically. The British samples gave off 0.03-0.04 ppm Pb in the mild tests, and 0.07-0.08 ppm in the drastic one; the Japanese samples did not split off any Pb in either test. The laboratory-made samples gave off 0.04-0.05 ppm in the former and 0.10-0.12 ppm in the latter test. For the indigenous samples, the corresponding ranges were 0.08-0.50 and 0.25-0.60, respectively. Generally, the 5% acetic-acid solution gave slightly higher figures than the 0.5% citric-acid solution. The 10% citric-acid solution on the average yielded only twice as high values as the 0.5% one.

Considering the threshold limit of 2 ppm Pb as the maximum permissible amount of acid-soluble Pb in glazes (Galler and Creamer, 1939), none of the samples tested with the exception of the indigenous sample No. 10, which was attacked appreciably both by dilute and concentrated acid, constituted a health hazard.

- 262 Chow, T.J., and Tatsumoto, M. (Univ. California, La Jolla): ISOTOPIC COMPOSITION OF LEAD IN THE SEDIMENTS NEAR JAPAN TRENCH. In *Recent Research in the Fields of Hydrosphere, Atmosphere and Nuclear Geochemistry*. Tokyo, 1964, p. 179-83.

The isotopic composition of Pb in the sediments near the Japan Trench was determined. The values are:  $^{206}\text{Pb}/^{204}\text{Pb} = 18.45$ ;  $^{207}\text{Pb}/^{204}\text{Pb} = 15.63$ ; and  $^{208}\text{Pb}/^{204}\text{Pb} = 38.68$ . The  $\mu$  and  $\kappa$  values of the source material are also calculated to be 8.8 and 3.9 respectively. (From U.S. Government Research and Development Reports 40:64 (Aug. 20), 1965)

- 263 Datsko, V.G., Klimov, I.T., and Krasnov, V.N. (Hydrochem. Inst., Novocherkassk, USSR): (HEAVY METALS IN THE WATER AND THE MUD OF THE TSIMLYANSK WATER RESERVOIR.) *Gidrokhimicheskie Materialy* 36:50-5, 1964. Spectral analysis of samples of water and bottom mud collected from the reservoir monthly for 1 yr showed the presence of Ni, Cu, V, Mo, Al, Fe, Mn and Ag in the water and Ni, Co, Cu, V, Fe, Pb and Mn in mud samples from a depth of 4-24 m. (From Chemical Abstracts 63:2742, 1965)

- 264 deTreville, R.T.P. (Mellon Inst., Pittsburgh, Pa.): NATURAL OCCURRENCE OF LEAD. *Archives of Environmental Health* 8:212-21 (Feb.), 1964.

The concentration of Pb in soil, water, food, and air is discussed and data obtained by various investigators are presented in tables. The average concentration of Pb in soil is 16 ppm, with urban soils sampled in old residential sections where Pb paint had been applied and removed for many years, ranging up to 360 ppm and certain anomalous soils, near natural or artificial sources of Pb, up to 10,000 ppm. The average concentration of Pb in public water supplies in the US is about 0.01 ppm, or 1/5 of the present standard of the US Public Health Service for potable water. The natural Pb content of vegetation, including the edible portions, in the fresh state is of the order of a few hundredths of a ppm, with the exception of some items in which Pb had been concentrated. The flesh of animals and especially certain organs (eg, the liver) tend to have higher Pb concentrations than food of vegetable origin, and skeletal tissues have still higher Pb contents. The edible tissues of shellfish and crustacea are high in Pb. Contamination of human food and beverage may introduce Pb in amounts which vary in significance from negligible to highly significant. The Pb concentration in the ambient air of cities of the US averages 1-5  $\mu\text{g}/\text{m}^3$ .

- 265 Dios Vidal, R. (Spanish Polytech. Inst. Pontevedra): (RADON-GENERATING ACTIVITY IN DIFFERENT GALICIAN SOILS IN RELATION TO OTHER GREAT WORLD GROUPS AND THE TOTAL LEAD CONTENT.) *An. Edafol. Agrobiol.* (Madrid) 23:53-63, 1964.

Data are presented on the  $^{222}\text{Rn}$  generating potential of different Galician prairie soils formed from granite and gneiss parent material, and comparisons with some of the major soil types throughout the world were made. The number of curies of  $^{222}\text{Rn}$  escaping from 2500 g of soil material, at equilibrium with its parent Ra, was much greater in some Galician soils than in other soil types, with higher Rn-generating potentials in the middle and lower parts of the soil profile. The accumulation of Pb in soils and its absorption by native plants, such as *Ulex nanus*, *Pteris aquilina* and *Carinephorus canescens* showed correlation with Rn generation even though the soils with highest Rn levels provided for most of the Pb concentration in soils and plants. (From Nuclear Science Abstracts 22:Abstr. No. 6826, 1968)

- 266 Doro, B., and Remoli, S. (District Chem. Lab. of Trieste, Italy): Ricerca del piombo ceduto dagli strati vetrificati degli utensili da cucina. (DETERMINATION OF LEAD DERIVED FROM GLAZED KITCHENWARE.) *Bollettino dei Laboratori Chimici Provinciali* (Bologna) 15, No. 5:482-9, 1964.

The Italian law prohibits the use and sale of utensils coming in direct contact with foods and beverages (excluding water) which are made of Pb or coated inside with Sn, containing >1% Pb or which are soldered with a mixture of Sn and Pb where Pb >10%. The recent sanitary law of April 30, 1962, includes the regulations first established in 1901 whereby enameled and glazed utensils (porcelain, earthenware) are required to yield no Pb into a 1% solution of acetic acid af-

ter 24 hr of contact. The fact that the minimum tolerable amount of Pb as it may leach into the liquid has not been established, makes the problem of applying the law realistically a difficult one for the analyst and the legislator. The order that "no Pb be yielded" to a 1% solution of acetic acid in 24 hr had a different implication in 1901 than at the present time because of the degree of sensitivity of the methods that have been developed since that time.

The authors undertook the determination, qualitatively and quantitatively, of Pb extracted from numerous samples of pottery and earthenware. Several of the samples containing notable amounts of Pb were repeated, and the results of the colorimetric method with dithizone titration, as used by the authors, were compared with the gravimetric (PbSO<sub>4</sub>) method. By the modern methods quantities as small as 0.05 µg/ml (0.00005 mg) could be determined, while the limit of the older ones was 0.5 mg.

By referring to permissible limits of Pb in drinking water supplies as adopted in various countries, the authors point out that their results disclosed amounts of Pb greatly exceeding the highest limits, and urge that the regulation be amended to include the tolerable limits of Pb in the acetic-acid test of utensils.

- 267 Durfor, C.N., and Becker, E. (Water Resources Div., U.S.G.S., Washington, D.C.): SELECTED DATA ON PUBLIC SUPPLIES OF THE 100 LARGEST CITIES IN THE UNITED STATES, 1962. *Journal American Water Works Association* 56:237-46 (Mar.), 1964.

Spectrographic analyses were made for trace elements in treated water supplies of the 100 largest cities in the US in 1962. Data found for Pb were as follows, in ppb: maximum, 62; median, 3.7; minimum, not detected; criterion value, 10; percentage of supplies with concentrations below the criterion value, 95.

- 268 Dvornikov, O.G., Tkach, B.I., Shtanchenko, M.S., and Antonov, V.M.: (MINERALS OF THE NATIVE ELEMENT GROUP IN LOOSE ROCKS AND SOILS OF THE NAGOL'NYI RIDGE.) *Dopovidi Akad. Nauk Ukr. RSR* 1964, No. 9:1226-9.

The following minerals were found during mineralogical study of soils and friable bedrocks of the Nagol'nyi Ridge in 1959: native Au, Ag alloy, Pb, Zn, and Cu. The Ag alloy was found in intergrowth with embolite, ankerite, and cinnabar. It contained Hg 33.2, Ag 64.31, Al<sub>2</sub>O<sub>3</sub> 0.22, Fe<sub>2</sub>O<sub>3</sub> 0.76, and insoluble residue 2.45%. The native Pb was exceptionally abundant. The occurrence of these minerals was closely related to areas containing Pb-Zn and Au mineralizations. Therefore, they can be used as indicators of Pb-Zn and Au mineralization during geologic explorations in the Nagol'nyi Ridge. (From Chemical Abstracts 62:1449, 1965)

- 269 Dytowska, O. (Inst. Leków, Warsaw, Poland): Zawartość metali ciężkich w niektórych surowcach roślinnych. (HEAVY-METAL CONTENT OF CERTAIN PLANT MATERIALS.) *Acta Polonae Pharmaceutica* 21, No. 6:497-500, 1964.

Seven samples of each of the following plants were analyzed for Pb, Cu, Zn and Fe. The average percent values found for Pb were: caraway seeds, 0.01; frangula bark, 0.011; valerian rhizomes, 0.009; belladonna leaves, 0.007; belladonna roots, 0.012; oak bark, 0.004. Variations between plants collected in various regions were negligible.

- 270 Eremenko, V.Y.: (FORMS OF HEAVY METALS IN SOME NATURAL WATERS.) *Gidrokhimicheskie Materialy* 36:125-33, 1964.

Heavy metals, including Pb, are present in the waters of the Volga, Don, and Tselina as colloids and pseudocolloids, as simple ions and complex ions with positive and negative charges. (From Chemical Abstracts 63:2741, 1965)

- 271 Glazovskaya, M.A. (State Univ., Moscow, USSR): (BIOLOGICAL CYCLE OF ELEMENTS IN VARIOUS LANDSCAPE ZONES OF THE URALS.) *Fiz., Khim., Biol. i Mineralog. Pochv. SSSR, Akad. Nauk SSSR, Dokl. k VIII-mu (Vos'momu) Mezhdunar. Kongr. Pochvovedov, Bucharest* 1964:148-57.

The accumulation of trace elements in plants was followed by means of spectral analyses of soils and plant ashes. Samples were taken from various soil zones of the Urals: tundra, taiga, forest-steppe, and steppe. The coefficients of biological accumulation (K<sub>b</sub>) of the 20 elements studied were calculated as ratios of the concentrations of the given element in plants to that in soil. According to the K<sub>b</sub>, the elements can be arranged in the following order: K<sub>b</sub> = 100: Ba, Sr, Pb; K<sub>b</sub> = 10: Zn, Mn; K<sub>b</sub> = 1: Sn, Mo; K<sub>b</sub> = 0.1: Ni, Ti, Cr; K<sub>b</sub> = 0.01: As, V. Other elements were not found. From north towards south, from the mountain tundra towards the coniferous and mixed forests, meadow and arid steppes, the amounts of trace elements in plant ashes and the values of K<sub>b</sub> decrease. The contents of mobile forms of trace elements and their availability for plants also decrease with increasing soil pH. The elements absorbed by plants return to the soil surface at the end of the growth period. In the upper soil layers the content of elements with the highest K<sub>b</sub> increases 3-10 times, as compared with the lowest (rocky) layer. Elements with a low K<sub>b</sub> do not accumulate in soil. The content and distribution of trace elements in the profile of the zonal soils depend on the nature and capacity of the biological absorption of elements, the rate of the organic residue mineralization and the intensity of leaching. (From Chemical Abstracts 62:4562, 1965)

- 272 Holtzman, R.B. (Argonne Natl. Lab., Ill.): LEAD-210 (RaD) AND POLONIUM-210 (RaF) IN POTABLE WATERS IN ILLINOIS. In Adams, J. A.S., and Lowder, W.M., ed.: *The Natural Radiation Environment*. Chicago, University of Chicago Press, 1964, pp. 227-37.

A study of the concentrations of <sup>210</sup>Pb and <sup>210</sup>Po in potable well and surface waters in Illinois was undertaken in order to estimate the contribution of potable water to the content of <sup>210</sup>Pb and <sup>210</sup>Po in the human body. <sup>210</sup>Pb and its daughters have been found in many parts of the human environment, the atmosphere, plants, animals, and in the human

body itself. Rain water contains about 2.5 pCi  $^{210}\text{Pb}$ /l (Lockhart et al, 1958), ocean surface water 0.054, Colorado river water 0.13-6.7 and tap water at La Jolla, Calif., 0.054 (Rama and Goldberg, 1961).

The samples for the present study were collected mostly at the pumping station of the water system and rarely from taps in private homes, in 18 communities where the water was treated by filtration or settling and 4 communities with untreated water.  $^{210}\text{Pb}$  was determined from the amount of its daughter,  $^{210}\text{Po}$ , by a modification of Black's method (1961);  $^{226}\text{Ra}$  was estimated by the Rn-emanation technique of Lucas (1961). In order to correct the measured  $^{210}\text{Pb}$  concentrations for build-up from  $^{226}\text{Ra}$  and its daughters during storage, retention of  $^{222}\text{Rn}$  in the storage containers had also to be determined. The contents of  $^{226}\text{Ra}$  and  $^{210}\text{Pb}$  in these 22 water supplies were tabulated. Average  $^{226}\text{Ra}$  and  $^{210}\text{Pb}$  concentrations, respectively, in pCi/l, were as follows: all waters,  $0.14 \pm 0.27$ ,  $0.039 \pm 0.076$ ; treated waters,  $0.084 \pm 0.048$ ,  $0.019 \pm 0.012$ ; untreated waters,  $0.43 \pm 0.60$ ,  $0.127 \pm 0.054$ . The low  $^{210}\text{Pb}$  concentrations indicate that the waters are very old with respect to  $^{210}\text{Pb}$  decay, ie, the average water precipitated 70 yr prior to measurement, or that removal by biological and chemical activity is significant. In another table, the contents of  $^{226}\text{Ra}$ ,  $^{210}\text{Pb}$ , and  $^{210}\text{Po}$ , well depths and type of aquifer for 28 untreated well-water supplies were listed. Ranges and averages of concentrations, pCi/l, were, respectively:  $^{226}\text{Ra}$ , 0.02-22.6,  $5.1 \pm 3.9$ ;  $^{210}\text{Pb}$ , 0.0-0.21,  $0.051 \pm 0.042$ ;  $^{210}\text{Po}$ , 0.0-0.069,  $0.016 \pm 0.030$ . The low ratio of  $^{210}\text{Pb}$  to  $^{226}\text{Ra}$  indicates an effective loss of  $^{210}\text{Pb}$ , possibly due to the presence of Pb precipitants, H sulfide, sulfate ion, biological activity, and the highly porous aquifer. Considering that the concentrations of  $^{222}\text{Rn}$  (which is the precursor of  $^{210}\text{Pb}$ ) range from 30-300 pCi/l, the low  $^{210}\text{Pb}$  values indicate that the residence time of the 3.8-day  $^{222}\text{Rn}$  in the water is short and that its decay does not contribute significantly to the  $^{210}\text{Pb}$  concentration. The  $^{210}\text{Pb}$  level is inversely correlated with the  $^{226}\text{Ra}$  level and decreases with increasing well depth. No gross changes in  $^{210}\text{Pb}$  concentration seem to occur during storage or distribution.

Based on previous studies of the author (1960, 1962) and on the report of the International Congress for Radiation Protection (1960) it was calculated that the contribution of  $^{210}\text{Pb}$  from drinking water to the skeleton is  $\sim 0.017$  pCi/g ash assuming a  $^{210}\text{Pb}$  concentration in water of 0.051 pCi/l, this is 0.004 pCi/g of skeletal ash. Since the average content of  $^{210}\text{Pb}$  in subjects investigated by the author is 0.15 pCi/g ash, the contribution from well water would range from a maximum of 11 to an average of 3% and from average surface water (which contains 0.019 pCi  $^{210}\text{Pb}$ /l) about 1% of the total body content.

The conclusion was drawn that potable water does not constitute an important source of  $^{210}\text{Pb}$  in the human skeleton.

- 273 Ishibashi, M., Fujinaga, T., Morii, F., Kanchiku, Y., and Kamiyama, F. (Univ. Kanazawa, Japan): CHEMICAL STUDIES ON THE

OCEAN. XCIV. CHEMICAL STUDIES ON THE SEA-WEEDS. 19. DETERMINATION OF ZINC, COPPER, LEAD, CADMIUM, AND NICKEL IN SEAWEEDS USING DITHIZONE EXTRACTION AND POLAROGRAPHIC METHOD. Rec. Oceanogr. Works Jap. 7, No. 2:33-6, 1964.

The method of analysis of seaweeds was described. *Eisenia bicyclis* was found to contain 112-127  $\mu\text{g}$  Zn, 11-24  $\mu\text{g}$  Cu, and 7-16  $\mu\text{g}$  Pb/g dried material. Five species of seaweed contained 0.1-0.3  $\mu\text{g}$  Cd and 2-4  $\mu\text{g}$  Ni/g dried seaweed. (From Chemical Abstracts 66:83094, 1967)

- 274 Jochmann, F.: (GLASS CONTAINING ARSENIC.) Sprechsaal 97, No. 9:230-4, 1964.

The author reviews the chemical properties of As in glass, enamel containing Pb arsenate, and the solubility in boiling water of glass containing an appreciable amount of As. (From Chemical Abstracts 61:4037, 1964)

- 275 Kaminski, B., and Dytkowska, O. (Inst. Lekow, Warsaw, Poland): (HEAVY-METAL CONTENT IN SOME SELECTED GALENICS.) Acta Poloniae Pharmaceutica 21, No. 6:493-6, 1964.

Valerian rhizomes, belladonna leaves, absinth herb and Chelidonium herb were found to contain 50, 100, 50 and 50 mg Pb respectively. No Pb was detected in commercial tinctures. (From Chemical Abstracts 62:8943, 1965)

- 276 Kato, N., Sunada, T. (Radiation Center of Osaka Prefecture, Japan): LEAD FROM TABLEWARE MADE OF POLYVINYL CHLORIDE PLASTIC. Japanese Journal of Hygiene 19:214-8 (Aug.), 1964.

Polyvinyl chloride plastics are often made by using a stabilizer which contains Pb compounds. When drinking straws made of this plastic were immersed in a 4% solution of acetic acid for 10 min, amounts of Pb ranging from 0 to  $>100$   $\mu\text{g}$  were dissolved. Even water, pH 5.4, extracted some Pb. The amount of Pb dissolved depended on the pH. To eliminate the leaching of Pb from straws, washing of the straws with acid was found to be effective and feasible. As a control measure, the straws should be immersed in an acidic solution of rhodizonic soda for the development of a purple color. (From authors' English summary)

- 277 Kayser, P., and Meunier, A. (Fac. Med. Nancy, France): Teneur en radioéléments naturels (Unat, Thnat,  $\text{K}^{40}$ ,  $\text{Ra}^{226}$ ,  $\text{Rn}^{222}$ , et  $\text{Pb}^{210}$ ) des eaux thermales de Plombières-les-Bains. (NATURAL RADIOISOTOPES (U, Th,  $\text{K}^{40}$ ,  $\text{Ra}^{226}$ ,  $\text{Rn}^{222}$ , and  $\text{Pb}^{210}$ ) CONTAINED IN THE THERMAL WATERS OF PLOMBIÈRES-LES-BAINS (VOSGES).) Annales Pharmaceutiques Françaises 22, No. 5:365-72, 1964.

Analyses of samples from 9 different sources gave a  $^{210}\text{Pb}$  content of 1-7  $\mu\text{Ci/l}$ .

- 278 Kovalev, V.F., Kozlov, A.V., and Kralin, G.A.: (GEOCHEMICAL CHARACTERISTICS OF NATURAL WATERS IN WESTERN PART OF THE TURGAI SYNCLINE.) Tr. Inst. Geol., Akad. Nauk SSSR, Ural'sk. Filial 1964, No. 69: 37-48.

In the studied territory most of the subsurface waters are  $\text{Cl}$  and  $\text{Cl-HCO}_3$  waters, having total mineral concentrations of 1.5-15 g/l. Only in the Tobol River valley do the Paleozoic formations, outcropping as a narrow belt, contain waters of mineral concentrations <1 g/l. The anomalously high content in waters of Cu, Zn, Mo, Bi, Ag, As, Pb, and Sn was used as an exploration index during prospecting for the Cu-pyritic and polymetallic ores. (From Chemical Abstracts 61:14350, 1964)

- 279 Krainov, S.R., and Korol'kova, M.Kh.: (DISTRIBUTION OF SOME TRACE ELEMENTS IN THE MINERAL WATERS OF THE LESSER CAUCASUS.) Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Gidrogeologii i Inzhenernoi Geologii (N.S.) 1964, No. 9:72-93.

A maximal amount of 0.04 mg Pb/l was found in various mineral waters of the Lesser Caucasus, with the carbonated waters containing the largest amounts. (From Chemical Abstracts 61:10439, 1964)

- 280 Malyuga, D.P.: BIOGEOCHEMICAL METHODS OF PROSPECTING. Authorized translation from the Russian Text published for the V.I. Vernadskii Institute of Geochemistry and Analytical Chemistry by the Academy of Sciences Press in Moscow, 1963. New York, Consultants Bureau Enterprises, Inc., 1964, 205 pp.

The essence of the biogeochemical method of prospecting lies in the discovery of aureoles of disseminated ore deposits by analyzing soils and plants. In contrast to other geochemical methods (metallometric surveys, hydrochemical method) the biogeochemical prospecting method uses a group of natural phenomena that are not taken into account by other methods: (1) increased content of metals in the ash of land plants above ore deposits, (2) biogenic accumulation of metals in the humus layer of soil and changes in the ratios of these metals, and (3) the restriction of biocoenoses to zones of mineralization and the variability of vegetation (endemic forms) under the influence of elevated contents of ore elements in the environment. Subjects covered by the author include: History of development of the method, internal factors governing the migration of chemical elements over ore deposits, external migration factors, ore deposit dispersion haloes, patterns of distribution of heavy metals in soils, conditions for the accumulation of heavy metals in plants, experience with the application of the biogeochemical exploration method in different zones of the USSR, practical problems involved in a plant-soil biogeochemical survey, geochemical interpretation of the results of a biogeochemical survey, and a critical evaluation of the biogeochemical exploration method.

In Chapter V on patterns of distribution of heavy metals in soils, tables are given showing distribution of heavy metals in zonal soils by horizons and the percentage content of certain ore elements in the zonal soils of the USSR. Pb is listed in these tables.

The list of chemical elements required by plants has been expanded considerably (Chapter VI, Conditions for the accumulation of heavy metals in plants). Many chemical elements in small quanti-

ties are stimulators of growth and development of surface plants (ie, Ni, Cr, Pb, Ra), but have a negative effect in large doses, being considered poisonous to surface plants in high concentrations.

Geochemical characteristics of Cu, Zn, and Pb in the zone of oxidation of the sulfide deposit is one of the points of discussion in Chapter VII (Experience with the application of the biogeochemical exploration method in different zones of the USSR). In the process of the oxidation of sulfide minerals, Cu, Zn, and Pb migrate with the soil and ground water. Depending on the composition of the ores and the ore-bearing rocks, the migration of the ore elements occurs jointly or separately. In cases of acidic weathering, when organic acids are present in the soil and ground water, Cu, Zn, and Pb migrate together. In cases when the climate is relatively dry, Pb is precipitated in the form of a sulfate and enriches barites. Cu, Zn, and Pb are constant constituents of soils and plants and their study in rocks and the biosphere makes it possible to determine their precise mean values in rocks, soils, water, and surface plants. In the process of oxidation of sulfide minerals, Cu, Zn, and Pb migrate with the soil and ground water. Depending on the composition of the ores and the ore-bearing rocks, the migration of the ore elements occurs jointly or separately. When values are compared with the content of Cu, Zn, and Pb in soils and plants taken from ore deposits, there often is a noticeable lack of correspondence--ie, there is a sharp increase in the content of these elements over the zone of mineralization, which confirms the basic principle relating to exploration for these elements using soils and plants.

The problem of selecting the method used in biogeochemical survey, whether to use soils or plants, and the selection and development of methods for geochemical exploration in general is a basic problem for geological exploration. Of >30 chemical elements investigated with respect to applicability of the biogeochemical method, only 10 have been studied relatively well (B, Fe, Mn, Co, Ni, Cu, Zn, Pb, Mo, U) and therefore recommendations are made for these elements. Pb is mobile in the podzol profile and thus is reflected clearly in woody vegetation; and it is recommended that in exploration for Pb, plant samples be obtained for analysis. (12 pages of references)

- 281 Masuda, A. (Univ. Tokyo, Japan): DEPTH OF SOURCE OF LEAD. Nature 204:567-9 (Nov. 7), 1964.

In this study, an attempt has been made to evaluate the liquid fraction values (ie, the quantitative fraction occupied by a liquid at a certain stage of solidification relative to the amount of initial liquid, the latter amount being taken as unity) for the source materials of Pb and to reduce them to depths within the earth. It is thought that the source of Pb originated from material that had been produced by partial melting shortly after the formation of the mantle and pocketed in situ. The study suggests that the most frequent seats of original sources from which Pb in ores was derived are at about 150 km and

rarely below 400 km and above 75 km.

- 282** Patterson, C.C. (California Inst. of Technol., Pasadena): PRELIMINARY REPORT ON THE ISOTOPIC COMPOSITION OF LEADS IN LAVAS FROM THE HAWAIIAN ISLANDS. In Recent Researches in the Fields of Hydro-sphere, Atmosphere and Nuclear Geochemistry. Miyake, Y., Koyama, T., ed.: Nagoya, Japan, Sugawara Volume, Nagoya Univ., 1964, pp. 257-61.

The isotopic compositions of some Pb's in Hawaiian lavas are listed. These Pb's did not show the expected high values of  $^{206}\text{Pb}$ , but were even less radiogenic than continental basalt Pb's. Furthermore, the difference between Pb's from widely separated magma chambers (islands of Oahu and Hawaii) was substantial. There was a suggestion, in the Hualalai lavas, that Pb became more radiogenic in the acid differentiates, since the 2 Pb samples from the 1801 flow are regarded as isotopically different. The data show that different areas of the Pacific contain Pb's of entirely different geneses. (From Nuclear Science Abstracts 20: Abstr. No. 25299, 1966)

- 283** Pencheva, E.N., and Pavlova, V.N.: (TRACE ELEMENTS IN BRINES OF THE POMORIA LAKE.) Tr. Vurkhu Geol. Bulgar., Ser. Inzh. Geol. Khidrogeol., Bulgar. Akad. Nauk 3:207-22, 1964.

The content and distribution of 29 trace elements (including Pb) in various phases and concentrates of the Pomoria-Lake brines was studied. The content of most trace elements increased gradually with increased density of brine, reaching a maximum usually in the mother brine of 36.2° Baumé. Pb increased especially rapidly at 30° Baumé. (From Chemical Abstracts 62:8829, 1965)

- 284** Pereira, J.F., and Echandi, E. (Univ. Costa Rica, San Jose): (RESIDUAL ARSENIC IN LEAVES AND SEEDS OF COFFEE PLANTS SPRAYED WITH LEAD ARSENATE) Turrialba 14, No. 2:85-90, 1964.

When 20-yr-old coffee trees were sprayed with Pb arsenate, As concentrations in the beans were relatively low; qualitative analysis of the beans revealed also the presence of Pb. (From Biological Abstracts 47:Abstr. No. 44386, 1966)

- 285** Picciotto, E., Crozaz, G., and De Breuck, W. (Free Univ., Brussels, Belgium): RATE OF ACCUMULATION OF SNOW AT THE SOUTH POLE AS DETERMINED BY RADIOACTIVE MEASUREMENTS. Nature 203:393-4 (July 25), 1964.

The rate of accumulation of snow at the South Pole as determined by stratigraphic observations and by measurements on the fission products and on  $^{210}\text{Pb}$  are reported. The stratigraphic observations and fission product measurements were in good agreement. They indicate a mean annual accumulation of  $6.5 \pm 0.5$  cm of water between 1955 and 1962. The  $^{210}\text{Pb}$  activity was measured on a 2-m deep section covering the 1962-64 interval and on 60-cm thick specimens collected at intervals of ~4 m up to a depth of 26 m. The 3 completely independent methods lead to a mean value of the annual rate of accumulation between 6 and 7 cm of water at the

South Pole.

- 286** Reiter, R. (Fraunhofer-Ges. Förderung Angew. Forschung, Garmisch-Partenkirchen, Germany): Die charakteristische natürliche und künstliche Radioaktivität der meteorologischen Luftkörper in 700 und 1800 m. Seehöhe. (THE CHARACTERISTIC NATURAL AND ARTIFICIAL RADIOACTIVITY OF METEOROLOGICAL BODIES OF AIR AT 700 AND 1800 m. SEA LEVEL.) Nukleonik 6:313-20 (Oct.), 1964.

The characteristic concentrations of  $^{214}\text{Pb}$  and  $^{212}\text{Pb}$  and nuclear decay products in the different meteorological air bodies were determined at 700 and 1800 m, and the influences of the source and movement of the air bodies on their radioactivity content were shown.

- 287** Sheftel', V.O. (Ukr. Sci. Res. Inst. Communal Hyg., Kiev, USSR): O vyshchelachivani svintsovykh stabilizatorov iz polivinilkhlordnykh vodoprovodnykh trub. (THE LIXIVIATION OF LEAD STABILIZERS FROM POLYVINYL CHLORIDE WATER PIPES.) Gigiena i Sanitariya 29, No. 10:105-6, 1964. Hygiene and Sanitation (USSR) 29:121-2 (Oct.), 1964.

Among the stabilizers used for the manufacture of polyvinyl chloride plastics, Pb compounds are the most commonly used. Although the transfer of Pb into water from vinyl plastics has been confirmed, several authors have recently claimed that the presence of Pb stabilizers should not prevent the use of plastic pipes for drinking water supplies.

In the tests described, the ratio of the volume of water to the surface of plastic tubes of 40-mm diameter was chosen to be 1:1. Discs cut from 4 different makes of plastic pipe (containing 2-6% Pb) were placed in dechlorinated tap water. In the first test, when the water was allowed to stand for 90 min, no Pb was removed from the discs; after vigorous stirring, the concentrations of Pb were 0.16, 0.13, 0.28, and 0.18 mg/l. When the plastic was allowed to stand in the water for 24 hr at 20°C, the corresponding amounts were 0.50, 0.35, 0.38, and 0.28 mg/l. After 10 days these rose to 1.13, 0.64, 0.70, and 0.94 mg/l. In another test, the water was changed daily. Although Pb concentrations in the 24-hr infusions gradually decreased, after 4 days 0.30, 0.28, 0.21, and 0.30 mg/l were obtained, and after 15 days, 0.19, 0.10, 0.15, and 0.17 mg/l. The findings confirmed literature reports that free  $\text{CO}_2$  increased leaching of Pb. To investigate the effect of temperature, tests were run at 5, 20 and 50°. The respective ranges at 5° were 0.09-0.19; at 20°, 0.10-0.20; and at 50°, 0.19-0.58 mg/l.

The conclusion is that the leaching of Pb from vinyl plastic pipes in which Pb stabilizers are used would cause Pb concentrations in drinking water exceeding maximum permissible concentrations, and that Pb stabilizers are not acceptable for use in plastic pipes conveying drinking water.

- 288** Šmelhaus, V., and Válek, B. (Ceskoslov. Akad. Vied., Prague, Czechoslovakia): Rozšíření mikroelementov v půdách Československa. (OCCURRENCE OF TRACE ELEMENTS



IN THE SOILS OF CZECHOSLOVAKIA.) Pol'-nohospodárstvo 10, No. 11:833-6, 1964. Soils from 48 different regions in Czechoslovakia were analyzed for trace elements. If Pb was found at all, it occurred in quantities of <0.1 mg/100 g of soil.

- 289** Starikov, V.S., Kononov, B.T., and Brushtein, I.M. (Northern Caucasus Mining-Met. Trust., Ordzhomikidze City): (BIOCHEMICAL METHOD OF PROSPECTING AND RESULTS OF ITS APPLICATION IN THE GORNAYA OSETIA.) Geokhimiya 1964, No. 10:1070-2.

Analysis of 32 plants showed elevated amounts of Pb, Zn and Cu in marjoram, coltsfoot, Alpine bellflower, centaurea and in leaves of hazel, birch, alder, maple and sometimes rhododendron. The Alpine bellflower which contained in its ash 0.001-0.1% Pb and 0.01-0.3% Zn was found to grow in soils of elevated content of Pb and Zn. In general, plants growing 250 m from the Main Sadonsk fracture containing polymetallic mineralizations were high in Pb, Zn and Cu. (From Chemical Abstracts 61:15847, 1964)

- 290** Strasheim, A., Norval, E., and Butler, L.R.P. (Council Sci. Ind. Res., Pretoria, S. Africa): ATOMIC ABSORPTION DETERMINATION OF TRACES OF LEAD IN FISH FLOUR. Journal of the South African Chemical Institute 17, No. 2:55-60, 1964.

By the method described, concentrations of Pb ranging from 0.75-12 ppm were found in the presence of about 12,000 ppm of Ca as phosphate. (From Chemical Abstracts 62:9693, 1965)

- 291** Talipov, R.M.: (CONCENTRATION OF NONFERROUS METALS IN SOILS AND PLANTS OF THE SARY-CHEKU AND UCH-KULACH DEPOSITS (UZBEKISTAN).) Geokhimiya 1964, No. 5:457-67.

The contents of Cu and Pb were determined in soils and plants in the area of the Sary-Cheku Cu-Mo and the Uch-Kulach polymetallic deposit. The data obtained were sufficient to outline the areas of enriched sections. Parallel increases in the contents of Cu and Pb in soils and in plants were observed near known ore bodies. The concentrations of Cu, Pb, and other metals in soils increase 10-20 times above average. This permitted detection of the presence of ore bodies not yet discovered by exploration. (From Chemical Abstracts 61:4103, 1964)

- 292** Talipov, R.M.: (RESULTS OF BIOGEOCHEMICAL SURVEY IN SOME UZBEKISTAN ORE FIELDS.) Poleznye Iskopaemye Uzbekistana i Voprosy ikh Genezisa, Akad. Nauk Uz. SSR, Otd. Geol. Nauk 1964:95-102.

Plants growing over an ore body showed elevated amounts of Pb, Zn and Cu compared with those growing at a certain distance from the ore body. Cu is localized in the leaves, Pb and Zn mostly in the stems. The ash of Ferula growing in soils over ore bodies contained 0.02% Pb while the Pb content in a plant growing several hundred meters from the ore body was 0.002%. (From Chemical Abstracts 62:6268, 1965)

- 293** Tew, R.P., and Sillibourne, J.M. (East

Malling Res. Sta., Maidstone, Kent, England): PESTICIDE RESIDUES ON FRUIT. VI. LEAD AND ARSENIC RESIDUES ON APPLES. Journal of the Science of Food and Agriculture 15:678-83 (Oct.), 1964.

Further residue studies, including the measurement of Pb, have confirmed previous findings that harvest residues of Pb and As from biologically effective programs of Pb arsenate sprays, applied by hand lance to bush trees, may exceed official limits at least on the earlier ripening varieties of apple. Pb deposits of 6.97  $\mu\text{g}/\text{cm}^2$  and 2.0  $\mu\text{g}/\text{cm}^2$  of As were found at harvest.

- 294** Tilton, G.R., Davis, G.L., Hart, S.R., Aldrich, L.T., Steiger, R.H., and Gast, P.W. (Carnegie Inst., Washington, D.C.): GEOCHRONOLOGY AND ISOTOPE GEOCHEMISTRY. Carnegie Institution of Washington, Papers from the Geophysical Laboratory No. 1440: 240-56 (Dec.), 1964.

Theoretical and practical aspects of the use of U, Th, Pb, Sr, Rb, Ar and K isotopes for determining ages of minerals and rocks were discussed and a study of the isotopic composition of Pb in feldspars and galenas of different ages was reported. The value quoted for the age of the earth of  $4.55 \times 10^9$  yr was based on a comparison of the isotopic composition of some modern terrestrial Pb with that of Pb from the troilite phase of Fe meteorites. (From Nuclear Science Abstracts 21:Abstr. No. 10448, 1967)

- 295** Truhaut, R. (Univ. Paris, France): Les substances minérales existant dans la nature. (OCCURRENCE OF MINERALS IN NATURE.) In Proceedings of the Seventh Meeting of the European Committee on Chronic Toxic Hazards (Eurotox), Brussels, June 3-6, 1964. Food and Cosmetics Toxicology 2: 661-3 (Dec.), 1964.

The hazards connected with repeated absorption of certain naturally occurring minerals such as F, Se, As, Zn and Pb are discussed. Concerning Pb, the author mentions that experimental studies have shown a toxic and possibly cancerogenic effect of some of its compounds upon man. Also, the possibility of contamination of foods and beverages by Pb is pointed out. The importance of the prevention of hazards both in occupational and non-occupational exposure is stressed.

- 296** Tso, T.C., Hallden, N.A., and Alexander, L.T. (US Dept. Agric., Beltsville, Md. and US Atomic Energy Comm., New York, N.Y.): RADIUM-226 AND POLONIUM-210 IN LEAF TOBACCO AND TOBACCO SOIL. Science 146:1043-5 (Nov. 20), 1964.

$^{210}\text{Po}$  in tobacco plants is derived from either soil or air. It may be taken up directly from the soil or may result from radioactive decay of  $^{210}\text{Pb}$  or  $^{226}\text{Ra}$  taken up from the soil. It may also result from radioactive decay of the daughters of  $^{222}\text{Ra}$  deposited on leaves. In attempting to establish its origin, the authors studied natural radioactivity in different types of leaf tobacco produced in various years in various localities, and in soils producing tobaccos in 1963. Included in the analyses was the calculation of the equilibrium

activity of  $^{210}\text{Pb}$  (daughter of  $^{226}\text{Ra}$  and precursor of  $^{210}\text{Po}$ ) from both nuclides. Comparison of calculation from  $^{210}\text{Po}$  with that calculated from  $^{226}\text{Ra}$  showed that  $^{226}\text{Ra}$  is not the only source of  $^{210}\text{Pb}$  in tobacco.

The results showed that contents of  $^{226}\text{Ra}$  and  $^{210}\text{Po}$  in leaf tobacco and tobacco-growing soils vary with the source. The differences may result from production locality, culture, and curing.  $\text{Po}$  is not entirely derived from the  $\text{Ra}$ ; plants probably take it up from soil or air. (15 references)

- 297** Vilenskii, V.D., Davydov, E.N., and Malakhov, S.G.: (SEASONAL AND GEOGRAPHICAL CHANGES IN THE  $^{210}\text{Pb}$  CONTENT OF THE ATMOSPHERE.) In *Radioaktivnye Izotopy v Atmosfere i Ikh Ispol'zovanie v Meteorologii*, Moscow, Atomizdat, 1964, pp. 120-31.

The concentration of  $\text{Rn}$  and  $^{210}\text{Pb}$  was measured over a 2-yr period in the surface boundary layer of the atmosphere over Moscow and the Kheys Island and the influx of  $^{210}\text{Pb}$  and  $^{90}\text{Sr}$  into the atmosphere of polar regions was studied. Also, the seasonal changes in the rate of purification of the  $^{210}\text{Pb}$  aerosol-carrier was evaluated. (From Nuclear Science Abstracts 20:Abstr. No. 16640, 1966)

- 298** Vilenskii, V.D., Dmitrieva, G.V., and Krasnopevtsev, Yu.V.: (NATURAL AND ARTIFICIAL RADIOACTIVITY OF THE ATMOSPHERE OVER THE OCEANS AND THE RELATIONSHIP TO METEOROLOGICAL FACTORS.) In *Radioaktivnye Izotopy v Atmosfere i Ikh Ispol'zovanie v Meteorologii*, Moscow, Atomizdat, 1964, pp. 307-22.

The content and distribution of natural  $\text{Rn}$  and artificial ( $^{210}\text{Pb}$  and  $^{90}\text{Sr}$ ) radioactivity in the near-water layer of the atmosphere in the low and equatorial latitudes was studied. (From Nuclear Science Abstracts 20:Abstr. No. 16699, 1966)

- 299** Wampler, J.M., and Kulp, J.L. (Columbia Univ., Palisades, N.Y.): (AN ISOTOPIC STUDY OF LEAD IN SEDIMENTARY PYRITE.) *Geochimica et Cosmochimica Acta* 28:1419-58 (Sept.), 1964.

The  $\text{Pb}$  in sedimentary pyrite is typical of dissolved  $\text{Pb}$  in the sea from which the sediments are deposited, provided that the pyrite is formed at the time of or soon after deposition, and its isotopic composition is not changed by radioactive decay of  $\text{U}$  or  $\text{Th}$ . These conditions appear to be realized generally in pyrite from unmetamorphosed sedimentary rocks. In metasedimentary rocks, the origin of  $\text{Pb}$  in pyrite may be quite complex, but in favorable cases the isotopic composition of such  $\text{Pb}$  provides some information about the pre-metamorphic history of the samples. The  $\text{Pb}$  content of 30 samples of pyrite from sedimentary and metasedimentary rocks has been determined by X-ray fluorescence spectrometry.  $\text{Pb}$  contents ranged from a few ppm to several hundred ppm in both sedimentary and metasedimentary samples. The  $\text{U}$  content of most samples was determined by isotope dilution; much of the  $\text{U}$  and in some cases much of the  $\text{Pb}$ , associated with the samples, could be removed by leaching for several days in hot  $\text{HCl}$ .

The  $\text{U}/\text{Pb}$  ratio was mostly so low that the contribution of radiogenic  $\text{Pb}$  by decay of  $\text{U}$  was negligible. The isotopic abundances of  $\text{Pb}$  were related to a 2-stage model for development of oceanic  $\text{Pb}$  based on the isotopic composition of  $\text{Pb}$  in the modern North Pacific. Samples from black schists in Finland contained excess  $^{206}\text{Pb}$  which probably originated in black shale environments prior to metamorphism. The amount of excess  $^{206}\text{Pb}$  and the composition of other samples indicate deposition times in excess of 2100 million yr. A group of samples of Ordovician or Silurian age have isotopic compositions similar to those observed in modern marine  $\text{Pb}$ .

- 300** Wilkening, M.H. (New Mexico Inst. Mining Tech., Socorro): RADON-DAUGHTER IONS IN THE ATMOSPHERE. In Adams, J.A.S., and Lowder, W.M., ed.: *Natural Radiation Environment*. Chicago, Univ. of Chicago Press, 1964, pp. 359-68.

$^{222}\text{Rn}$ ,  $^{220}\text{Rn}$  and  $^{219}\text{Rn}$  are present in the atmosphere in measureable amounts;  $^{222}\text{Rn}$  with a half-life of 3.82 days has the best chance of escaping into the air. The  $\text{U}-\text{Ra}$  series from  $^{222}\text{Rn}$  to the 22-yr  $^{210}\text{Pb}$  isotope is shown in a figure. The  $\text{Rn}$ -daughter small ions of positive charge and high mobility that result during the decay of  $^{222}\text{Rn}$  and its short-lived daughters are measured with a negative-wire apparatus. The activity of the  $^{220}\text{Rn}$  daughters is governed by the 10.6-hr decay period of  $^{212}\text{Pb}$ . The measurement of the  $\text{Rn}$ -daughter ions is a useful tool in studying atmospheric electrical environment.

- 301** Williams, H.A. (Public Analyst, City London Labs, England): THE OCCURRENCE OF  $\text{Pb}$  IN TEA. *Journal Association Public Analysts* 2, No. 1:8-12, 1964.

It was suggested that a fine dust from a  $\text{Pb}$ -bearing soil introduces the contaminant into tea. (From Chemical Abstracts 63:10584, 1965)

- 302** Zabugina, E.A., Los, L.I., Polyakova, E.G., and Pyatnitskaya, L.K. (Med. Inst., Saratov, USSR): (TRACE ELEMENTS IN WELL WATER FROM VARIOUS WATER-BEARING HORIZONS OF THE SARATOV REGION.) *Gigiena i Sanitariya* 29, No. 5:88-91, 1964.

The  $\text{Pb}$  content reported for various water sources ranged from 0.67-19.36  $\mu\text{g}/\text{l}$ .

### III. PLANTS AND ANIMALS

#### A. COLD-BLOODED ANIMALS, LOWER ORGANISMS, PLANTS, AND IN VITRO SPECIMENS

1950

- 303 Engelbreth-Holm, J., and Plum, C.M. (Univ. Inst. Pathol. Anatomy, Copenhagen, Denmark): PRODUCTION OF STIPPLED ERYTHROCYTES IN VITRO. *Nature* 166:990 (Dec. 9), 1950.

Since no studies appear to have been carried out to detect whether the direct action of a Pb medium on erythrocytes in vitro may cause basophilic stippling (BSE), the authors suspended normal rabbit erythrocytes in plasma from rabbits poisoned with daily iv injections of 0.25 g PbO suspended in 10 ml water. In 8 days the BSE increased to 20% and then declined to normal values toward death at 16 days. No relation was found between the number of reticulocytes and BSE. To the plasma obtained from the poisoned rabbits, washed red cells from normal rabbits were added and the specimens were placed in a water-bath of 37°C. After 4 hr 6-14% BSE were formed in the plasma culture from poisoned rabbits vs 3-7% in that from normal rabbits. The authors conclude that stippling may be induced in normal cells cultivated in vitro in a medium which conditions stippling in vivo.

- 304 Olson, C.K., and Binkley, F. (Univ. Utah Coll. of Med., Salt Lake City): METABOLISM OF GLUTATHIONE. III. ENZYMIC HYDROLYSIS OF CYSTEINYLGLYCINE. *Journal of Biological Chemistry* 186:731-5, 1950.

Cysteinylglycine was prepared from glutathione treated with 1.2 N HCl. Cysteinylglycine could not be isolated and apparently was converted to cysteinylglycine during isolation attempts. CGase (enzyme which hydrolyzes cysteinylglycine) was separated from GSHase (enzyme which hydrolyzes  $\gamma$ -glutamyl linkage of glutathione) from pig kidney. CGase was activated by Co<sup>++</sup>, Fe<sup>++</sup>, and Mn<sup>++</sup>; unaffected by Mg<sup>++</sup>, Ca<sup>++</sup>, and glutamine; inhibited by Pb<sup>++</sup>. Preincubation of CGase with Mn<sup>++</sup> ions and glutathione inhibited its activity. The maximum hydrolysis of cysteinylglycine by the action of CGase was approximately 50% at pH 8.2 under test conditions. (From authors' summary)

1951

- 305 Działoszynski, L.M. (Univ. Poznań, Poland): (PHENOLSULFATASE. III. A NEW METHOD FOR THE ESTIMATION OF PHENOLSULFATASE ACTIVITY, INHIBITION, INACTIVATION, FRACTIONAL PRECIPITATION.) *Bull. Soc. Amis Sci. Lettres Poznań* B11, 87-99, 1951.

The molecular concentration (M) and percentage inhibition respectively, for the following inhibitors added to the previously published list are: AgNO<sub>3</sub> 10<sup>-4</sup>, 66; NaCN 10<sup>-5</sup>, 10; NH<sub>2</sub>OH 10<sup>-5</sup>, 7; NH<sub>2</sub>OH 10<sup>-4</sup>, 63; H<sub>2</sub>NCONHNH<sub>2</sub> 10<sup>-4</sup>, 8; Pb(NO<sub>3</sub>)<sub>2</sub> 10<sup>-3</sup>,

44; Pb(NO<sub>3</sub>)<sub>2</sub> 10<sup>-2</sup>, 59; KH<sub>2</sub>PO<sub>4</sub> 10<sup>-2</sup>, 25; and AcONa 10<sup>-2</sup>, 0. (From Chemical Abstracts 46:7605, 1952)

1952

- 306 Ruffilli, D. (Univ. Sassari, Italy): Azione dell'ambiente biochimico sulla riproduzione del virus influenzale in culture di tessuti. III. Azione di alcuni ioni metallici. (INFLUENCE OF THE BIOCHEMICAL ENVIRONMENT ON THE REPRODUCTION OF INFLUENZA VIRUS IN TISSUE CULTURES. III. EFFECT OF SOME METAL IONS.) *Bollettino della Società Italiana di Biologia Sperimentale* 28:828-32, 1952.

All cations studied, including Pb and Ag inhibited specifically the multiplication of the virus. The latter 2 did so when present in concentrations of 1 x 10<sup>-8</sup> and 10<sup>-9</sup>M, respectively, but did not destroy the vitality of transplants of chorioallantoic membrane. Pb was fixed in the tissue.

- 307 Yoshida, K. (Kyoto Univ., Japan): MECHANISM OF LEAD POISONING. I. OXYGEN UPTAKE OF EXPERIMENTALLY LEAD-INJECTED ANIMAL TISSUES. II. THE OXYGEN UPTAKE OF TISSUE SLICES ON ADDING LEAD TO WARBURG'S FLASK. III. INFLUENCE OF LEAD SALT ON THE ADAPTIVE PRODUCTION OF GLYCOLYSIS ENZYMES. *Japan. J. Nation's Health* 21:2-4; 68-73; 74-8, 1952.

I. After intracardial injection of 9.1 mg Pb acetate to guinea pigs the O consumption of tissues was decreased; the decrease in the liver was proportional to the log dose of the Pb, but the O consumption was not clear in other tissues. The O consumption of tissues was increased gradually with the decrease of Pb in tissues.

II. The O uptake of tissue slices in vitro in Warburg's flask containing asparagine and NaOH or NaCl, glycine, and NaOH solution at pH 7.4 with various amounts of Pb chloride (0.3-300 mg%) was retarded by the presence of the Pb at the concentration of 2 mg% for liver, 15 mg% for brain, and 11 mg% for kidney, and the retardation was proportional to the concentration of Pb in tissues. However, the decrease of O uptake by the Pb-poisoned animal tissues cannot be explained on the basis that the direct inhibition is caused only by Pb.

III. Tests with bakers' yeast on the respiration in media containing NaCl and various amounts of Pb chloride indicated that Pb<sup>++</sup> was not the direct cause of respiration inhibition; it was attributed to the damage of the production of glycolysis enzyme. (From Chemical Abstracts 47:11535, 1953)

- 308 Hashimoto, K. (Kozo High School, Osaka, Japan): REFRACTILE BODIES WITH AFFINITY FOR LEAD IN STYLONYCHIA HISTRIO. Zool. Mag. (Tokyo) 62:241-4, 1953.

Refractile bodies with an affinity for Pb were demonstrated in the ectoplasm of Stylonychia Pleurotricha, and Oxytricha; physiological observations are given. (From Chemical Abstracts 48:13999, 1954)

- 309 Hewitt, E.J. (Univ. Bristol Res. Station, Long Ashton, England): METAL INTERRELATIONSHIPS IN PLANT NUTRITION. I. EFFECTS OF SOME METAL TOXICITIES ON SUGAR BEET, TOMATO, OAT, POTATO, AND NARROW STEM KALE GROWTH IN SAND CULTURE. Journal of Experimental Botany (London) 4:59-64, 1953.

The title products were grown in sand cultures with additions of several heavy metals, including Pb (at 0.5 and 1.0 meq/l in 1947 and 0.5 in 1948). Pb was among the metals that were less active in causing chlorosis (Cr, Zn, V, Mn, and Pb vs Cu, Co, and Cd).

- 310 Hiyama, Y., and Ichikawa, R. (Tokyo Univ., Japan): THE INFLUENCE OF VARIOUS TYPES OF TAGS AND LEAD INJECTION UPON THE MORTALITY RATE OF FISH. Bull. Japan. Soc. Sci. Fisheries 19:376-81, 1953.

By injection of Pb acetate a passage of time can be recorded upon the layer of scales and other hard tissues of fishes. In aquarium experiments Pb acetate injection (0.1 cc 0.1% Pb acetate/10 g) had no influence on the mortality rate of goby (Acanthogobius flavimanus). (From Chemical Abstracts 49:5698, 1955)

- 311 Miyoshi, Y. (Keio Univ., Tokyo, Japan): DISTRIBUTION OF LEAD IN BLOOD CONSTITUENTS. I. EXPERIMENTS IN VITRO WITH GOAT BLOOD. Journal of Science of Labour (Japan) 29:488-95, 1953.

A Pb acetate solution (100 mg Pb/ml) was mixed with 15 ml goat plasma. With increasing volumes of Pb solution the Pb up to 100 µg was distributed uniformly between the supernatant fluid and sediment. Beyond this point the sediment contained more Pb, coagulating the plasma protein. In goat blood containing a small volume of Pb acetate solution at 37° the Pb in plasma decreased to a minimum in 2 hr and thereafter remained unchanged (Pb distribution between the plasma and corpuscles at equilibrium). The Pb concentration (µg/dl) in plasma (x) was related to that in corpuscles (y) as  $y = 205.31 \times x^{0.286}$ . (From author's summary)

- 312 Monnier, A.M. (Univ. Sorbonne, Paris, France): Les affinités des globulins sériques pour divers cations et leur variations à la suite de la formolisation. (AFFINITY OF SERUM GLOBULINS FOR VARIOUS CATIONS AND ITS VARIATION FOLLOWING TREATMENT WITH FORMALDEHYDE.) Comptes Rendus des Séances de la Société de Biologie et de ses Filiales 148:1548-51, 1953.

The effects of HCHO treatment and variations in pH

on the affinity of highly diluted serum proteins for small amounts of Cu, Zn, Cd, La, Ce, Pb, Co, and Ni ions are discussed.

- 313 Reddi, K.K. (Univ. Stockholm, Sweden): THE UPTAKE OF THORIUM B (LEAD) BY THE ERYTHROCYTES OF THE RABBIT BLOOD. Arkiv. Kemi 6:147-54, 1953.

When rabbit blood was treated with Pb salts the Pb as ThB was taken up by the erythrocytes rather than by the plasma. Of the total ThB, 2.9% was bound to the stroma, equally distributed between stromal protein and cholinesterase. The hemolyzate containing the bulk of the bound ThB lost its activity when dialyzed against acetate buffer of pH 2.8. A 21% loss occurred after dialysis with borate buffer of pH 10.0. A 15-fold increase in activity occurred after addition of 1/3 volume of absolute ethanol to the hemolyzate, accounting also for 70% of nondialyzable ThB. By ionophoresis the denatured hemoglobin became free of ThB. The alcohol precipitate yielded protein and non-protein, probably phenolic, fractions. The non-protein fraction bound 2/3 of the ThB in the precipitate. (From Chemical Abstracts 47:11560, 1953)

- 314 Reddi, K.K. (Univ. Stockholm Sweden): ISOLATION OF THORIUM B (LEAD)-BINDING SUBSTANCE FROM THE ERYTHROCYTE OF RABBIT BLOOD. Nature 172:202-3, 1953.

An O stream striking the surface of radio-Th was used to activate heparinized rabbit blood. The plasma was removed by centrifugation and the cells washed 3 times with cold 0.9% NaCl, then hemolyzed with water and alcohol. The hemolyzate was removed by centrifugation and dialyzed against distilled water; 61% of the ThB was in the nondialyzable form with the remainder in the dialyzate. A precipitate which had 15 times the activity of the hemolyzate was formed by the addition of absolute alcohol at -10°. The precipitate was insoluble in water, 0.9% NaCl, and mineral acids; slightly soluble in 0.02N NaOH. The biuret, Millon-Nasse, xanthoproteic and ninhydrin tests were positive. A weak blood group B was also evident. A green precipitate was formed with Benedict reagent but no sugars were detected chromatographically. The precipitate was dissolved in 0.02N NaOH and the protein denatured by Sevag's reagent. The precipitated protein was shaken with  $\text{CHCl}_3$ -BuOH 10:1, then centrifuged. This was repeated until the supernatant solution gave a negative ninhydrin test.  $\text{CO}_2$  was passed through the protein-free solution to precipitate all of the active component. This water insoluble precipitate was dissolved in 0.02N NaOH.  $\text{NH}_4\text{OH}$  and 20% Pb acetate were added to form the Pb salt which contained C 35.95, H 4.88, N 12.14 and Pb 26.08%. The Pb salt was suspended in water and acidified with 6N HCl and  $\text{H}_2\text{S}$  to saturation and centrifuged. The  $\text{H}_2\text{S}$  free supernatant gave a positive Millon-Nasse reaction, a precipitate with  $\text{Br-H}_2\text{O}$ , an orange color with diazotized p-nitroaniline, and a blue color with phosphotungstic-phosphomolybdic reagent. It is suggested that the substance which takes up the ThB in nondialyzable hemolyzate consists of a protein and a nonprotein component which is probably a phenolic compound.

- 315 Roth, J.S. (Hahnemann Med. Coll. and Hosp., Philadelphia, Pa.): EFFECT OF SULFHYDRYL REACTANTS ON LIVER RIBONUCLEASE. *Nature* 171:127-8, 1953.

The method of Roth and Milstein was employed to measure the activity of rat-liver ribonuclease. Several reagents which react with sulfhydryl (SH) groups increased the activity of the enzyme in homogenates. The activity was increased ~25% by  $4 \times 10^{-4}M$  Ag and Pb ions. Saturation of the system with p-chloromercuribenzoic acid or phenyl mercuric chloride caused a similar increase. Cu ions at a concentration of  $4 \times 10^{-4}M$  inhibited the activity by ~50%. The inhibitory action of Cu ions could be reversed by the addition of BAL. BAL had no effect on the systems containing the other SH reacting agents, or on the enzyme alone. The possibility of a SH-containing ribonuclease inhibitor in liver homogenates is discussed.

- 316 Santi, R., and Taormina, A.: (PHARMACOLOGICAL STUDIES ON ADENOSINETRIPHOSPHATE (ATP). I. COMBINED ACTION OF ATP AND HEAVY METALS ON THE ISOLATED FROG HEART.) *Arch. Ital. Sci. Farmacol.* 3:367-73, 1953. ATP (1:5000-1:10,000) inhibits the toxic action of Cu and Pb on the isolated frog heart, but not that of Hg. This is considered in relation to the notable tendency of Cu and Pb to form precipitates with ATP. (From Chemical Abstracts 49:13510, 1955)

- 317 Yoshida, K. (Kyoto Univ., Japan): MECHANISM OF LEAD POISONING. IV. INFLUENCE OF LEAD ON THE PHOSPHATE AND NUCLEIC ACID METABOLISM. *Japan J. Nation's Health* 22: 58-62, 1953.

The synthesis of enzymic protein from the formation of galactozymase in *Saccharomyces cerevisiae* was lowered in the presence of Pb; the addition of adenosinetriphosphate had no influence while addition of ribonucleic acid to 20  $\mu g/ml$  allowed normal galactozymase production.  $PbCl_2$  added to the extent of 1000  $\mu g/ml$  had no influence on respiration. The cause of damage on general metabolism by the Pb is attributed to the damage on nucleic acid metabolism. (From Chemical Abstracts 48:6021, 1954)

#### 1954

- 318 Fusco, M., and Guarino, A. (Univ. Naples, Italy): L'Azione del Pb sull'attivita' succino-deidrasica. (ACTION OF LEAD ON SUCCINODEHYDRASE ACTIVITY.) *Bollettino della Societa' Italiana di Biologia Sperimentale* 30:195-6, 1954.

Fresh tissue slices were frozen and washed, then immersed in buffer solution of methylene blue and Na succinate at pH 7.7 for 15-20 min, then placed between slides under water and sealed with paraffin, and the discoloration followed to ~80 min. When Pb nitrate or acetate was included in the immersion solution, no discoloration was found with 0.1N and 0.01N solutions. At 0.001N slight retardation in discoloration was found, and at 0.0001N the tests ran parallel with the buffer solutions. Tl at 0.1N concentration did not inhibit the succinodehydrase activity, Mn acceler-

ated the reaction slightly, and Hg at 0.001N was inhibitory.

- 319 Gurd, F.R.N., and Murray, G.R., Jr. (Harvard Univ. Cambridge, Mass.): PREPARATION AND PROPERTIES OF SERUM AND PLASMA PROTEINS. XXXIX. THE INTERACTION OF HUMAN SERUM ALBUMIN. *Journal of the American Chemical Society* 76:187-90, 1954.

The interaction of human serum mercaptalbumin with plumbous ions at 0° has been studied by observing the effect of the metal on the solubility of the protein and by measurements of binding. Pb ions render the protein insoluble over almost the entire pH range 2-8. The reaction can be reversed; as many as 70 Pb ions have been combined with albumin without obvious effect on the properties of the protein after removal of the metal. Binding was measured either by the dialysis equilibrium technique or by analysis of the Pb-protein precipitate and of the supernatant solution. Studies of the competition between Pb and H ions indicated that Pb ions are bound to carboxylate groups in this protein. The failure of Pb ions to compete with Zn ions for common binding sites is taken as evidence that Pb ions do not bind to the imidazole groups in human serum mercaptalbumin. (From authors' summary; 35 references).

- 320 Joyce, C.R.B., Moore, H., and Weatherall, M. (London Hosp. Med. Coll., England): THE EFFECTS OF LEAD, MERCURY AND GOLD ON THE POTASSIUM TURNOVER OF RABBIT BLOOD CELLS. *British Journal of Pharmacology and Chemotherapy* 9:463-70, 1954.

Rabbit red cells poisoned with Pb, Hg, or Au chlorides lost K at 37° and 7°, and later hemolyzed (except with Pb chloride at 7°). Pb chloride accelerated the entry of  $^{42}K$  into the cells at the same time net losses of K were occurring. With Hg chloride,  $^{42}K$  entry was accelerated only with large K losses and incipient hemolysis. Au chloride acted less rapidly and produced effects intermediate between Pb and Hg. (20 references)

- 321 Kostial, K., Vouk, V.B., and Purec, L.: (THE INFLUENCE OF LEAD IONS ON THE RELEASE OF ACETYLCHOLINE.) *Arhiv Hig. Rada* 5:351-4, 1954.

The preganglionic nerve of cat superior cervical ganglion was stimulated with a current of 2 cycles/sec and perfused with Ringer solution containing 1:100,000 eserine sulfate. Addition of Pb nitrate (1  $\mu g/cc$ ) reduces the amount of acetylcholine in perfusate to 35% of its original value. When nictitating membrane contractions were measured, the addition of Pb ions caused a complete block of ganglionic transmission, while stimulating the preganglionic nerve fibers. (From Chemical Abstracts 49:16220, 1955)

- 322 Ono, S., and Hiromi, K. (Naniwa Univ., Sakai, Japan): NONCOMPETITIVE INHIBITION OF BACTERIAL  $\alpha$ -AMYLASE BY CALCIUM AND OTHER METALLIC IONS. *Proc. Japan Acad.* 30:467-72, 1954.

The effect of metallic ions on the action of crystalline bacterial  $\alpha$ -amylase on amylose was measured by determining the increase in reducing end groups

(small fragments) and the decrease in the color of amylose-iodine complex (large fragments). The reaction was carried out in acetate buffer, pH 5.8, at 30°. Next to Hg, Pb was among the strongest inhibitors of the production of large fragments. (From Chemical Abstracts 49:3311, 1955)

- 323** Saito, G.: (ELECTRON-MICROSCOPIC STUDIES ON THE ACTION OF VARIOUS METALLIC SALT SOLUTIONS UPON THE ERYTHROCYTE MEMBRANE.) Yokohama Igaku 4:16-21, 1954, Japanese Science Review, Medical Sciences Abstracts 1955, Abstr. No. 2980.

Defibrinated human red blood cells were hemolyzed in hypotonic metal salt solution, and the changes which resulted in the cell membrane were observed with the electron microscope. The effects of Cu, Ag, Au, Zn, Cd, Hg, Al, Sn, Pb, Cr, Mn, Fe, Co, and Ni were tested. (From Chemical Abstracts 52: 9241, 1958)

- 324** Shaw, W.H.R. (Univ. Texas, Austin): THE INHIBITION OF UREASE BY VARIOUS METAL IONS. Journal of the American Chemical Society 76:2160-3, 1954.

Data on the relative toxicity of metal ions toward the enzyme urease were collected from the literature. It was found possible to arrange the common metal ions in a toxicity sequence:  $\text{Ag}^+ \sim \text{Hg}^{++} > \text{Cu}^{++} > \text{Cd}^{++} > \text{Co}^{++} > \text{Ni}^{++} > \text{Mn}^{++}$  with  $\text{Pb}^{++}$  and  $\text{Zn}^{++}$  unassigned but  $< \text{Cu}^{++}$ . Correlation of toxicity with various properties of metal ions is discussed and illustrated on the basis of a model mechanism. (26 references)

- 325** Weinberg, E.D. (Indiana Univ., Bloomington): THE REVERSAL OF THE TOXICITY OF OXYTETRACYCLINE (TERRAMYCIN) BY MULTIVALENT CATIONS. Journal of Infectious Diseases 95:291-301, 1954.

The mutual effects of oxytetracycline and a number of inorganic cations and 8 multivalent anions including  $\text{Pb}^{++}$ , and 5 antibiotics, bacitracin, chloramphenicol, chlortetracycline, penicillin G, and streptomycin, on the growth of cells of *Pseudomonas aeruginosa*, were studied. The inclusion in the medium of subinhibiting concentrations of oxytetracycline occasionally reversed slightly the toxicity of bivalent cations to detect mutual reversal or enhancement of the toxicities of drugs and other test substances or to detect the stimulation of growth by a single drug, the spread plate technique of Foster and Pittillo is recommended.

## 1955

- 326** Beccari, E., and Milani, M. (Univ. Turin, Italy): Interazioni piombo/cisteamina nel consumo di ossigeno. (THE INTERACTION LEAD/CYSTEAMINE IN THE CONSUMPTION OF OXYGEN.) Bollettino della Società Italiana di Biologia Sperimentale 31:714-6, 1955.

In their earlier work the authors had noted that  $\text{O}_2$  uptake in liver and kidney slices from Pb nitrate poisoned rats was increased to a greater extent in the liver than in the kidney. Definite interpretation was not possible in view of the presence of enzymes which are affected by Pb.

The influence of concentration of Pb was ex-

plored here to determine whether a certain decrease of Pb took place by forming a chelate with cysteamine. Determination of Pb was by the method of Vesterberg and Sjöholm (1951) based on the colored complex formed with dithizone. Pb found in the liver slices incubated without or with cysteamine ranged from 58.66-314.00  $\mu\text{g/g}$ ; in kidney, 799-3076  $\mu\text{g}/100\text{ g}$  (both dry tissue). The results showed that in the tissues treated with cysteamine  $\text{O}_2$  consumption was greater than in the tissues not treated. In the absence of cysteamine, the presence of Pb stimulated consumption of  $\text{O}_2$  only in the liver by concentrations  $<150\text{ }\mu\text{g/g}$ , while at higher concentrations,  $\text{O}_2$  consumption was inhibited. In the kidney, it was always inhibited probably because the quantity of Pb was much higher there than in the liver ( $\sim 10$  times). In the presence of cysteamine, these differences were heightened and in the liver there was stimulation of  $\text{O}_2$  consumption even at doses  $>150\text{ }\mu\text{g/g}$ , while in the kidney inhibition was of greater extent. The authors conclude that this behavior cannot be explained entirely by chelation of Pb. (13 references)

- 327** Deszyck, E.J., and Ting, S.V.: EFFECT OF LEAD ARSENATE SPRAYS ON THE SUCROSE CONTENT OF GRAPEFRUIT. Am. Soc. Hort. Sci., 52nd Ann. Meeting, East Lansing, 1955: 47-8. Journal of the Science of Food and Agriculture 7:i-259, 1956.

Post-bloom sprays of Pb arsenate applied to grapefruit: cause a low acid content and an increased sucrose content in the fruit.

- 328** Eriksen, L. (Univ. Oslo, Norway): LEAD INTOXICATION. I. THE EFFECT OF LEAD ON THE IN VITRO BIOSYNTHESIS OF HEME AND FREE ERYTHROCYTE PORPHYRINS. Scandinavian Journal of Clinical and Laboratory Investigation 7:80-5, 1955.

The effect of Pb on the biosynthesis of heme and free porphyrins in immature rabbit erythrocytes and normal duck erythrocytes was studied in vitro with the aid of Na acetate labeled in the carbonyl group with  $^{14}\text{C}$  and ferric ammonium citrate labeled with  $^{55/59}\text{Fe}$ .

It was shown that Pb exercises a strong inhibitory effect on the formation of heme, but the effect is not due to a blocking of the incorporation of Fe into protoporphyrin (PP) as suggested by Rimington (1938) but to a diminished formation of the porphyrin part of heme.

It is suggested that free erythrocyte PP is used for the biosyntheses of heme. (From author's summary; 15 references)

- 329** Herrero, F.J.: (EFFECT OF CATIONS ON THE DEVELOPMENT OF CANDIDA ALBICANS.) Arch. farm. y bioquim. Tucumán 7:179-92, 1955.

*C. albicans* grown on agar-peptone-glucose medium at pH 6.5 was grown in an agar-free medium for 48 hr at 28° and 0.1 ml placed in a Petri dish. After 48 hr incubation, observations on growth inhibition were made. Pb has the lowest toxicity level. (From Chemical Abstracts 51:14895, 1957)

- 330** Jachimowicz, Th. (Bundes-Lehr-u. Versuchsanstalt, Vienna-Grinzing, Austria): (THE

- EFFECT OF LEAD OXIDE ON BEES.) Z. Bienenforsch. 3:29-31, 1955.
- The lethal dose of PbO when fed to bees in honey was 0.32-0.50 mg/bee. The toxic symptoms included decreased inertia, slow wing movement, and inability to climb, followed by paralysis, inability to feed, and death. (From Chemical Abstracts 49: 9826, 1955)
- 331 Kleinsorge, H., and Rösner, K. (Med. Univ. Polyclinic, Jena, Germany): Über die Beeinflussbarkeit der basophilen Substanz jugendlicher Erythrozyten durch Vitamin B<sub>12</sub>. (THE INFLUENCE OF VITAMIN B<sub>12</sub> ON THE BASOPHILIC SUBSTANCE IN YOUNG ERYTHROCYTES.) Folia Haematologica 73:75-9, 1955.
- The influence of vitamin B<sub>12</sub> on the erythrocytes in the peripheral blood was studied. Rabbits were poisoned with Pb (6 mg/kg Pb acetate iv which produced anemia on the 4th day) and the resulting basophil stippled cells were studied. To 0.1 ml of such blood was added equal parts of a solution containing 3.8% Na citrate and 0.75-4.5 µg of vitamin B<sub>12</sub>. This was kept from 1-48 hr at 37°. The basophilic stippling did not disappear. It was not possible to demonstrate any effect of vitamin B<sub>12</sub> on the peripheral erythrocytes. (22 references)
- 332 Kostial, K. (Inst. Ind. Hyg., Zagreb, Yugoslavia): (EFFECT OF SODIUM, POTASSIUM, CALCIUM, MAGNESIUM AND LEAD IONS IN SYNAPTIC TRANSMISSION.) Arhiv Hig. Rada 6:193-200, 1955.
- The acetylcholine output was measured after perfusing the superior cervical ganglion of cats with 10-25 mM/l Mg, 6.6-10.5 Ca, 23 K, and Na in an unspecified concentration, single or in combinations, and also 5.40 µM/l Pb. Results are given in the form of columnar plots rather than numerical values. (40 references) (From Chemical Abstracts 50:5160, 1956)
- 333 Laroze, A.: (EFFECT OF POISONS ON FISH.) Anais fac. farm. Porto 15:77-111, 1955.
- Squalius cephalus 7-8 cm long, were used in a volume of 200 cc. The time required to kill was determined as a function of concentration, and was nearly constant for ferric lactate 1.60-9.83.10<sup>-3</sup>N, Al chloride 0.03-2.8.10<sup>-3</sup>N, and Cu sulfate 0.157-6.28.10<sup>-3</sup>N, while for Hg chloride up to 10<sup>-3</sup>N and for HCl up to 10<sup>-2</sup>N there was a rapid increase. Temperature studies showed that for Ag nitrate, Ba chloride, Pb acetate, uranyl acetate, Cu sulfate, NaF, and LiCl the velocity of fatality was nearly constant up to 15° after which it increased rapidly. For Hg chloride, ferric lactate, and NaCN, quinine sulfate, sparteine sulfate and strychnine sulfate a minimum velocity of mortality was found around 15°. (From Chemical Abstracts 50: 10287, 1956)
- 334 Meier, R., Schuler, W., and Krueger, R. (Laboratories, Ciba Co., Basel, Switzerland): Pharmakodynamische Bedeutung der Zell-Stoffwechselwirkung "cytotoxischer" Stoffe. (PHARMACOLOGICAL SIGNIFICANCE OF THE ACTION OF CYTOTOXIC SUBSTANCES ON CELL

METABOLISM.) Naunyn-Schmiedeberg's Archiv für Experimentelle Pathologie und Pharmakologie 224:206-23, 1955.

In an evaluation of a certain metabolic effect on yeast for the purpose of determining pharmacologic effects on cells, a large series of irritants and their effect on metabolism of yeast and of various other substances was compared. In addition to irritants, the substances included nerve stimulants, capillary poisons, cytotoxic substances, histamine liberators, disinfectants, chemotherapeutics, hormones, vitamins, etc. Pb acetate was 1 of 15 substances tested which did not affect respiration, but increased fermentation. (23 references)

- 335 Sapeika, N. (Univ. Capetown, S. Africa): ACTIONS OF LEAD EDTA COMPLEX. Archives Internationales de Pharmacodynamie et de Thérapie 101, No. 4:488-94, 1955.

The PbEDTA complex is a water-soluble contrast medium. It is practically nontoxic. Large iv doses, eg, 1 ml/kg given experimentally in the high concentration (50%) produce in cats, rabbits, and rats a transitory fall of blood pressure that rapidly returns to normal; it is not prevented by atropine and is not due to vasodilation as shown by intestinal plethysmography. The fall of blood pressure is due to depression of the auricles and ventricles, and arises presumably from the production temporarily of electrolyte imbalance. Respiration is temporarily and slightly altered. The muscle of the intestine and nonpregnant uterus is not stimulated even by high concentrations of the complex. In rats no interruption of pregnancy was produced. The PbEDTA complex is excreted without harm to patients in cases of Pb poisoning given the Ca complex as antidote. The PbEDTA complex has radiographic value orally and parenterally as demonstrated experimentally. (From author's summary)

- 336 Wallen, L.L. (Iowa State Coll., Ames): THE EFFECT OF ORGANOMETALLIC AND QUATERNARY AMMONIUM COMPOUNDS ON THE GROWTH OF MICROORGANISMS. Iowa State Journal of Science 29:526-8, 1955.

Saccharomyces cerevisiae, Acetobacter suboxydans, Lactobacillus delbrueckii, L. casei, Clostridium acetobutylicum, and Aspergillus niger were subjected to the presence of organometallic compounds and quaternary ammonium compounds, when all other growth conditions were optimum. Tetrakis(p-dimethylaminophenyl)Pb tetramethiodide and triphenyl (2-(p-carboxyphenylazo)-5-(dimethylamino)phenyl)Sn were so insoluble in water that their aqueous solutions were not toxic. Triphenyl(3-(diethylmethylammonium)propyl)Pb methosulfate was toxic to all microorganisms at a concentration of 10<sup>-5</sup> M/ml. Toxicity was probably due to reduction of surface tension or adsorption on the surface of the cells. Replacing Pb of this compound by C produced a new compound (4,4,4-triphenylbutyl) diethylmethylammonium methosulfate (444T). This was less toxic than its Pb analog. Diphenyl-Hg, triphenylbenzyl-Pb, triphenyl-p-tolyl-Pb, and triphenylsilanol were all toxic. Tetraphenyl-Pb and tetraphenyl-Sn were not soluble enough to be tested. British antilewisite reduced the

inhibition of glucose metabolism by triphenyl-p-tolyl-Pb when used with *S. cerevisiae* and *L. casei* but had no effect on the action of diphenyl-Hg.

- 337 White, I.G. (Univ. Sydney, Australia): THE TOXICITY OF HEAVY METALS TO MAMMALIAN SPERMATOOZOA. Australian Journal of Experimental Biology and Medical Science 33:359-66 (June), 1955.

The motility of ram, bull, rabbit, and human spermatozoa was tested in the presence of bivalent cations of Mn, Fe, Co, Cd, Cu, Zn, and Pb at 2.0, 0.20, and 0.02 mM for 4 hr at room temperature. Fe and Cu were most consistently toxic, although species differences exist, as shown by the susceptibility of ram spermatozoa to the action of Cu. Cd was slightly toxic to bull spermatozoa and more so to human. Glutathione decreased the toxicity of Cu for ram spermatozoa and Cd for human. High concentrations of Pb and Co depressed the motility of rabbit and human spermatozoa. The use of distilled water as an artificial insemination diluent appears to be unnecessary in order to avoid metallic contamination. (23 references)

### 1956

- 338 Baier, H., Bässler, K.H., and Lang, K. (Univ. Mainz, Germany): Wirkungen von Blei im Intermediärstoffwechsel. (EFFECTS OF LEAD ON INTERMEDIARY METABOLISM.) Archiv für Experimentelle Pathologie und Pharmakologie 229:495-504, 1956.

The effect of Pb, used as  $PbCl_2$ , on the citric acid cycle, fatty acid oxidation, and anaerobic glycolysis was investigated by using isolated mitochondria, homogenates, and the cyclophorase system according to Green et al (1948). The oxidative decarboxylation of pyruvate and  $\alpha$ -ketoglutarate was inhibited; the other reactions of the citric acid cycle were not influenced. The fatty acid oxidation was inhibited between the activation step and the  $\beta$ -ketothiolase reaction. The anaerobic glycolysis of hexosediphosphate was not inhibited. The respiratory chain does not seem to be affected by Pb.

- 339 Catchpole, H.R., Joseph, N.R., and Engel, M.B. (Univ. Illinois, Chicago): HOMEOSTASIS OF CONNECTIVE TISSUE. III. MAGNESIUM-SODIUM EQUILIBRIUM AND INTERACTIONS WITH STRONTIUM AND LEAD. A.M.A. Archives of Pathology 61:503-11, 1956.

Dilution potentials with 0.1 isotonic saline were measured before and after equilibration of rabbit connective tissue (skin and epiphysis) with isotonic saline containing low concentrations of Mg, Sr, or Pb (0.005, 0.005, and 0.001 M, respectively) and the difference was a measure of the bivalent cation bound to the tissue colloid. Free energies of formation of metal-colloid complexes were calculated to be -2700 cal for Mg, -2900 cal for Sr, and -3500 cal for Pb. Thus, the foreign cations and, in particular Pb, have a strong affinity for ground substance and would be expected to displace the physiological cations. The implications of this are discussed in relation to homeostasis and to treatment of Pb poisoning.

- 340 Grebecki, A., and Kuznicki, L. (Nencki Inst. Exptl. Biol., Warsaw, Poland): (AUTOPROTECTION IN PARAMECIUM CAUDATUM BY INFLUENCING THE CHEMICAL PROPERTIES OF ITS MEDIUM). Acta Biologica Experimentalis (Łódź) 17:71-107, 1956.

Self-protective reactions of the organism by influencing toxic properties of its environment were studied in *P. caudatum*. Toxicities of and protective devices against salts of inorganic and organic acids were discussed. Toxicity depended primarily on the cation involved. Among other elements Pb and Mn were studied. (From Chemical Abstracts 52:12251, 1958)

- 341 Nishizono, H. (Kagoshima Univ., Japan): THE DISTRIBUTION OF RADIOACTIVE LEAD (THORIUM B) IN BLOOD OF CATTLE. Journal of Science of Labour (Japan) 32:434-9 (June), 1956.

The distribution of Pb in the blood was studied in vitro at 37°C by using fresh cattle blood and ThB as a radioactive tracer of Pb. The blood was treated with an anticoagulant (oxalate) and ThB was added. The results obtained were as follows: 1. The distribution of ThB in blood reached equilibrium in about 2 hr after addition of ThB and 5-13% of added ThB was found in plasma, 52-61% in the stroma of red blood corpuscles, and 34-35% in the cytoplasm of these cells. 2. 1000-2000 cpm of ThB which was added to fresh blood was detected in hemoglobin crystals in such activity as from 43-98 cpm and the fluid, from which ThB was crystallized out, had no ThB. 3. The hemoglobin crystals possessed ThB not in their heme fraction but in globin fraction. 4. The distribution changed as follows when fresh blood was stored in a refrigerator: 20-25% of added ThB was found in plasma, 15-25% in the stroma of red blood corpuscles, and 50-60% in the cytoplasm of these cells, when measurement was made in 2 hr after addition of ThB to blood stored for 7 days. (From author's English summary)

- 342 Ogawa, M., Itakura, Y., and Imai, M.: (INFLUENCE OF COOKING ON CLAM THIAMINASE. THE EFFECT OF HEAVY METALS.) Eiyô to Shokuryô 9:59-62, 1956-57.

$Hg^{++}$  and  $Fe^{+++}$  accelerated thiaminase activity at higher concentrations ( $10^{-2}$  to  $10^{-3}$  M) but inhibited at lower concentrations ( $10^{-4}$  M).  $Al^{+++}$  accelerated at higher concentrations while  $Pb^{++}$ ,  $Cd^{++}$ , and  $Zn^{++}$  accelerated at lower concentrations.  $Co^{++}$  and  $Cu^{++}$  inhibited at lower concentrations. Glutathione and cysteine had antagonistic action with inhibition and acceleration of thiaminase activity by  $Hg^{++}$  and  $Fe^{+++}$ . Among metal vessels for cooking, Cu vessels were the most powerful, Fe vessel was less effective, and glass and alumite vessels were almost ineffective in inhibiting thiaminase activity. (From Chemical Abstracts 51:8920, 1957)

- 343 Parker, J. (Yale Univ., New Haven, Conn.): VARIATIONS IN COPPER, BORON, AND MANGANESE IN LEAVES OF PINUS PONDEROSA. Forest Science 2:190-8, 1956.

Spectrographic analysis of *P. ponderosa* needles showed the presence of Mn, B, Cu, Pb, Ti, Cr, Pt, Rb, Fe, Al, Ag, Mo, Sn, Na



and Ga. Sought for and not found were As, Be, Au, Zn, Tl and Os. The needles appeared to accumulate 38-102 ppm Mn, 14-135 ppm B and 2-8 ppm Cu.

- 344 Passow, H., and Schütt, L. (Univ. Hamburg, Germany): Versuche über den Einfluss von Komplexbildnern auf die Kaliumpermeabilität bleivergifteter Menschenerythrocyten. (EXPERIMENTS ON THE INFLUENCE OF COMPLEX FORMATION ON THE POTASSIUM PERMEABILITY OF LEAD POISONED HUMAN ERYTHROCYTES.) Pflügers Archiv für die Gesamte Physiologie des Menschen und der Tiere 262:193-206, 1956.

The loss of K of human erythrocytes in Pb containing solutions of NaCl could be prevented by addition of excess phosphate or EDTA. Cyanide or azide were ineffective. Cysteine, glutathione or citrate decreased the loss of K only when present in concentrations many magnitudes above that of Pb. Later addition of EDTA, chromate or phosphate to Pb poisoned cells stopped further loss of K but the cells did not resorb K already lost. At a given Pb concentration 2 cell fractions may exist in the same suspension which give off K at different rates. Probably Pb is not bound irreversibly but may be exchanged among the cells. It appears that the rate of exchange of Pb is comparable to the rate of loss of K. (19 references)

## 1957

- 345 Baier, H., and Lang, K. (Johannes-Gutenberg Univ., Mainz, Germany): Über die Chinin-oxydase. II. (QUININE OXIDASE. II.) Biochemische Zeitschrift 329, No. 5:381-91, 1957.

The enzyme could be reversibly separated into the apoenzyme and coenzyme, the latter containing no flavine. Concentrations of  $10^{-3}M$  of  $Mg^{++}$ ,  $Ba^{++}$ ,  $Pb^{++}$ ,  $Mn^{++}$ ,  $Co^{++}$ ,  $Fe^{++}$ , and  $Ag^{+}$  were of no effect on the purified enzyme.  $Cu^{++}$  in similar concentration caused 90% inhibition.

- 346 Dentzer, G. (Germany): Über einige Membranwirkungen von Komplexsalzen der Äthylendiamintetraessigsäure. (MEMBRANE ACTION OF COMPLEX SALTS OF ETHYLENE-DIAMINETETRAACETIC ACID. Archiv für Experimentelle Pathologie und Pharmakologie 232:311-2, 1957.

The isolated phrenic-diaphragm preparation of the rat was used to test the effect of complexes of EDTA on the action of a number of drugs. KCl was strongly influenced antagonistically, less so d-tubocurarine and flaxedil. There was a reinforcement of the actions of procaine, panto-caine, acetylcholine, and alcohol. The effect of succinylcholine was not altered. In tests on the frog rectus muscle the contraction produced by isosmotic KCl solution was inhibited 95% by the Ca and Pb complexes of EDTA. The caffeine, avertin, and acetylcholine contractions were not influenced. There was no regularity in ionic direction of the compounds tested.

- 347 Deschiens, R., Bertrand, D., and Molinari, V. (Inst. Pasteur, Paris, France): Capacité d'accumulation de certains métaux

par les mollusques de la famille des Planorbis. (ACCUMULATION OF METALS BY PLANORBOID MOLLUSKS.) Comptes Rendus des Seances de la Societe de Biologie et de Ses Filiales 151:1356-8, 1957.

The mollusks (Planorbis glabratus and Bulinus contortus) were kept in strongly ionized aqueous solutions of metal salts as follows: Zn 1.1 mg/l, Cu 0.17 mg/l, Fe 0.29 mg/l, and Pb 0.205 mg/l for 24-48 hr; 6 mollusks were used per experiment. Accumulation of Zn, Cu, Fe, and Pb, in controls and treated mollusks, in mg metal/kg dried tissue, were: Zn 98, 368; Cu 56, 2280; Fe 592, 4600; and Pb 0.16, 35. Cu and Zn were extremely toxic; Fe and Pb were well tolerated.

- 348 Houck, J.C. (Georgetown Univ. Hosp., Washington, D.C.): INHIBITION OF RIBONUCLEASE. Biochimica et Biophysica Acta 26:649-51, 1957.

The inhibition of ribonuclease by various cations and anionic polyelectrolytes was investigated.  $Hg^{++}$ ,  $Pb^{++}$ ,  $Mg^{++}$ ,  $K^{+}$  and  $Na^{+}$  were not inhibitory under the experimental conditions.  $Zn^{++}$ ,  $Fe^{++}$ ,  $Ag^{+}$ , and  $Cu^{++}$  were inhibitory, apparently through competition with ribonuclease for the anionic substrate.

- 349 Kostial, K., Lorković, H., and Vouk, V.B. (Inst. Med. Res. Yugoslav Acad. Sci. Arts, Zagreb): ACETYLCHOLINE SENSITIVITY OF SYMPATHETIC GANGLIA AND STRIATED MUSCLES IN PRESENCE OF LEAD IONS. In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 295-7.

See following abstract.

- 350 Kostial, K., and Vouk, V.B. (Inst. Med. Res., Yugoslav Acad. Sci. Arts, Zagreb, Yugoslavia): LEAD IONS AND SYNAPTIC TRANSMISSION IN THE SUPERIOR CERVICAL GANGLION OF THE CAT. British Journal of Pharmacology and Chemotherapy 12, No. 2: 219-22, 1957.

The investigations were limited to the influence of Pb ions on the contractions of the nictitating membrane and on the output of acetylcholine (ACh) in response to stimulation of pre- and postganglionic nerve fibers in perfused superior cervical ganglia of cats. The effect of increasing the concentration of Ca ions in the presence of Pb ions was also studied. In the tests when ACh was to be collected, eserine sulfate was added to the perfusion fluid. Pb nitrate was added to Locke solution in gradually increasing concentrations without altering the concentration of other components. Pb concentrations of 5-40  $\mu M/l$  caused block of ganglionic transmission, and reduced the output of ACh. Ca ions relieved the block produced by Pb ions and restored the ACh output. The presence of Pb ions did not seem to change the sensitivity of ganglion cells to injected ACh. The effects of Pb ions on synaptic transmission were noticeable after 1-3 min.

The authors conclude that the results seem to indicate that the preganglionic nerve endings are the main site of action of Pb ions. The influence of Pb on nerve conductions, on ACh synthesis and

on cholinesterase activity cannot be entirely eliminated but seemed not to have played a major role during the experiment.

- 351 Teisinger, J. (Czechoslovakia): Influence du sel monocalcique de l'acide éthylène-diamine tétraacétique sur quelques liaisons. (EFFECTS OF CALCIUM DI-SODIUM SALT OF ETHYLENEDIAMINE TETRAACETIC ACID ON SOME LEAD BONDS IN THE ORGANISM.) In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 278-80.

Pb<sup>++</sup> was bound to human erythrocytes by addition of Pb solutions. After allowing to stand for several hours, EDTA was added at different concentrations for the study of its liberation both in physiological saline solution and in an EDTA medium. It was found that EDTA influences very substantially the liberation of Pb ions from erythrocytes. The same could be proved in experiments with dialysis of serum albumin treated with low concentrations of Pb. The question of the spontaneous liberation of Pb and its liberation under the influence of EDTA was studied in perfusion experiments on the liver of normal and Pb-poisoned cats. The liver very quickly binds large amounts of Pb; its liberation into the blood stream is however, a slow process. EDTA increases substantially the amount of Pb liberated from the liver.

In vivo, Pb-ions move spontaneously from blood cells to the plasma. This process is the expression of a state of equilibrium between blood cells and plasma. EDTA apparently quickly binds spontaneously liberated Pb ions, thus, permanently disturbing the equilibrium and accelerating the reaction. From the experiments, it seems probable that EDTA does not penetrate into the cells. This already has been shown by Foreman for red blood cells. Chelating agents acting in a similar way as EDTA are limited in their effects by their time relationship. Their effect cannot be enhanced by excessively increasing dosage. The study of the mechanism of action of these substances is of great importance. Substances acting in a similar manner as does EDTA cannot fully achieve these results. (From author's abstract)

- 352 Teisinger, J., Luštinec, K., and Srbová, J.: Vliv vápenaté soli kyseliny ethylen-diamino-tetraoctové na vazbu olova v játrech. (THE INFLUENCE OF Ca SALTS OF ETHYLENEDIAMINOACETIC ACID ON THE BINDING OF LEAD IN THE LIVER.) Časopis Lékařů Českých (Prague), 96:1345-9 (Oct. 18), 1957.

The question of immobilization of Pb in the liver and the influence of CaNa<sub>2</sub>EDTA on the amounts which can be washed out by perfusion of the livers of healthy cats and cats poisoned with Pb have been studied. It has been shown that the liver can quickly bind a large quantity of Pb. This binding is reversible, but the reverse reaction to the blood is slow. Under the experimental conditions CaNa<sub>2</sub>EDTA accelerated this reverse reaction by a factor of 2-4. The concept has been put forth that CaNa<sub>2</sub>EDTA quickly binds Pb ions freed from liver cells; in this way the reverse reaction

is accelerated. A direct effect in the sense of competitive binding of Pb within the liver cell is considered less probable. Liver cells do not at all bind PbEDTA. It is probable that neither PbEDTA nor CaNa<sub>2</sub>EDTA penetrates into the liver cell. (From Bulletin of Hygiene 33:141, 1958).

- 353 Teisinger, J., Zumanová, R., and Žezula, I.: Vliv vápenaté soli ethylen-diamin-tetraoctové kyseliny na vazbu olova v červených krvinkách a krevních bílkovinách. (INFLUENCE OF CALCIUM-DISODIUM ETHYLENEDIAMINE TETRAACETIC ACID UPON THE COMBINATION OF LEAD WITH RED BLOOD CELLS AND BLOOD PROTEINS. Pracovní Lékařství 9:277, 1957.

In Pb poisoning, Pb mainly combines with the red blood cells and less with the proteins in the serum. The reaction of Pb ions mobilized by CaNa<sub>2</sub>EDTA in the blood was studied. It was found that up to 3 hr the blood corpuscles in physiological solution do not release any polarographically detectable amounts of Pb. After addition of CaNa<sub>2</sub>EDTA Pb is released by the blood cells whereby an equilibrium is reached which remains unchanged for hours. Authors believe that addition of CaNa<sub>2</sub>EDTA results in a combination of the ionized Pb with the complex whereby the equilibrium between Pb in the blood cells and the plasma becomes disturbed. Thus, another portion of Pb is transferred into the plasma which in turn reacts with CaNa<sub>2</sub>EDTA. (From Zentralblatt für Arbeitsmedizin und Arbeitsschutz 8, No. 12:301, 1958)

- 354 Vouk, V.B., Kostial, K., Hefer-Šlat, B. (Inst. Med. Res. Yugoslav Acad. Sci. Arts, Zagreb): A COMPARISON OF THE EFFECTS OF MERCURY AND LEAD IONS ON SYNAPTIC TRANSMISSION. In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 283-4.

Isolated sympathetic ganglia of the cat were perfused with and without addition of Hg and Pb ions. Nictitating membrane contractions to pre- and postganglionic nerve stimulation and the level of acetylcholine (ACh) output to preganglionic nerve stimulation were used as indicators of synaptic activity. Both Pb and Hg ions caused a failure of the nictitating membrane response to preganglionic nerve stimulation if added to the perfusing fluid in concentrations from 5 μM-40 μM/l. The effect of Hg ions was much slower compared to the effect of Pb ions which acted almost instantaneously. The effects of Pb ions were easily reversed in contrast to the effects of Hg ions which persisted even after perfusing the ganglion with Locke's solution for longer periods. Both Pb and Hg ions reduced the ACh output on preganglionic nerve stimulation. The sensitivity of ganglionic cells to ACh was increased in presence of Pb ions and much reduced on addition of Hg ions. The response of the nictitating membrane to postganglionic stimulation was not influenced either by Hg or by Pb ions.

- 355 Wallen, I.E., Greer, W.C., and Lasater, R. (Oklahoma Agr. Mech. Coll., Stillwater): TOXICITY TO GAMBUSIA AFFINIS OF CERTAIN PURE CHEMICALS IN TURBID WATERS. Sewage

and Industrial Wastes 29, No. 6:695-711, 1957.

Data were collected on the toxicity of 86 pure chemicals to the mosquito-fish (*Gambusia affinis*). Among chemicals tested were organic substances such as phenol, cresol, naphthalene, pyridine; inorganic substances such as chlorides, sulfates, sulfides, sulfites, acetates, carbonates, chromates, dichromates, hydroxides, fluorides, and thiocyanates of Na, Ca, Cu, Fe, Mg, Pb. The following data were given for Pb nitrate (temperature 22-24°C, final turbidity, <25 ppm): At 180 ppm and lower all fishes were normal; at 320 ppm and higher all were dead in 24 hr. Pb oxide (temperature 18-20°, final turbidity 300 ppm): At 56,000 ppm 1 fish was dead in 24 hr but no other fish seemed to be affected. The median tolerance limit was >56,000 ppm. (46 references)

## 1958

- 356 Baier, H. (Physiol. Chem. Inst., Univ. Mainz, Germany): Über die Wirkung von Blei auf die Acetylcholinsynthese. (EFFECT OF LEAD ON ACETYLCHOLINE SYNTHESIS.) *Klinische Wochenschrift* 36:681-2 (July), 1958.

Since Pb intoxication frequently results in damage of the peripheral nerves, a study was undertaken to determine whether a disturbance of the acetylcholine (ACh) synthesis is involved. The enzyme was obtained from the brain of rabbits and rats. It could be shown that Pb does not inhibit the ACh synthesis with acetate, acetaldehyde and citrate, whereas in the presence of pyruvate the ACh synthesis is clearly inhibited. Pb concentration used was 3 µM as Pb chloride.

- 357 Benard, H., Gajdos, A., and Gajdos-Török, M. (Res. Lab., Med. Clinic Hôtel-Dieu, Paris, France): Étude de la biosynthèse de l'hème in vitro à l'aide des isotopes radioactifs à partir du sang de Lapin intoxiqué par le plomb. (BIOSYNTHESIS OF HEME IN VITRO IN PRESENCE OF RADIOACTIVE ISOTOPES BY BLOOD OF RABBITS POISONED WITH LEAD.) *Comptes Rendus des Séances de la Société de Biologie et de ses Filiales* 152:296-9, 1958.

Blood from a rabbit made anemic by Pb acetate (100 mg Pb/kg several times every 5 days), when incubated with radio-active glycine or with a <sup>59</sup>Fe compound, formed very small amounts of free porphyrin but was unable to incorporate enough Fe to form more than traces of radioactive heme.

- 358 Clarkson, T.W., and Kench, J.E. (Univ. Manchester, England): UPTAKE OF LEAD BY HUMAN ERYTHROCYTES IN VITRO. *Biochemical Journal* 69, No. 3:432-9, 1958.

On the basis of detailed experiments with human blood, the author concludes as follows: Pb appears to exist in plasma as a peptized Pb phosphate solution, which is rapidly aggregated in a second-order reaction to particulate form on the surface of the erythrocytes. More than 95% of small quantities of added Pb are rapidly attached to the cells. No competitive inhibition of uptake of Pb was observed with any of a number of potential

competitors tested. Chelating agents such as EDTA, hexametaphosphate and glutathione remove Pb attached to erythrocytes only slowly in vitro; intracellular Pb was not withdrawn. (From authors' summary)

- 359 Clarkson, T.W., and Kench, J.E. (Univ. Manchester, England): THE SEDIMENTATION RATE AND FRAGILITY OF HUMAN ERYTHROCYTES IN VITRO AFTER EXPOSURE TO LEAD CHLORIDE. *British Journal of Industrial Medicine* 15, No. 2:115-9, 1958.

A study is described of the interaction of Pb with human erythrocytes as portrayed by the sedimentation rate and osmotic fragility. Sedimentation rates were reduced for RBC exposed to Pb in media containing excess phosphate, eg, whole blood and Krebs Ringer bicarbonate solution. An increased sedimentation rate was observed in erythrocytes exposed to Pb chloride in saline. Little change in the osmotic fragility of RBC was detectable when Pb was added in the presence of excess phosphate, but in saline there was a marked increase in resistance to hemolysis in hypotonic saline. It is concluded that in vivo plasma Pb will cause only minimal changes in the fragility of circulating erythrocytes: all injurious effect (inhibition of heme synthesis and morphological abnormalities such as punctate basophilia) will have already been produced in precursor cells developing in the bone marrow. (From authors' summary)

- 360 Dentzer, G. (Leipzig, Germany): Über einige Membranwirkungen von Komplexsalzen der Äthylendiamintetraessigsäure. (MEMBRANE ACTION OF SOME COMPLEX SALTS OF ETHYLENEDIAMINETETRAACETIC ACID.) *Archiv für Experimentelle Pathologie und Pharmakologie* 232:311-2, 1958.

The author's previous work had established that stable complex compounds of EDTA have an antagonistic effect on Mg activity in the whole animal as well as in isolated organs. Since the effect can be achieved with Pb, Mn and Ca complexes, it was taken to be unspecific for Ca. In view of these findings, the author examined the effect on various membrane-active substances of EDTA complexes having high constants.

As anelectrotonics, 2-tubocurarine, flaxedril, novocaine and pantocaine were used, and as catelectrotonics, decamethonium, acetylcholine (ACh), succinylcholine (SCh), KCl and alcohol. In tests on the isolated phrenic diaphragm of the rat, the strongest antagonistic effect was found to be on the activity of KCl; the antagonistic effect on the activity of d-tubocurarine and flaxedril was less marked. The activity on novocaine, pantocaine, ACh and alcohol, on the other hand, was increased. That of SCh was not affected in the dosage range used.

In the frog rectus, the contraction caused by isoosmotic KCl solution was inhibited up to 95% by the Ca as well as the Pb complex of EDTA. The contraction by caffeine, avertine and ACh was affected to a negligible degree.

On the basis of his experiments, the author considers the classification of membrane-active complex constants as part of the group of an- or catelectrotonics to be difficult. He is unable to

state whether the effects described can be explained as pure membrane effects or whether mechanisms similar to the Ca-tubocurarine antagonism are involved.

- 361 Fukumoto, J., Yamamoto, T., Tsuru, D., and Ichikawa, K. (Osaka Municipal Univ., Japan): (ACTION OF BIVALENT METAL IONS ON BACTERIAL AMYLASE AND PROTEASE.) *Kôso Kagaku Shimpoziumu* 13:194-202; Discussion 343-4, 1958.

Effects of several bivalent ions are studied on the production of amylase and protease by resting cells of *Bacillus amyloliquefaciens*, and on the activity of the enzymes produced. The reactivating effect of bivalent ions is in the order:  $Zn > Co > Mn > Mg > Ba > Pb > Sr > Cu > Cd > Hg$ . (From *Chemical Abstracts* 55:1734, 1961)

- 362 Duerksen, J.D., and Halvorson, H. (Univ. Wisconsin, Madison): PURIFICATION AND PROPERTIES OF AN INDUCIBLE  $\beta$ -GLUCOSIDASE OF YEAST. *Journal of Biological Chemistry* 233:113-20 (Nov.), 1958.

An inducible enzyme that catalyzes the hydrolysis of aryl and alkyl- $\beta$ -D-glucosides was purified from *Saccharomyces cerevisiae* strain yeast foam. A number of divalent cations as inhibitors of the activity of  $\beta$ -glucosidase were studied. Ca, Mg and Mn had no appreciable effect while Cu, Fe, Zn, Co, Ag, Hg and Pb at  $33.3 \times 10^{-6}M$  inhibited the action. (27 references)

- 363 Gramenitskii, E.M. (Med. Inst. Sanit. and Hyg., Leningrad, USSR): EFFECT OF LEAD NITRATE ON THE SUPRAVITAL STAINING OF CELLS OF POIKILOTHERMS. *Bulletin of Experimental Biology and Medicine (USSR)* 45: 97-100, 1958.

Effect of Pb nitrate was studied on various cells of liver, kidneys, and nerves of frogs using a technique of supravital staining in situ with neutral red. Threshold paranecrotic doses of Pb nitrate were: liver cells, 3 mg/g body weight; kidney tubule cells, 7 mg/g body weight; and sympathetic nerve cells, 10 mg/g body weight. Paranecrotic changes were not revealed in the sensory nerve cells of the spinal ganglia, although reflex activity of the laboratory animals was depressed. A supravital staining technique, consisting of injection into the body cavity of 1% aqueous neutral red solution at dose levels of 0.3-0.5 mg dye/g body weight and removal and examination of organs within 1 hr after injection, is recommended for use in toxicology.

- 364 Grigarzik, H., and Passow, H. (Univ. Hamburg, Germany): Versuche zum Mechanismus der Bleiwirkung auf die Kaliumpermeabilität roter Blutkörperchen. (THE ACTION OF LEAD ON THE POTASSIUM PERMEABILITY OF ERYTHROCYTES.) *Pfluegers Archiv für die Gesamte Physiologie des Menschen und der Tiere*, 267:73-92, 1958.

The binding of  $^{210}Pb$  and the action of Pb on the K permeability of human erythrocytes was studied as a function of Pb concentration, temperature, and presence of EDTA. Substances from the cell interior formed inactive complexes with the Pb.

The action of Pb on K permeability decreased with time. Renewed addition of Pb led to new losses of K, when simultaneously a very small amount of cell content was added. These substances were not proteins, and could be hydrolyzed for 2-3 hr by 0.1 M HCl at 100° without loss of activity. (18 references)

- 365 Hayashi, K. (Kyoto Prefectural Med. Univ., Kyoto, Japan): THE INFLUENCE OF LEAD ION ON CATALYTIC DECOMPOSITION OF HYDROGEN PEROXIDE. *Kyoto Furitsu Ika Daigaku Zasshi* 64:923-52, 1958.

Pb ion inhibits the blood catalase reaction or the catalytic decomposition of H peroxide by Pt but it accelerates that by Pd. Pb is fixed to red blood cells to an extremely slight extent. Pb ion is adsorbed on catalase faster than dihydrostreptomycin, but the former can be displaced by the latter. (From *Chemical Abstracts* 54:24969, 1960)

- 366 Novák, J., and Májský, A.: (BINDING OF LEAD ON ERYTHROCYTES. I. IN VITRO EFFECT ON GROUP RECEPTORS.) *Časopis lékařů českých* 97:71-5, 1958.

The effect of Pb on the activity of antigens A, B, M, N, P, H, and D was studied by using agglutination and drying tests. It was shown that the binding of Pb inactivates only the D receptor. (From *Chemical Abstracts* 53:7437, 1959)

- 367 Novák, J., and Májský, A.: (THE BINDING OF LEAD ON ERYTHROCYTES. II. THE ROLE OF THE D RECEPTOR.) *Časopis lékařů českých* 97:1455-7, 1958.

Solutions containing  $10^{-9}$   $\mu g$  Pb/l erythrocytes were used. The concentration of Pb was estimated polarographically before the addition of erythrocytes and after the binding of Pb. The D receptor had no quantitative effect on Pb binding of erythrocytes. (From *Chemical Abstracts* 53:13241, 1959)

- 368 Piette, M. (Fac. pharm., Paris, France): Hydrolyse des acides nucléiques des leucocytes sanguins après traitement prolongé par l'acétate basique de plomb en milieu alcalin. (HYDROLYSIS OF THE NUCLEIC ACIDS OF THE LEUKOCYTES IN THE BLOOD AFTER PROLONGED TREATMENT WITH BASIC LEAD ACETATE IN ALKALINE MEDIUM.) *Annales Pharmaceutiques Françaises* 16:311-4, 1958.

- 369 Rondanelli, E.G., Gorini, P., Colombi, R., and Verga, L.: Ricerca sulla patogenesi dell'anemia saturnina. L'azione del piombo sulla mitosi eritroblastica. (STUDIES CONCERNING THE PATHOGENESIS OF SATURNINE ANEMIA. ACTION OF LEAD UPON ERYTHROBLASTIC MITOSIS.) *Haematologica* 43:1077-94, 1958.

The action of Pb nitrate on basophilic embryonal megakaryoblasts of the chicken, on normal human bone marrow and on circulating erythroblasts of the newt was studied. Pb in high concentrations inhibits karyokinesis (karyostatic effect) while in low concentrations it retards karyokinesis in metaphase (statokinetic effect). Even at weak concentrations, however, the karyostatic effect

persists besides the statokinetic effect which distinguishes the action of Pb from that of colchicine. (From *Medicina del Lavoro* 50:388 (Abstracts), 1959)

- 370 Růždič, I., and Črepinko, I. (Central Med.-Chem. Lab., Zagreb, Yugoslavia): Das Blei als Hemmstoff der Katalasewirkung. (INHIBITION OF CATALASE BY LEAD.) Hoppe-Seyler's Zeitschrift für Physiologische Chemie, 312, No. 1/3:22-5, 1958.

The experimental work described was undertaken to study the influence of Pb on catalase because of its possible importance in causing the anemia which occurs in Pb intoxication. As shown in charts, Pb ion (Pb nitrate) definitely inhibits the catalase action of blood serum. However, this inhibition occurs only when the serum is treated with the Pb salt for 30 min before being incubated with the substrate.

- 371 Sávy, G. (Inst. Anat. Histology, Med. Univ., Szeged, Hungary): LEAD-REACTIVE SUBSTANCES IN MYONEURAL SYNAPSES. *Nature* 181:1137-8, 1958.

Diaphragms of rats were fixed for 15 min in 8% formalin containing 5% Pb nitrate. Frozen sections of 30-40  $\mu$  were cut, washed rapidly in distilled water and immersed in a 2% aqueous solution of Na sulfide. The characteristic patterns of the subneural apparatus were then visible. The reaction did not take place if the muscle was frozen or incubated in distilled water before treatment with Pb nitrate, although neither treatment affected cholinesterase activity. This suggests that the reaction with Pb is not due to cholinesterase, but to a substance of lower molecular weight, such as cysteine, methionine or glutathione.

- 372 Stauff, J., and Uhlein, E. (Johann-Wolfgang Goethe Univ., Frankfurt/M., Germany): Einige Beobachtungen über die Beeinflussung der Denaturierungsgeschwindigkeit von Proteinen durch Schwermetallsalze. (THE EFFECT OF HEAVY METAL SALTS ON THE DENATURATION RATE OF PROTEINS.) *Biochemische Zeitschrift* 329, No. 7:549-59, 1958.

The effects of 10 metal ions on the aggregation rate of protein solutions were compared in phosphate buffer of pH 7.0 (used in ionic strengths of 0.25-0.4) and acetate buffer of pH 3.6 (at 0.1). With 0.2% bovine serum albumin at 67.2°,  $Mn^{++}$  and  $Pb^{++}$  in either buffer have no effect on the aggregation rate. With 0.2% bovine  $\beta$ -lactoglobulin at 76.8°,  $Mn^{++}$  and  $Pb^{++}$  in phosphate and  $Pb^{++}$  in acetate do not change the rate but  $Mn^{++}$  in acetate accelerates.

- 373 Talafant, E. (Masarykovy Univ., Brno, Czechoslovakia): Préměna olovnaté soli příneho žlučového barviva na rozpustnou sodnou sul pomoci Katexu FN. (THE TRANSFORMATION OF INSOLUBLE LEAD SALTS OF DIRECT BILE PIGMENTS TO SOLUBLE SODIUM SALTS BY MEANS OF KATEX FN.) *Časopis Lékařů Českých* 97:186-8 (Feb. 14), 1958.

A conversion of insoluble Pb salts of bile pigment to soluble Na salts was achieved by shaking the suspension for 1/2 hr in vacuo with anion ex-

changer Katex FN (a formaldehyde resin with phenosulfonic and  $\beta$ -naphthalenesulfonic acids) in Na cycle. After centrifugation the supernatant was evaporated under reduced pressure and room temperature until dry. In the dry residue 62% of bilirubin was photometrically demonstrated by means of diazo reaction. Only 55% bilirubin was found when using the Yamamoto oxidation method (1951). Calculated for Na diglucuronide: 59.5% insoluble Pb salts. (From author's summary)

- 374 Teisinger, J., Zumanová, R., and Zežula, I. (Inst. Ind. Hyg. Occup. Dis., Prague, Czechoslovakia): EFFECT OF EDATHAMIL CALCIUM-DISODIUM ON THE LEAD CONTENT OF RED BLOOD CELLS AND BLOOD PROTEINS. A.M.A. Archives of Industrial Health 17:295-301 (Apr.), 1958.

Experiments were undertaken to resolve the problem whether EDTA effects the release of  $Pb^{++}$  ions bound by red cells and blood proteins. Pb was bound in vitro to human red cells and these were subject to the action of different concentrations of EDTA. It was established that EDTA has a very considerable effect on releasing the  $Pb^{++}$  ions from red cells and Pb is then bound in the form of PbEDTA. EDTA has the same action on Pb bound by blood proteins. The mechanism of these reactions is very probably the speeding of the spontaneous transference of the  $Pb^{++}$  ions from blood cells into plasma by a disturbance in the equilibrium of this system due to EDTA. (From authors' summary)

- 375 Vincent, P.C., and Blackburn, C.R.B. (Univ. Sidney; Royal Prince Alfred Hosp., Camperdown, Australia): THE EFFECTS OF HEAVY METAL IONS ON THE HUMAN ERYTHROCYTE. I. COMPARISONS OF THE ACTION OF SEVERAL HEAVY METALS. *Australian Journal of Experimental Biology and Medical Science* 36:471-8, 1958.

$Pb^{++}$  in concentrations  $\leq 1 \mu M/ml$  of washed red cells suspended in isotonic solution caused a loss of K from these cells without hemolysis.  $Pb^{++}$  produced on the red cell effects different from other metals, especially in regard to water and electrolyte exchange. (From author's summary)

- 376 Yokohashi, G.: (DETERMINATION OF HUMAN SERUM PROTEIN FRACTION COMBINED WITH LEAD OR IRON IN VITRO BY PAPER ELECTROPHORESIS.) *Kôshû Eiseiin Kenkyô Hôkoku* (Tokyo) 7:102-4, 1958.

Human serum is mixed with an equal volume of 0.2 mg%  $^{210}Pb$  dichloride or  $^{55}Fe$  trichloride solution, and incubated at 37° for 2 hr. Paper electrophoresis of the mixture, followed by radioautography, indicates the higher affinity of  $Pb^{2+}$  and  $Fe^{3+}$  to  $\alpha$ - (predominately  $\alpha_2$ -) and  $\beta$ -globulin fractions, respectively. (From Chemical Abstracts 53:5368, 1959)

- 377 Yoshida, A., Nakao, K., Minakami, S., and Yoneyama, Y. (Tokyo Univ., Japan): (EFFECTS OF INHIBITORS ON THE SYNTHESIS OF HEMOGLOBIN IN CANINE RETICULOCYTES.) *Journal of Biochemistry* 45:913-7, 1958.

Reticulocyte formation is enhanced by injection of

phenylhydrazine or acetylphenylhydrazine into the dog. The heparinized blood is centrifuged and reticulocyte rich upper part of the erythrocytes layer is suspended in plasma.  $^{59}\text{Fe}$  incorporation is completely inhibited by  $10^{-2}\text{M}$  Pb acetate among other substances so tested.

### 1959

- 378 Bahadur, K., and Chandra, V. (Allahabad Univ., Agra, India): (INHIBITION OF UREASE BY LEAD ACETATE.) *Enzymologia* 20: 355-8, 1959.

Pb acetate inhibits the action of urease on urea at pH 8.8. (From Chemical Abstracts 55:3675, 1961)

- 379 Cremer, J.E. (Toxicology Research Unit, M.R.C. Laboratories, Carshalton, England): BIOCHEMICAL STUDIES ON THE TOXICITY OF TETRAETHYL LEAD AND OTHER ORGANO-LEAD COMPOUNDS. *British Journal of Industrial Medicine* 16:191-9 (July), 1959.

The actions of purified tetra, tri, and di-ethyl Pb (TEL, TrEL, DiEL) on rats and rat brain slices and brain brei have been examined. The method was developed based on a reaction with dithizone and is capable of estimating tri- and diethyl Sn in rat tissues. After injection into rats TEL is converted into TrEL and this is responsible for the toxic effects. DiEL is much less toxic and the effects are different. The utilization of lactate and the oxidation of glucose by brain brei and slices respectively are inhibited by TrEL. A similar effect is seen in slices taken from rats poisoned with TEL or TrEL. Rat liver cell microsomes readily convert TEL to TrEL and the latter is stable and remains in the animal tissues for several days. The concentration of TrEL in the brain is not high in comparison with other tissues but brain tissue appears to be unduly sensitive to its toxic action. Neither TEL nor TrEL reacts with BAL or ethylenediaminetetraacetic acid (EDTA). DiEL reacts with BAL but not with EDTA. (From author's summary)

- 380 Fujie, Y. (Univ. Tokyo, Japan): (EFFECTS OF HEAVY METAL IONS ON THE ADENOSINETRIPHOSPHATASE OF MUSCLE GRANULES.) *Japanese Journal of Pharmacology* 9:6-13, 1959.

Adenosinetriphosphatase from rabbit skeletal muscle granules was moderately inhibited by Pb.

- 381 Gitelman, H.J., and Neuman, W.F. (Univ. Rochester, N.Y.): LEAD-HYDROXY APATITE INTERACTION. US Atomic Energy Commission Document No. UR-551, 1959, 25 pp.

The present investigation demonstrates that although Pb-Ca exchange may occur it does not appear to be a prominent factor in the process of uptake reactions in bone mineral. (From author's summary)

- 382 Grévisse, J. (Univ. Liege, Belgium): Modification par l'acide éthylène-diamine-tetra-acétique des effets de l'ion plomb sur l'utérus non gravide et le jejunum isolés du Lapin. (MODIFICATION BY ETHYLENEDIAMINETETRAACETIC ACID OF THE EFFECTS

OF LEAD ION ON THE ISOLATED NON-GRAVID UTERUS AND JEJUNUM OF RABBITS.) *Comptes Rendus des Séances de la Société de Biologie* 153:702-4 (Mar. 20), 1959.

In these experiments in vitro (Grévisse, Goffart, (see also next abstract) Pb acetate in a concentration of  $10^{-4}\text{M}$  was found to inhibit the spontaneous movements of the non-gravid uterus and the tonus of the jejunum in the rabbit. When CaEDTA was introduced following the Pb ( $10^{-4}\text{M}$ ), the resulting complex EDTA-Pb was inactive with regard to the uterus while in the intestine it acted as an excitant. This behavior of EDTA explains why some symptoms of Pb intoxication disappear at the onset of EDTA treatment while others, such as colics, do not recede until a sufficient quantity of Pb has been eliminated by the kidneys.

- 383 Grévisse, J., and Goffart, M. (Univ. Liege, Belgium): Activation de l'ion plomb par la cystéamine sur certains muscles lisses isolés du lapin. (ACTIVATION OF THE LEAD ION BY CYSTEAMINE ON CERTAIN ISOLATED SMOOTH MUSCLES OF THE RABBIT.) *Journal de Physiologie (Paris)* 51:471-2 (June), 1959.

The isolated tissues used were the aorta, tracheal rings, uterus and intestine of the rabbit, bathed in Locke's solution to which Pb acetate was added in a concentration of  $10^{-4}\text{M}$  (37.7 mg/l). The same concentration of cysteamine was used. As summarized by the author,  $\text{Pb}^{++}$  as a complex with cysteamine has a stronger effect on the aorta and the tracheal rings of the rabbit than either of the components has when acting separately. In regard to other smooth muscles the complex reacts the same as Pb (intestines) or is less active (uterus). These phenomena are comparable to the reaction of As-BAL where the complex, though less toxic for the whole animal, produces a more intense Lunds-gaard effect on the isolated muscles of frogs.

- 384 Leiner, M., and Beck, H. (Johannes Gutenberg Univ., Mainz, Germany): (INHIBITION OF CATALYTIC ACTIVITY OF CARBONIC ANHYDRASE. I.) *Acta Biol. Med. Ger.* 2:631-49, 1959.

The heavy metal ions studied inhibit carbonic anhydrase in this order of decreasing effects: Au, Co, Pd, Ag, Ni, Zn, Cu, Hg, Pt, Pb, Sn. The sensitivity of carbonic anhydrase to heavy metals is much greater at pH 4 than at pH 7. (From Chemical Abstracts 54:14336, 1960)

- 385 Perlin, A.S. (Prairie Reg. Lab. Natl. Res. Council, Saskatoon, Saskatchewan, Canada): ACTION OF LEAD TETRAACETATE ON THE SUGARS. *Advances in Carbohydrate Chemistry* 14:9-61, 1959.

The mechanism of glycol-cleavage oxidation by Pb tetraacetate, the oxidative cleavage of vic-diols in acyclic and alicyclic systems, and the oxidative cleavage of N-containing carbohydrates is reviewed. (219 references)

- 386 Santhanam, M.S. (Univ. Madras, India): STUDIES ON COLLAGEN, IV. DEPOSITION OF INORGANIC CRYSTALLITES ON COLLAGEN. *Proceedings of the Indian Academy of Sciences, Section A*, 49:210-14, 1959.

Collagen fibers were treated with 10% solutions or suspensions of inorganic salts for 24 hr and then dried. With Pb salts, basic Pb carbonate crystallized in the fibers. This phenomenon may be of interest in Pb poisoning.

- 387** Simonovic, I., Kostial, K., and Marsic, A. (Univ. Zagreb and Inst. Med. Res., Zagreb, Yugoslavia): CLOTTING CHANGES INDUCED BY METAL IONS IN VITRO. *Arhiv za Higizenu Rada i Toksikologiju* 10:227-34, 1959.

Pb<sup>++</sup> ions were added to the plasma from female rats in concentrations of 12.5-62.5 µg. In a control test 0.5 ml of saline was added. Prothrombin time, as determined by Quick's method 8-180 min after the addition of Pb, was not influenced.

- 388** Somers, E. (Univ. Bristol, England): FUNGITOXICITY OF METAL IONS. *Nature* 184: 475-6 (Aug. 8), 1959.

Fungitoxicity of the nitrates of numerous metals, including Pb, against conidia of *Alternaria tenuis* were studied. It was concluded that the primary toxic action of metal cations is the formation of an unionized complex with surface ionogenic groups and that the different toxicities of the metals can be correlated with the varying strength of surface binding.

- 389** Trim, A.R. (Plant Breeding Inst., Trumpington, Cambridge, England): METAL IONS AS PRECIPITANTS FOR NUCLEIC ACIDS AND THEIR USE IN THE ISOLATION OF POLYNUCLEOTIDES FROM LEAVES. *Biochemical Journal* 73:298-304, 1959.

The precipitation of nucleic acids by metal ions was studied and 2 methods were devised for the isolation of nucleic acids from leaves, based on precipitation by metal ions. Analytical results on 10 preparations from leaves by these methods were given. Pb caused 82% precipitation in preparation without ethanol at pH 3; at pH 7 and with ethanol, no precipitation was observed. The mechanism of the interaction between metal ions and nucleic acids is discussed. (23 references)

- 390** Vincent, P.C. (Univ. Sydney, Camperdown, Australia): THE EFFECTS OF HEAVY METAL IONS ON THE HUMAN ERYTHROCYTE. III. INHIBITION OF THE EFFECTS OF LEAD AND MERCURY. *Australian Journal of Experimental Biology and Medical Science* 37:83-96, 1959.

Two types of inhibitor were studied: (1) chelating agents disodium-ethylenediaminetetraacetic acid (di-Na EDTA), thiosorbitol, and cysteine which combine with heavy metal ions in solution; (2) simple fractions of the red cell, such as stroma, lipid-free stroma, and hemoglobin, in competition with whole red cells for the uptake of Pb. Di-Na EDTA completely prevented the effects of equimolar Pb and also removed most of the metal from the cells after combination was established. In the latter instance, the Pb-induced K efflux was only partly curtailed. Preincubation of di-Na EDTA with red cells decreased its inhibitory capacity with respect to both Pb and Hg. A similar effect following preincubation with Ca was described. Fresh stromata, but not lipid-free stro-

matin or hemoglobin, competed equally with the red cell for the uptake of Pb. The implications of these findings were discussed.

- 391** Wang, H. (Stritch School Med., Loyola Univ., Chicago, Ill.): ANALYSES OF A TOXIC FACTOR, LETHAL TO PARAMECIUM PRESENT IN NON-GLASS-DISTILLED WATER. *Proceedings of the Society for Experimental Biology and Medicine* 101:682-5 (Aug.-Sept.), 1959.

The toxic effects of chloride, sulfate and nitrate of Cu and acetate of Pb and Zn on *paramecia aurelia* were tested. The threshold concentration, i.e., the concentration causing death of all or nearly all *paramecia* in 20-30 min, of Pb acetate was 25<sup>-4</sup>M.

- 392** Wu, H.W., Lu, S.H., and Chang, M.C.: (TREATMENT OF LEAD POISONING. II. EXPERIMENTS ON THE EFFECT OF VITAMIN C AND RUTIN.) *Chung Hua Nei Ko Tsa Chih* 7:22-3, 1959.

Five hundred tadpoles hatched from 1 batch of toad ova were kept in 10 jars (50/jar) with well water and weeds for 7 days when different drugs were added to the jars (in mg%: 10 vitamin C; 10 vitamin C + 0.5 Pb; 2.7 rutin; 2.7 rutin + 0.5 Pb; 10 vitamin C + 2.7 rutin; 10 vitamin C + 2.7 rutin + 0.5 Pb; 1 Pb; 0.5 Pb; 0.25 Pb; water). Vitamin C and rutin had a beneficial effect on the development of the tadpoles.

When a number of 8-day tadpoles were put into a solution containing 6.25 mg% Pb, half of them died in 72 hr and this concentration was taken as the LD<sub>50</sub>. Of a 100 8-day tadpoles put in a solution of the same concentration, 8 died in 24 hr. The remaining 92 were put into 3 jars: 30 in 25 mg vitamin C in 80 ml water; 30 in 10 mg rutin in 80 ml water; 32 in 80 ml water (controls). Tadpoles in the vitamin C and rutin solutions were alive after 6 days while 28 of the controls had died. (From Biological Abstracts 3:Abstract No. 1550, 1961; Chemical Abstracts 58:10647, 1963)

## 1960

- 393** Buffa, P., and Righi, L. (Univ. Modena, Italy): (ADAPTATION OF PSEUDOMONAS PYOCYANEA (AERUGINOSA) TO CHOLINE. V. A STUDY OF THE CHOLINE OXIDASE REACTION IN VIVO BY MEANS OF ENZYME INHIBITORS.) *Giorn. Microbiol.* 8:25-44, 1960.

The effect of various inhibitors on the choline oxidase reaction was studied by measuring O utilization of cell suspensions in choline-yeast extract medium. The adaptive enzyme appeared to be dependent on an essential SH group and to require metal ions as cofactors. Alkaline earth metal ions did not affect the rate of O uptake. They activated the decline reaction of cells at 75% final growth but not that of cells at 25% when their activity was maximum. Heavy metal ions inhibited O consumption in the following order: Hg>Ag>Pb>Ni>Cd>Zn>Co>Fe>Cr. (From Chemical Abstracts 54:22827, 1960)

- 394** Cabejszek, I., and Stasiak, M.: (TOXIC EFFECT OF SOME METALS ON WATER BIOGENESIS, WITH DAPHNIA MAGNA AS AN INDICATOR. II.) *Roczniki Pánstwowego Zakladu Higieny* 11:

533-40, 1960.

Toxicity of the following metals was:  $Hg > Cd > As > Zn > Pb > Sn$ ; the toxic effect increased with time and was more pronounced in sulfates than in chlorides.

- 395** California State Water Pollution Control Board (Pearson, E.A., Pomeroy, R.D., and McKee, J.E., Research Consulting Board): SUMMARY OF MARINE WASTE DISPOSAL RESEARCH PROGRAM IN CALIFORNIA. Sacramento, Calif., Publication No. 22, 1960, 77 pp.

The effects of waste discharges on kelp (*Macrocystis pyrifera*) are discussed in chapter 4, pp 44-9. Toxicity tests with heavy-metal ions showed Hg to be most toxic to kelp, followed by Cu, Zn, Pb and Ni as the least toxic.

- 396** Deszyck, E.J., and Ting, S.V. (Citrus Exptl. Sta., Lake Alfred, Fla.): SUGAR COMPOSITION, BIOFLAVONOID CONTENT, AND pH OF GRAPEFRUIT AS AFFECTED BY LEAD ARSENATE SPRAYS. Proceedings of the American Society for Horticultural Science 75: 266-70, 1960.

Fruit from orchards sprayed with Pb arsenate in concentrations up to 3 lb/100 gal for 4 seasons or less, contained slightly less reducing sugar, significantly more nonreducing sugar, and more total sugar than nonsprayed fruit.

- 397** Fry, F.E.J., Cucin, D., Kennedy, J.C., and Papon, A.: THE USE OF LEAD VERSENATE TO PLACE A TIME MARK ON FISH SCALES. Transactions of the American Fisheries Society 89:149-53, 1960.

Satisfactory deposits of Pb in scales for time marks were produced without adverse effects in whitefish and lake trout by injection of 5%-7% Pb di-Na versenate at doses of 50 mg/kg wt.

- 398** Glenner, G.G., and Cohen, L.A. (Natl. Insts. Health, Bethesda, Md.): HISTOCHEMICAL DEMONSTRATION OF A SPECIES-SPECIFIC TRYPSIN-LIKE ENZYME IN MAST CELLS. Nature 185:846-7 (Mar. 19), 1960.

In histochemical experiments with fresh frozen sections of animal and human skin, or sections fixed in neutral formalin and a new incubation medium Na-benzoyl-dl-arginine- $\beta$ -naphthylamide hydrochloride localization by a simultaneous reaction of enzymatic activity to mast cells was noted. Enzymatic activity was completely abolished by Pb nitrate ( $2 \times 10^{-3}M$ ) among the inhibitors tested. Subsequent tests identified the enzyme to have properties relating to trypsin.

- 399** Hata, Y.: (INFLUENCE OF HEAVY METALS UPON THE GROWTH AND THE ACTIVITY OF MARINE SULFATE-REDUCING BACTERIA.) Norinsho Suisan Koskusho Kenkyu Hokoku 9:363-75, 1960.

Marine sulfate-reducing bacteria strain SM 1 was used throughout this work. Heavy metals originally contained in peptone and lactic acid employed were removed by use of the 8-quinolinol treatment. Among the conditions investigated, when Bi, Co, Cr, Mn, Pb, and Sb were present in the culture media, sulfides were accumulated in higher concentration than in the absence of these metals

although the initial growth of the bacteria was considerably retarded as compared with the latter case. These results may suggest that the above metals acted not only as inhibitors of the bacterial growth, but also as precipitants of free  $H_2S$  produced. Removal of free  $H_2S$  by precipitation from the media has a favorable effect upon the sulfate-reducing activity of these bacteria. (From Chemical Abstracts 58:11710, 1963)

- 400** Hayashi, A. (Kinki Univ., Osaka, Japan): (BIOCHEMICAL STUDIES ON OSTREA GIGAS. IX. LEAD CONTENT.) Seikagaku 32:871-3, 1960.

Seasonal changes of the Pb content in *Ostrea gigas* were determined by using the method of Gage. Except for September when the Pb content was 5.9 ppm of fresh tissue, rather constant values, ranging from 0.1-0.4 ppm, were obtained. Different culture methods did not influence the Pb content. Distribution of Pb was highest in the mantle (ppm of ashed sample). (From Chemical Abstracts 60: 3307, 1964)

- 401** Högberg, B., and Uvnäs, B. (Karolinska Inst., Stockholm; ABL Co. Hålsingborg, Sweden): FURTHER OBSERVATIONS ON THE DISRUPTION OF RAT MESENTERY MAST CELLS CAUSED BY COMPOUND 48/80, ANTIGEN-ANTIBODY REACTION, LECITHINASE A AND DECYLAMINE. Acta Physiologica Scandinavica 48:133-45, 1960.

$Pb^{++}$  was among the bivalent metal ions tested that strongly inhibited the disruptive action of compound 48/80, antigen and lecithinase A of rat mesentery mast cells in situ. At molar concentrations of  $10^{-6}$ - $10^{-5}$ , Pb nitrate caused 50% inhibition of the disruptive action caused by 0.5  $\mu g/ml$  48/80 compound, 2  $\mu g/ml$  lecithinase A or 1/100-1/1000 horse serum. No inhibition of mast cell disruption was observed using 20  $\mu g/ml$  of decylamine with  $10^{-3}M$  Pb nitrate.

- 402** Johnson, L.A., and Seven, M.J.: OBSERVATIONS ON THE IN VIVO STABILITY OF METAL CHELATES. In Seven, M.J., and Johnson, L.A., ed.: Metal-Binding in Medicine. Philadelphia, Lippincott, 1960, pp 225-9.

The authors summarize their review of the title subject, based on 29 references, as follows: The in vivo stability of a metal chelate may be influenced by its inherent stability (indicated by its equilibrium constant, K), the competition of body cations for the chelate, pH and tendency of the metal to form insoluble hydroxides, the distribution and metabolism of the chelate and the competition of physiological complexing radicals for the metal ion. Many metal chelates that are very stable in vitro, including the Fe and Y chelates of N-hydroxyethylethylenediaminetriacetic acid (HEDTA), Pb and Bi chelates of EDTA, have been shown to break down in vivo. Various methods of estimating the relative stabilities of metal chelates in vivo have been attempted but, as yet, no ideal method has been devised.

- 403** Lindemann, B., and Passow, H. (Harvard Med. School, Boston, Mass.; Physiol. Inst. Univ., Hamburg, Germany): Kaliumverlust



und ATP-Zerfall in bleivergifteten Menschenerythrocyten. (POTASSIUM LOSS AND ADENOSINE TRIPHOSPHATE DECOMPOSITION IN LEAD-POISONED HUMAN ERYTHROCYTES.) Pflügers Archiv für die Gesamte Physiologie des Menschen und der Tiere 271:369-73, 1960.

As determined by addition of Pb at  $0.9 \times 10^{-7}$  and  $7.2 \times 10^{-7}$  M/g cells, the conclusion was drawn that the K loss after Pb poisoning was caused by a direct effect of Pb on the cell membrane and not by the interruption of intermediary metabolism. The Pb effect on the cellular ATP was apparently produced by interactions of Pb with ligands in the cell membrane, since Pb was rendered inactive by erythrocyte contents.

- 404 Madlo, Z. (Inst. Ind. Hyg. and Occupational Diseases, Prague, Czechoslovakia): (ISOLATION AND PROPERTIES OF CYSTEINE DESULFHYDRASE.) Collection of Czechoslov. Chem. Commun. 25:729-34, 1960.

Pb was 1 of the metals inhibiting the title enzyme. The inhibition was partially reversed by pyridoxal-5-phosphate. (From Chemical Abstracts 55:640, 1961)

- 405 Meyer, H.: Der Synergismus von Schwermetallionen ( $\text{Cu}^{++}$ ,  $\text{Cd}^{++}$ ,  $\text{Pb}^{++}$ ,  $\text{Hg}^{++}$ ) und kolloidalem Schwefel bei der fungiciden Wirkung auf Conidien von *Fusarium decemcellulare*. (THE SYNERGISTIC ACTION OF  $\text{Cu}^{++}$ ,  $\text{Cd}^{++}$ ,  $\text{Pb}^{++}$ ,  $\text{Hg}^{++}$  AND COLLOIDAL SULFUR IN THEIR FUNGICIDAL EFFECTS ON THE CONIDIA OF *F. DECEMCELLULARE*. Archiv für Mikrobiologie 37:28-48, 1960.

Formation of sulfides did not explain synergism of above ions with colloidal S (CS); rate of Cu, Cd, Pb uptake in cells increased in presence of CS.

- 406 Miyata, S. (Gifu Pref. Med. Coll., Japan): THE INTERACTION BETWEEN ALBUMIN AND HEAVY-METAL IONS. Japanese Journal of Industrial Health 2:495-501 (June), 1960.

For the purpose of clarifying the significance of CaEDTA as an accelerator of heavy-metal excretion, the interactions between albumin and heavy-metal ions and the effect of CaEDTA on the combination of the metal with albumin were studied under various conditions by polarography.

EDTA and CaEDTA were found to have the ability to combine with Cd, Pb, and Mn stoichiometrically at pH 7, and the complexes were stable. Cd combined with bovine serum albumin at the imidazol group, but this combination was inhibited by tris(hydroxymethyl)aminomethane. Combination of Pb ions with albumin was completely inhibited by tartaric ions. EDTA and CaEDTA reacted also with the Cd or Pb combined with bovine serum albumin. (From author's English abstract; 20 references)

- 407 Miyata, S. (Gifu Pref. Med. Coll., Japan): HEMOLYSIS OF ERYTHROCYTES BOUND WITH LEAD AND THE INFLUENCE OF Ca-EDTA. Japanese Journal of Industrial Health 2:649-56 (Aug.), 1960.

Studies on combination of erythrocytes with Pb were made physically or chemically through hemolysis. Normal erythrocytes (A, consisting of normal human erythrocytes rinsed with physiological saline solution and suspended in physiological

saline solution at a rate of 2%), erythrocytes bound with Pb (B, prepared by putting  $5 \times 10^{-4}$  M of Pb into A), and erythrocytes whose bound Pb was removed with CaEDTA (C, obtained by adding CaEDTA twice the equivalent of Pb into B) were respectively hemolyzed by the use of hypotonic saline solution, saponin, monoiodoacetic acid, heat, and ultrasonic wave for comparative studies of their behavior to the hemolytic factors.

It was found that resistance to hypotonic saline solution was highest in A, followed in order by C and B; resistance to saponin was highest in A, followed in order by B and C; erythrocytes bound with Pb showed remarkably increased resistance to the hemolytic activity of monoiodoacetic acid; this resistance was lost following the removal of Pb; erythrocytes bound with Pb as well as Pb-freed erythrocytes were more apt to undergo hemolysis by heat; hemolysis by ultrasonic showed no difference among the 3. These findings suggested that Pb has the greatest effect on the blood cell membrane. Results of the experiments with saponin and monoiodoacetic acid indicated that the combination between Pb and blood cell membrane is a chemical phenomenon, suggesting the presence of a close relationship of Pb with lipid and SH groups of protein in the cell membrane. The combination velocity of Pb with erythrocytes was very high. However, the effect of the binding did not appear rapidly, but became increasingly noticeable with the lapse of time. (From author's English abstract; 25 references)

- 408 Passow, H., and Weiss, C. (Univ. Hamburg, Germany): Das Grenzflächen-pH roter Blutkörperchen in Gegenwart von Schwermetallionen. (THE SURFACE pH OF RED BLOOD CELLS IN THE PRESENCE OF HEAVY-METAL IONS.) Pflügers Archiv für die Gesamte Physiologie des Menschen und der Tiere 271:374-7, 1960.

According to Hartley and Roe (1940) the surface pH of suspended particles can be calculated from the pH of the bulk phase if the electrophoretic mobility of the particles is known. The mobility of human red cells has been measured in the presence of low concentrations of Cu, Cd, and Pb (0.06 mM). No differences between untreated cells and cells treated with heavy metals were found.

- 409 Pecora, L., Fati, S., and Vecchione, C. (Univ. Naples, Italy): Patogenesi delle turbe porfiriniche nel saturnismo. (PATHOGENESIS OF PORPHYRIN DISORDERS IN SATURNISM.) Folia Medica (Naples) 43:685-95 (July), 1960.

Having observed in earlier experiments that the addition of tissue homogenates of Pb poisoned animals stimulates the synthesis of erythrocyte protoporphyrin (PP) of the system erythrocytes + glycocoll, the authors investigated the effect of enzymatic inhibitors and stimulants on the above system. The addition of Na citrate, vitamin B<sub>12</sub> and Fe saccharate strongly stimulated PP synthesis; malonic acid, neoarsphenamide, cysteine, NaF and ATP inhibited it by ~50%, while Pb nitrate (50 µg), Na cyanide and iodoacetic acid strongly inhibited it. The authors consider that the homogenate acts by stimulating the 1st phase of PP synthesis.

They had also found that even ether, acetone and aqueous extract of the tissues, and the serum of these animals was capable of stimulating PP synthesis in vitro. (From authors' summary)

- 410 Reichel, L., and Müller-Freymuth, H. (Humboldt Univ. Berlin, Germany): Über die Bedeutung gewisser Ionen bei der Carotin-Biosynthese. (SIGNIFICANCE OF CERTAIN IONS IN BIOSYNTHESIS OF CAROTENE.) *Naturwissenschaften* 47:62-3, 1960.

*Phycomyces blakesleeanus* (strain Nit(-)) synthesizes carotene only if  $Mn^{++}$ ,  $PO_4^{---}$ , and  $Mg^{++}$  are present. Small amounts of thiamine are necessary. The composition of the nutritive solution is given. The following ions increase the production of carotene:  $Co^{++}$ ,  $Ca^{++}$ ,  $Fe^{+++}$ ,  $Ni^{++}$ ,  $Zn^{++}$ ,  $Mo^{6+}$ ,  $Pb^{++}$ , and  $Cu^{++}$ . A concentration of  $9 \times 10^{-6}M$   $SeO_2$  doubles the formation of carotene, but the effect of the concentration of  $SeO_2$  is very limited.

- 411 Sakō, M. (School Med., Keio Univ., Tokyo, Japan): DIFFERENCE OF AFFINITY WITH LEAD BY ORGANS -- AN EXPERIMENTAL STUDY USING CaEDTA. *Japanese Journal of Industrial Health* 2:657-64 (Aug.), 1960.

The chelating action of CaEDTA was applied to the study of the different combining ability of organs, ie, liver, brain, lung, muscle, etc, with Pb. As observed in homogenates to which Pb and EDTA were added, in the liver of normal rabbits, the relationship between the dose of added Pb and the composition of Pb-EDTA can be expressed by the equation:  $y = 4.70x^{0.84}$ , where  $y$  = dose of Pb,  $x$  = Pb amount of Pb-EDTA. The added Pb combines more firmly with bone and liver than with brain or lung. In organs of rabbits with chronic Pb poisoning, the combined Pb is more stable than the complex forming in acute Pb poisoning. The different state of Pb combination with the various organs or the difference of affinity to Pb of the organ is attributable not only to the difference of chemical property of water-insoluble proteins, but might also be due to water-soluble proteins and other biological factors which were not detected by this experiment. (From author's English abstract; 23 references)

- 412 Tarzwell, C.M., and Henderson, C. (Robt. A. Taft San. Eng. Center, Cincinnati, O.): TOXICITY OF LESS COMMON METALS TO FISHES. *Industrial Wastes* 5:12 (Feb.), 1960.

Exploratory tests showed the toxicity of  $PbCl_2$  for fathead minnows in soft and hard water, respectively, as 2.4 and  $>75$  mg/l Pb as the 96 hr TLm. Be was the most toxic, followed by U (0.2 mg/l in very soft water, and 3 mg/l, respectively).

- 413 Waltner, K., Jr., and Csernovszky, M. (Univ. Med. School, Szeged, Hungary): EFFECTS OF METAL SALTS ON THE ELECTROLYTE CONTENT OF HUMAN RED BLOOD CELLS. *Clinica Chimica Acta* 5:230-4, 1960.

The salts of the following metals were added to red cell (RBC) suspensions from young healthy adults at concentrations from 0.01-7  $\mu M/ml$ : Al, Ba, Ca, Cd, Co, Cr, Cu, Fe, Hg, Mg, Mn, Ni, Pb (as chloride and acetate), Sn, Zn, and Zr. The chlorides (at 1  $\mu M$ )

reduced the K content in the following order:  $Pb > Hg > Cu > Sn > Zn > Ba > Co > Cr > Cd > Ni > Mn > Mg$ , and promoted the Na uptake in a rather similar order (at 3  $\mu M$ ). The effect of the sulfate or nitrate was more pronounced than that of the Cl. Addition of EDTA with the salts to the RBC suspension brought about no change in the K or Na content when the EDTA concentration was 1-1/2 times that of the metal. Cysteine HCl also had no marked effect. The water content of RBC diminished by the action of some salts, including Pb, nearly in parallel with the K content. With Pb, Cu, and Co, the loss of K began already after some minutes; a decrease in labile phosphate esters was found only after incubation for 1 hr. The electrolyte changes are thought by the authors to be produced by a direct membrane ("electrolyte pump") action. (13 references)

- 414 Weinberg, E.D.: THE RELATIONSHIP OF METAL-BINDING TO ANTIMICROBIAL ACTION. In Seven, M.J., and Johnson, L.A., ed.: *Metal-Binding in Medicine*. Philadelphia, Lippincott, 1960, pp. 329-34.

Many antimicrobial compounds have the ability to bind metals. The metals that have been found to affect in some manner the biological activities of these compounds, ie, Fe, Cu, Zn, Co, Mn, Ca, Al, Mg, and Mo, are those which can be activators of specific enzymes. Although such ions as Ni, Bi, Sb, Sn, Cd, Sr, Ba, and Pb are bound quite firmly by the positive group of antimicrobials, it is found almost always that these ions, which usually do not activate enzymes likewise do not usually affect the biological activities of the compounds. (35 references)

## 1961

- 415 Britten, R. (Univ. Inst. Microbiol., Copenhagen, Denmark): HYDROLYSIS OF RNA BY LEAD ACETATE. *Comptes Rendus des Travaux du Laboratoire Carlsberg* 32, No. 23: 371-80, 1961.

RNA of *Tetrahymena pyriformis*, *Salmonella typhimurium* and *Escherichia coli* was labelled by growth of the cells in the presence of 2- $^{14}C$ -uracil. After washing the cells in TSM buffer or "boiling" the cell suspension in TSM (100°C for 15 min), the RNA was extracted. Ribosomes were prepared from *Salmonella typhimurium* cells suspended in TSM and disintegrated in a modified Hughes press. RNA samples were hydrolyzed by 1M Pb acetate solutions (pH 5.5), precipitated with trichloroacetic acid (TCA), filtered and the filters were assayed for radioactivity. Hydrolysis products were examined by paper chromatography and also separated on a column of Dowex-1 formate. *Tetrahymena* RNA was rapidly hydrolyzed with a half life of 20 min. The hydrolysis of *Salmonella* RNA depended on the state of the RNA (whole cells, boiled cells, ribosomes, boiled ribosomes). Ribonuclease had no effect on the hydrolysis and it was shown that Pb acetate inhibits the action of beef ribonuclease. DNA was not hydrolyzed by Pb acetate. The hydrolysis products were not 5'-nucleotides, but a mixture of 2'- and 3'-nucleotides. The precursors to ribosomal RNA in *E. coli* were hydrolyzed twice as fast as the average RNA of the cell. The author

suggested that the RNA in the whole cell is bound in such a way as to protect it from Pb ions, a way that differs from the protection observed in isolated ribosomes.

- 416 Cherchi, P. (Univ. Cagliari, Italy): Sali di piombo ed attivita' esterasiche (ricerche in vitro). (LEAD SALTS AND ESTERASE ACTIVITY (RESEARCH IN VITRO).) Rassegna Medica Sarda 63:663-8 (Nov.-Dec.), 1961.

Blood sera of clinically healthy subjects were incubated for 2 hr at 37° with either Pb nitrate or chloride so that the resulting Pb concentration was equal to 100 µg/100 cm<sup>3</sup>. Measurements of the activity of pseudocholinesterase and procaine esterase showed that neither of the 2 Pb salts had an inhibitory action on these enzymes. This confirms a previous statement of the author that the decrease of serum pseudocholinesterase and procaine esterase in Pb intoxications is not due to an action of Pb on these enzymes but rather to a decreased production of the enzymes in the formative organs, particularly in the liver.

- 417 Feldman, F., and Lichtman, H.C. (State Univ. of New York, Brooklyn): IN VITRO PYRROLE SYNTHESIS IN LEAD POISONING. American Journal of Diseases of Children 102, No. 4:485-6, 1961.

The anemia of Pb poisoning may be in part related to inadequate heme production. The following scheme has been suggested for heme synthesis: glycine + succinate → amino-β-ketoadipic acid → δ-aminolevulinic acid → porphobilinogen → porphyrins → heme, each step being dependent on one or more enzymes. The ability to synthesize porphobilinogen and porphyrins from δ-aminolevulinic acid (ALA) was studied in vitro in the erythrocytes of Pb-poisoned infants and compared with that in the blood cells of normal adults and Fe-deficient children. Porphobilinogen synthesis which is a function of ALA dehydrase activity, tended to be less than normal when the Pb-poisoned erythrocytes were used as an enzyme source. This deficit could be favorably influenced by preactivation of the incubation mixture with glutathione. Uroporphyrins and coproporphyrin synthesis from ALA was also diminished in the Pb-poisoned blood cell.

- 418 Lloyd, R. (Water Poll. Res. Lab., Stevenage, England): EFFECT OF DISSOLVED OXYGEN CONCENTRATIONS ON THE TOXICITY OF SEVERAL POISONS TO RAINBOW TROUT. Journal of Experimental Biology 38:447-55 (June), 1961.

Reduction in dissolved O concentration increases the toxicity to *Salmo gairdneri* of Zn, Pb, and Cu salts, and a mixture of monohydric phenols, to approximately the same extent. It is suggested that a given toxic effect is produced by a specified concentration of poison at the gill surface, and that this concentration is governed by the concentration of poison in the bulk of the solution and also by the velocity of respiratory flow.

- 419 Magistretti, M., Peirone, E., and Majoni, A. (Univ. Milan, Italy): Azione in vitro del piombo-tetraetile sulla monoaminossidasi cerebrale. (THE ACTION OF TEL ON

CEREBRAL MONOAMINE OXIDASE.) Medicina del Lavoro 52:498-506 (Aug.-Sept.), 1961.

Recent investigations have shown that the content of serotonin in the brain affects neuropsychologic behavior. Serotonin is metabolized by monoamine oxidase and inhibition of the enzyme leads to accumulation of serotonin in the brain. The effect of TEL on monoamine oxidase was studied in vitro by preincubating brain homogenates from rats with ethyl fluid (consisting of TEL, dichloroethane and dibromoethane) in concentrations of 0.1-0.07-0.05 ml/ml of homogenate and determining the disappearance curve of serotonin that had been in contact with these homogenates. While in the controls ~90% of the serotonin present was metabolized within 1 hr, homogenates preincubated with 0.1 mg of ethyl fluid/ml of homogenate led to inhibition of the enzyme and homogenates containing lower concentrations of ethyl fluid caused a lesser but still significant inhibition. Corresponding experiments made singly with the components of the ethyl fluid, ie, 50 mg TEL, 150 mg dibromoethane and 90 mg dichloroethane, respectively, showed that the inhibitory effect was caused only by TEL.

The hypothesis is advanced that the accumulation of serotonin in the brain is at least partly responsible for the neuropsychologic manifestations characteristic of acute TEL poisoning. (56 references)

- 420 Murakami, T., Ishihara, Y., and Uesugi, K. (Himeji, Japan): (INORGANIC CONSTITUENTS IN MARINE ORGANISMS. III. QUANTITATIVE DETERMINATION OF MOLYBDENUM, LEAD, AND COBALT IN SHELLFISH.) Himeji Kogyo Daigaku Kenkyu Hokoku No. 13:98-108, 1961.

High Pb levels were found in the shell *Paphia philippinarum* and *Corbicula leana*. (From Chemical Abstracts 56:1848, 1962)

- 421 Shkol'nik, M.Ya.: (SOME RESULTS OF A THREE-YEAR STUDY (1958-60) OF THE PHYSIOLOGICAL ACTION OF TRACE ELEMENTS.) Mikroelementy v SSSR, Byul. Vses. Koordinats. Komis. po Mikroelementam 1961, No. 1:23-9.

A study was made of the physiological effects of trace elements on plants. Most of the study concerned the influence of Cu, Co, Mn, Zn, Mo, B, and Al. At 28-32° more Mn, Zn, Cu, Mo, Ni, Fe, Al, Pb, Ag, and Ca were assimilated by plants than at 14-20°. (From Ref. Zh., Biol. 1962, Abstr. No. 14G75; Chemical Abstracts 58:8381, 1963)

- 422 Umegaki, I.E., and Tanabe, M. (Kyoto Pref. Med. Univ., Kyoto, Japan): (I. EFFECTS OF SALTS OF HEAVY METALS ON ERYTHROCYTES. II. TOTAL ERYTHROCYTES.) Kyoto Furitsu Ika Daigaku Zasshi 69:1413-18, 1442-4, 1961.

I. Erythrocytes were suspended in solutions of Pb acetate, Pb nitrate, and other metal solutions ranging in concentration from 10<sup>-3</sup>M-10<sup>-5</sup>M. Only Ag nitrate solution strengthened both the maximum and minimum hemolytic resistance. II. The hematocrit always decreased in concentrations up to 10<sup>-3</sup>M, regardless of the metal salt. (From Chemical Abstracts 57:2805, 1962)

- 423 Aldridge, W.N., Cremer, J.E., and Threlfall, C.J. (Med. Res. Council Lab., Carshalton, Surrey, England): TRIALKYLLEADS AND OXIDATIVE PHOSPHORYLATION: A STUDY OF THE ACTION OF TRIALKYLLEADS UPON RAT LIVER MITOCHONDRIA AND RAT BRAIN CORTEX SLICES. *Biochemical Pharmacology* 11:835-46 (Sept.), 1962.

The action of trimethyl-, triethyl-, tripropyl-, and tributyllead upon processes associated with oxidative phosphorylation in rat liver mitochondria and rat brain slices was studied and compared with that of trialkyltins. All the trialkyllead compounds studied inhibited the stimulating effect of apyrase on  $O_2$  uptake by liver mitochondria; trimethyllead was the least active, the other trialkylleads were equally active. Oxidative phosphorylation, measured by using hexokinase and glucose to trap ATP, and the stimulation of ATP by 2,4-dinitrophenol were inhibited by all trialkylleads. The respiration and formation of creatinine by rat brain slices were also inhibited. Although a close similarity was found between the series of trialkyltins and trialkylleads in regard to their action studied in vitro, they do not bring about the same signs of poisoning in animals. Thus, there seems to be a qualitative difference in their biological properties which cannot be explained at present.

- 424 Cavagna, G., and Beard, R.R. (Univ. Milan, Italy): POTASSIUM LOSS FROM LEAD-POISONED ERYTHROCYTES. FAILURE TO DEMONSTRATE CORRELATION WITH AGE OF CELLS. *Medicina del Lavoro* 53:779-81 (Dec.), 1962.

In earlier experiments, the authors had observed that when red cells were treated in vitro with Pb, K loss occurred, and the result was an increase in osmotic resistance. At moderately low Pb concentrations (0.008 mM/l), 2 groups of erythrocytes could be differentiated: one showed rapid K loss, the other a slow one. Thus the authors inferred that this was due to the enzyme content of the cells, which considerably decreases with age, and that the young cells could be separated by centrifugation. Therefore, heparinized blood from clinically normal persons was centrifuged, the top 20% and the bottom 20% red cells were removed and each group of cells was exposed to several concentrations of Pb chloride. At Pb concentrations of 0.003-0.008 mM/l, both groups lost at about the same rate. The authors conclude that the results failed to prove their hypothesis; however, this could be due to the possibility that centrifugation is not a suitable method for the separation of cells.

- 425 Crandall, C.A., and Goodnight, C.J. (Purdue Univ., Ind.): EFFECTS OF SUBLETHAL CONCENTRATIONS OF SEVERAL TOXICANTS ON GROWTH OF THE COMMON GUPPY, *LEBISTES RETICULATUS*. *Limnology and Oceanography* 7:233-9 (Apr.), 1962.

The effects of prolonged exposure to sublethal concentrations of 3 industrial by-products, i.e., Pb, Zn, and Na pentachlorophenate, were studied in the common guppy, *Lebistes reticulatus*. The pH of the metal salts was 7.9-8.2, total hardness was 80 ppm, and total alkalinity, 51 ppm. In

the case of Pb concentrations of 2 ppm analytical grade Pb nitrate (Pb, 1.24 ppm) were used. In addition, fish were placed in 5 ppm Pb nitrate (2.48 ppm Pb). Control fish were kept in water. After 30 days, the fish were weighed individually every 15 days until the 90th day. Size, activity, behavior, and sexual maturity were observed. Of a total of 109 fish in 5 groups in the 2 ppm Pb nitrate solution, 29 or 26.6% were dead at the end of 90 days, compared with 6.5 and 9.3% in 2 control solutions. Two groups of 12 and 10 fish in the 5 ppm solution reached a 50% mortality at 76 and 35 days, respectively. The median weights of the fish in the Pb solutions were less than the control medians at all times measured; the median confidence limits at 90 days corresponded to those of the controls at 30-45 days. The weight distributions in the Pb solutions were asymmetric, indicating the ability of some fish to grow normally. Of the 5 groups in the 2 ppm solution, 2 groups did not contain any recognizable males even after 90 days, in another group, a single male was observed, and in the 2 remaining groups 1 male was observed at 86 days and 1 at 80 days, respectively.

The results of this study strongly suggest that Pb produced chronic intoxication. The occurrence of such chronic or cumulative toxicity makes the determination of "safe" pollution levels for fish difficult.

- 426 Cremer, J.E. (M.R.C. Laboratories, Carshalton, Surrey, England): THE ACTION OF TRIETHYL TIN, TRIETHYL LEAD, ETHYL MERCURY AND OTHER INHIBITORS ON THE METABOLISM OF BRAIN AND KIDNEY SLICES IN VITRO USING SUBSTRATES LABELLED WITH  $^{14}C$ . *Journal of Neurochemistry* 9:289-98, 1962.

The effect of triethyl-Pb on the oxidation by rat brain and kidney slices of substrates labeled with  $^{14}C$  has been measured. At concentrations of  $1.2-4.0 \times 10^{-6}M$  triethyl-Pb inhibited the  $O_2$  consumption and the output of  $^{14}CO_2$  by brain slices when U- $^{14}C$  glucose was added as a substrate, but was inactive against kidney slices. The reason for the sensitivity of glucose oxidation by brain slices to triethyl-Pb is not known.

- 427 Galzigna, L., and Brugnone, F. (University Padua, Italy): Azione dell'acido adenosin-5-monofosforico nel saturnismo sperimentale. Prove in vitro. (EFFECT OF ADENOSINE-5-MONOPHOSPHATE IN EXPERIMENTAL SATURNISM. EXPERIMENTS IN VITRO.) *Bollettino della Societa' Italiana di Biologia Sperimentale* 38, No. 24:1827-8, 1962.

Blood of rabbits that had been poisoned with neutral Pb acetate was diluted with a physiological solution and incubated for 4 hr at 38°C with glycine and one of the following compounds: adenosine-monophosphate (AMP), adenosine-diphosphate (ADP), adenosine-triphosphate (ATP), pyridine-phosphate (PLP). Following incubation the free protoporphyrin (PPE) in the blood cells was determined. ATP and ADP were found to increase the production of PPE by 160% and PLP did so by 40%, whereas AMP caused a 24% inhibition and AMP + PLP a 72% inhibition. The data obtained in vitro agree with results obtained in an in vivo series.

- 428 Ishizuka, Y., and Tanaka, A. (Hokkaido Univ., Sapporo, Japan): (INORGANIC NUTRITION OF RICE PLANT. VIII. EFFECT OF LEAD, MAGNESIUM, AND ARSENIC LEVELS IN CULTURE SOLUTIONS ON YIELDS AND CHEMICAL COMPOSITION OF THE PLANT.) Nippon Dojo-Hiriyogaku Zasshi 33, No. 9:421-3, 1962.

Pb was present in culture solutions at the level of 0-50 ppm. At 50 ppm Pb had no effect, for it was precipitated as Pb sulfate; 10 ppm was the critical level when  $\text{SO}_4^{--}$  was absent. Maximum content of Pb was 200 ppm in straw and 300 ppm in roots. (From Chemical Abstracts 60:3448, 1964)

- 429 Koval'skii, V.V., Rezaeva, L.T., and Kol'tsov, G.V. (V.I. Vernadskii Inst. Geochem. and Anal. Chem., Moscow, USSR): (THE CONTENT OF TRACE ELEMENTS IN THE TISSUES AND BLOOD OF ASCIDIANS.) Doklady Akademii Nauk SSSR 147:1215-17, 1962.

The trace elements found in *Ascidia aspersa* included 0.015% Pb (relative to ash weight). (From Chemical Abstracts 58:9444, 1963)

- 430 Mambeeva, A.A., and Tikhonov, N.N. (Inst. Regional Pathol., Acad. Sci. Kazakh SSR): Vliyanie uksusnokisloi soli svintsia na sokratimost' poperechnoposostykh myshts kholodnokrovnykh. (EFFECTS OF LEAD ACETATE ON THE CONTRACTION OF TRANSVERSOSTRIAL MUSCLES OF COLD-BLOODED ANIMALS.) Trudy Instituta Kraevoi Patologii, Akademii Nauk Kazakhskoi SSR 10:103-7, 1962.

Pb acetate solutions used in these experiments on the isolated frog muscle were of the following concentrations: 0.01, 0.02, 0.05, 0.075, 0.1, 0.25, 0.5, 1.0, 2.0, 5.0, and 10.0%. The results showed that the contraction of transversostriatal muscle was greatly reduced by Pb acetate. The magnitude of the contraction rose with increased concentrations of Pb. However, in respect to comparatively weak solutions the known resistance was observed as a result of which muscle contraction did not reach great height on the kymogram. Pb contraction was characterized by having a short latent period, slow increase, no decrease and irreversibility.

- 431 Moritsugu, M., and Kobayashi, J.: (TRACE METALS IN BIOMATERIALS. I. GEOGRAPHICAL DIFFERENCE OF METALS CONTAINED IN AYU.) Biol. J. Okayama Univ. 11:393-411, 1962.

Pb, among other trace elements, was determined with the aid of a quartz spectrograph in *Plecoglossus altivelis*. Of the 116 sample locations along Japanese rivers, Pb was detected in both the entrails and gills of the fish. (From Chemical Abstracts 57:6449, 1962)

- 432 Sijpesteijn, K.A., Rijkens, F., Luijten, J.G.A., and Willemsens, L.C. (Org. Chem. Inst. T.N.O., Utrecht, Netherlands): (ANTIFUNGAL AND ANTIBACTERIAL ACTIVITY OF SOME TRISUBSTITUTED ORGANOGermanium, ORGANOTIN AND ORGANOLEAD COMPOUNDS.) Antonie van Leeuwenhoek, J. Microbiol. Serol. 28: 346-56, 1962.

The antifungal and antibacterial activities of a number of acetates of trialkyl- and triphenyl-substituted Pb were investigated. High activity was found for certain Pb compounds. A probable mode of action of the compounds was discussed. (From Chemical Abstracts 58:7308, 1963)

- 433 Tikhonov, N.N., and Mambeeva, A.A.: (THE CHANGES OF SORPTION PROPERTIES OF MUSCLE TISSUE OF COLD-BLOODED ANIMALS UNDER Pb ACETATE ACTION.) Tr. Inst. Kraevoi Patol., Akad. Nauk Kaz. SSR 10:100-2, 1962.

A study of isolated frog muscles, after intoxication with Pb acetate, revealed a rise of sorption activity of the muscular tissue which is evidently caused by paranecrosis. (From Chemical Abstracts 58:10653, 1963)

- 434 Vulpis, N., and Giorgino, R. (Univ. Bari, Italy): SOME EFFECTS OF METAL IONS ON BLOOD COAGULATION. Thrombosis et Diathesis Haemorrhagica 8:121-31, 1962.

Clotting mixtures consisting of 0.15 ml plasma containing 220,000 platelets/ $\text{mm}^3$  0.09 ml salt solution, and 0.09 ml imidazole buffer of pH 7.2-7.8 were recalcified with 0.03 ml 0.125M  $\text{CaCl}_2$ , and clotting was recorded in the thromboelastograph. Salts of Cd, Zn, Ni,  $\text{Fe}^{++}$ , Co, Pb, Al, Mn, Ba, Sr, Hg, and Li were used. All salts increased the reaction time and decreased the maximum amplitude, the first 3 markedly in small amounts, the following 4 in larger amounts, and the next 3 hardly at all. When tested at a concentration of 0.2  $\mu\text{g}$  of ion/0.36 ml final mixture, the reaction time decreased from >200 to 5 sec in the order Cd, Zn, Ni, Pb, Al, Co, Fe, Sr, Mn, Ba, Li, and Hg; the maximum amplitude increased from 0-50 mm in the order Cd, Hg, Zn, Ni, Co, Sr, Al, Pb, Fe, Li, Mn, and Ba. Hg was tested in several dilutions and gave very short reaction times, which were explained by lysis of the platelets. To rabbit plasma Pb nitrate was added to a final concentration of 1.70  $\mu\text{g}/\text{ml}$ . When this and normal plasma were mixed in various proportions, the reaction times increased and the maximum amplitudes decreased progressively. Plasma was fractionated by starch electrophoresis, and 0.65  $\mu\text{g}$  Pb in 0.05 ml was added to 0.30 ml platelet-rich plasma, 0.13 ml plasma fraction, and 0.18 ml imidazole buffer of pH 7.4. The mixtures were recalcified and examined as before. The  $\alpha_1$ -, fibrinogen-, and  $\gamma$ -globulin fractions showed the highest inhibitory action. Thromboelastograms, abnormal by the action of metal ions, could be restored to normal by the addition of  $\text{Na}_2\text{EDTA}$ .

## 1963

- 435 Alber, M.A. (Univ. Palermo, Italy): Api raccogliatrici di vernici al minio. (COLLECTING OF RED LEAD PAINT BY HONEY BEES.) Bollettino dell'Istituto di Entomologia Agraria e dell'Osservatorio di Fitopatologia di Palermo 5:303-6, 1963-1964.

It is known that bees are attracted to paint mixed with rosins. In 1963, bees from an apiary in the neighborhood of the new Pirelli factory at Villa-franca gathered a mass of red Pb paint

from the iron structures. They filled crevices and narrow spaces in the hives and varnished the surface of honey combs with the poisonous Pb paint.

- 436 Chandra, S. (Univ. Lucknow, India): PHYSICO-CHEMICAL PROPERTIES OF MILK. I. COAGULATION OF COW MILK WITH VARIOUS ELECTROLYTES. Proc. Natl. Acad. Sci. India, Sect. A 33, Pt. 1:17-24, 1963.

Pure milk can be coagulated with 0.0067M and 0.168M HCl. The normal dilution law is applicable in the 1st zone; whereas in the 2nd the reverse is the case, i.e., the lower the concentration of colloid, the higher the concentration of electrolyte needed to coagulate. Similarly, 2 separate zones of coagulation are observed with  $\text{HNO}_3$ , acetic acid (AA),  $\text{AlCl}_3$ ,  $\text{Al}(\text{NO}_3)_3$ ,  $\text{H}_2\text{C}_2\text{O}_4$ , and tartaric acids. In the 2nd zone a change of charge from - to + took place with HCl,  $\text{HNO}_3$ , AA,  $\text{H}_2\text{C}_2\text{O}_4$ , and tartaric acids due to the adsorption of  $\text{H}^+$ , and with  $\text{AlCl}_3$  and  $\text{Al}(\text{NO}_3)_3$  to the  $\text{Al}^{+++}$ . It is not possible to distinguish the 2nd zone of coagulation with tartaric acid and AA at all dilutions and with  $\text{Al}(\text{NO}_3)_3$  at  $<0.065\text{M}$ . The results of coagulation of milk with  $\text{H}_2\text{SO}_4$ ,  $\text{AgNO}_3$ ,  $\text{Pb}(\text{NO}_3)_2$ , Pb acetate,  $\text{CuSO}_4$ ,  $\text{ZnSO}_4$ ,  $\text{CoSO}_4$ ,  $\text{MnCl}_2$ ,  $\text{NiCl}_2$ , and  $\text{FeCl}_2$  in the 1st zone are listed. Coagulation of pure milk and reconstituted powdered milk both whole and skim and their mixtures by  $\text{Pb}(\text{NO}_3)_2$ , Pb acetate,  $\text{ZnSO}_4$ , and  $\text{AlCl}_3$  are studied. Powdered milks obeyed the normal dilution law in the 1st zone of coagulation, and the skim, powdered milk is more stable than pure milk. (From Chemical Abstracts 59:6902, 1963)

- 437 Evans, E.A., Eisenlord, G., and Hine, C.H. (Med. School, Univ. California, San Francisco): STUDIES IN DETOXICATION BY MEANS OF THE ISOLATED PERFUSED LIVER. Toxicology and Applied Pharmacology 5:129-41 (Mar.), 1963.

Clearance rate of Pb, morphine, ethanol, and pentobarbital was measured using isolated perfused livers of normal rats and rats whose livers had been damaged by intragastric administration of 50 mg/kg of allyl alcohol or by sc administration of 480 mg/kg of C tetrachloride. Damaged livers cleared Pb more rapidly than normal ones and also had higher tissue concentrations of Pb than controls at the end of perfusion. (28 references)

- 438 Frenk, E.: De l'affinité de la peau pour certains métaux. (AFFINITY OF THE SKIN TO CERTAIN METALS.) Dermatologica 127, No. 1: 33-8, 1963.

Guinea pig skin sections in 1% Pb nitrate solution treated with diphenylcarbazone showed strong red coloration of erythrocytes and musculature, but very weak skin reaction. This confirmed marked affinity of erythrocytes for Pb, poor fixation of Pb in skin, and rare production of Pb eczema.

- 439 Granata, A., and Germano, D. (Univ. Messina, Sicily): Diverso potere eritrolesivo del piombo e dei suoi principali composti inorganici. (ACTION OF LEAD AND ITS PRINCIPAL INORGANIC SALTS ON RED BLOOD CELLS.) Bollettino della Società Italiana di Biologia Sperimentale 39:928-31 (Aug.

31), 1963.

Slightly heparinized venous blood from 20 normal subjects was reacted at  $25^\circ\text{C}$  with 100 mg each of the compounds to be tested, and the spontaneous hemolyzing time was determined. Highest hemolysis values were observed for Pb nitrate, Pb acetate, Pb carbonate and Pb sulfate in that order, whereas the chloride and oxide of Pb and metallic Pb were weak hemolyzing agents. A relationship between toxicity and penetrating capacity of the substances into the red cells is suggested.

- 440 Granata, A., and Germano, D. (Univ. Messina, Italy): Potere eritrolitico del rame e analisi comparativa del "tempo di emolisi provocata" di alcuni metalli. (THE HEMOLYTIC POWER OF COPPER AND THE COMPARATIVE ANALYSIS OF "TIME OF HEMOLYSIS" INDUCED BY DIFFERENT METALS.) Medicina del Lavoro 54:81-7 (Feb.), 1963.

Hemolytic properties of Pb and 6 other metals were examined in vitro with red blood cells taken from the blood of 35 normal subjects. (Metals were added at 100 mg to 2 ml blood.) Pb had a lower lytic power than many other metals, which confirms central action of Pb and its minimal capacity for poisoning through cell membrane of mature erythrocytes.

- 441 Granata, A., and Papalia, D. (Univ. Messina, Italy): Potere eritrolitico in vitro di alcune sostanze in polvere d'interesse professionale. (HEMOLYTIC ACTION IN VITRO OF SOME POWDERED SUBSTANCES USED IN INDUSTRY.) Medicina del Lavoro 54:519-23 (June-July), 1963.

The time required by a number of substances to induce hemolysis was determined in vitro in the blood of 40 healthy adult subjects.  $\text{Pb}_3\text{O}_4$  produced hemolysis in all cases, a maximum effect being reached on the 3rd day. A comparison with hemolytic effect of Pb dust showed that  $\text{Pb}_3\text{O}_4$  damages red cells much more intensely than Pb. With Pb, maximum effect was reached on the 10th day.

- 442 Granata, A., and Stilo, R. (Univ. Messina, Italy): L'azione dell'acido etilendiaminotetracetico sugli eritrociti in vitro. (ACTION OF ETHYLENEDIAMINETETRAACETIC ACID ON ERYTHROCYTES IN VITRO.) Bollettino della Società Italiana di Biologia Sperimentale 39:925-8 (Aug. 31), 1963.

Venous blood was collected from 14 subjects with chronic Pb poisoning and 14 individuals with some kind of blood disease, and immediately mixed with solutions of disodium ethylenediaminetetraacetate ( $\text{Na}_2\text{EDTA}$ ) at concentrations ranging from 15-0.93%. Sedimentation occurred quickly at concentrations  $<7.5\%$  and more slowly at the higher concentrations. Hemolysis started at 48 hr in the 15% solution and on the 5th day at concentrations of from 6.42-9%. There was no significant difference in the time of hemolysis between the blood of Pb-poisoned subjects and that of the other group, only in advanced Pb poisoning hemolysis started after 30 hr in the 15% solution. After the 4th-5th day, all samples contained stippled cells; granulations were indistinct in both poisoned and not poisoned subjects. The granulations caused by

Na<sub>2</sub>EDTA were quite different from stippled basophils as they appear in Pb poisoning. There was also a pronounced anisocytosis with numerous spherocytes; the neutrophils were either damaged or anomalous due to degeneration while the lymphocytes showed more resistance; the megakaryocytes were slightly increased and monocytes were absent already after the 2nd day. Consequently, EDTA, at all concentrations except between 6 and 9%, had a direct injurious effect on red blood cells in vitro. At concentrations between 6 and 9% the red cell was preserved at least until the 6th day. The conclusion was drawn that EDTA should be administered for treatment only in concentrations of 6-9% and that a dose of 500 mg/adult normal subject should not be exceeded.

- 443 Keller, R. (Univ. Zürich, Switzerland): Zur Histochemie der Mastzellesterase. (THE HISTOCHEMISTRY OF THE ESTERASE OF MAST CELLS.) Schweizerische Medizinische Wochenschrift 93, No. 42:1504-5, 1963.

The effect of various inhibitors on esterase, leucine aminopeptidase (LAP) and adenosinetriphosphatase (ATP-ase) of isolated rat mast cells has been studied. Pb nitrate in a solution of  $2 \times 10^{-2}M$  did not affect esterase or ATP-ase, but inhibited LAP by 25%.

- 444 Lishko, V.K. (Inst. Biochem. Acad. Sci. Ukr. SSR, Kiev): (PROPERTIES OF BRAIN CATHEPSIN.) Ukr. Biokhim. Zh. 35, No. 6: 874-80, 1963.

From purified cathepsin prepared from brain homogenate by a method described earlier (Polyakova et al, 1962; 1960), a protein fraction in which the cathepsin was concentrated by a factor of 1000 was isolated by absorption on diethylaminoethyl cellulose and elution with 0.1M NaCl. The maximum proteolytic action of the concentrated cathepsin was at pH 3.1 with bull hemoglobin as a substrate and at pH 4.1 with serum albumin as a substrate. The enzyme exhibited a maximum stability at pH 5.5-8.5. Its activity was not affected by Pb ions ( $0.001M$ ). Of the 3 protein substrates investigated, viz, denatured hemoglobin, serum albumin, and egg albumin, cathepsin split hemoglobin best and egg albumin least. (From Chemical Abstracts 60: 12292, 1964)

- 445 Morihara, K. (Shionogi Co. Ltd, Osaka, Japan): PSEUDOMONAS AERUGINOSA PROTEINASE. I. PURIFICATION AND GENERAL PROPERTIES. Biochimica et Biophysica Acta 73:113-24, 1963.

Heavy-metal ions such as Pb<sup>2+</sup> inactivate the enzymic activity of *P. aeruginosa*. (19 references)

- 446 Muraoka, S. (Okayama Univ., Japan): MECHANISM OF SUBSTRATE INHIBITION AND ITS REVERSAL BY HISTAMINE. Biochimica et Biophysica Acta 73:27-38, 1963.

In the presence of histamine or in dithizone-treated medium the inhibition of milk xanthine oxidase can be suppressed. Since the inhibition caused by the substrate can be demonstrated by the addition of a minute amount of metallic ion, such as  $6.6 \times 10^{-7}M$  Pb<sup>2+</sup>, to the metal-free system, the presence of a trace of some metallic ion in

the reaction mixture may be responsible for the inhibition. (16 references)

- 447 Oborn, E.F.: EFFECTIVENESS OF COMMON AQUATIC ORGANISMS IN REMOVAL OF DISSOLVED LEAD FROM TAP WATER. U.S. Department of the Interior, Geological Survey, Professional Papers No. 475-C:220, 1963.

Four kinds of aquatic plants absorbed Pb approximately in proportion to the area of the plant-body surface in contact with the water. Symbiotic bacteria were the most active of the organisms studied.

- 447a Parkbok, T.A., and Kuznetsova, G.N.: (EFFECT OF THE SOIL TEMPERATURE ON THE ABSORPTION AND DISTRIBUTION OF TRACE ELEMENTS IN PLANTS.) Tr. Botan. Inst., Akad. Nauk SSSR, Ser. 4, Eksperim. Botan. 1963, No. 16:27-48.

The effect of the soil temperature on the content and distribution of B, Mn, Zn, Fe, Al, Ti, Cu, Ni, Pb, Mo, Ag, Cr, Ga, V, Sn, and Co in young bean, barley, and tomato plants was investigated. The experiments were carried out during the summer months in a light, air, and temperature-controlled growth chamber with several podzol soils and in sand cultures at 2 series of soil temperatures: 26, 28, 30° and 12, 14, 18° controlled by special arrangement. Soil moisture was maintained at 60% of capacity. The plants were irrigated daily. After harvesting the plants were analyzed, leaves, stems, and roots separately. The effect of the soil temperature on the content of the same element varied with different soils. At higher temperatures the increases of B and Mn were the highest. In some instances the higher temperature affected the distribution of Mn, Fe, and Ni in the different parts of the plant, increasing their transportation from the roots to the leaves. In the young bean, sharp differences in trace element contents were observed in various parts of the plant. Leaves and roots were characterized by a high content of Mn, Fe, Ti, Al, Cu, and Zn. The heavy metals Pb, Ag, Ga, Cr, V, and Sn accumulated primarily in the roots. The stems had a low content of all trace elements with the exception of Ni and Mo. In tomato plants the absorption of B and Mn increased with the higher temperature. The differences in the B contents were more pronounced in the leaves and not too significant in the stems and roots. It is assumed that in order to meet the requirements of the plant for the trace elements it would, in addition to availability, be necessary to take into consideration the temperature of the soil. Tables of the trace element contents of the plants at the different soil temperatures are presented. (From Chemical Abstracts 59:14303, 1963)

- 448 Schweiger, H.G., Schweiger, E., and Vollertsen, I. (Max Planck Inst. Sea Biol., Wilhelmshaven, Germany): Ribonucleinsäure-Abbau und Hämoglobinsynthese in Reticulocyten. (RIBONUCLEIC ACID DEGRADATION AND HEMOGLOBIN SYNTHESIS IN RETICULOCYTES.) Biochimica et Biophysica Acta 76:482-4 (Nov. 22), 1963.

Since the disappearance of RNA is a sign of reticulocyte maturation, the authors set out to prove indirectly that RNA degradation is connected with Hb synthesis. The reticulocytes used in the experiments were derived from rats made anemic by phenylhydrazine. Washed cells were incubated in Krebs-Henseleit buffer to which were added  $^{14}\text{C}$ -labeled leucine, amino acids, glucose, Fe, and Pb ( $1 \times 10^{-4}\text{M}$ ). The incorporation of leucine in the soluble protein was taken as a measure of Hb synthesis. RNA was determined as RNA-P after acid extraction. The results showed that leucine incorporation and RNA degradation behaved synonymously. It was also found that both RNA degradation as well as leucine incorporation were inhibited almost completely by Pb. The authors point out that the fact that Pb is not a general inhibitor for protein synthesis but acts specifically on Hb formation was seen in the finding that leucine incorporation in the stroma proteins was not markedly affected by Pb. (14 references)

- 449 Sirs, J.A. (Univ. London, England): UPTAKE OF  $\text{O}_2$  AND CO BY HEMOGLOBIN IN SHEEP ERYTHROCYTES AT VARIOUS TEMPERATURES. *Journal of Applied Physiology* 18:166-70 (Jan.), 1963.

The rate of uptake of O and of CO by hemoglobin in intact red cells of sheep increased by a factor of  $\sim 1.5$  for each  $10^\circ\text{C}$  rise in temperature over the range of  $10\text{--}35^\circ\text{C}$ . Metals (as chlorides, Ag at  $5 \times 10^{-8}\text{ g/l}$ , Mg at 20 mg, Cu at 10, and Pb at 100 mg/l) increased the rate of uptake of both gases by a factor of 1.14-1.3 (Pb, 1.14). The influence of metal ions appears to be one of increasing the membrane permeability.

- 450 Tiunov, L.A.: (ENZYMES AND POISONS.) *Vopr. Obshch. Prom. Toksikol. Leningrad, Sb.* 1963:80-5.

Commercial poisons are classified according to their effect on enzymes and action on the various enzyme systems governing organ functions and metabolic processes. Pb is classified among the poisons acting on the prosthetic group of enzymes, ie, disturbing synthesis of prosthetic groups. (From *Ref. Zh., Farmakol., Toksikol.* 1965, Abstr. No. 3.54.310; *Chemical Abstracts* 62:13747, 1965)

## 1964

- 451 Aoki, K., and Hori, J. (Univ. Nagoya, City Univ., Japan): EFFECT OF METALLIC CATIONS ON HUMAN SERUM: STUDY BY STARCH-GEL ELECTROPHORESIS. I. EFFECT OF  $\text{Pb}^{++}$ ,  $\text{Cu}^{++}$ , AND  $\text{NH}_4^+$ . *Archives of Biochemistry and Biophysics* 106, No. 1:317-25, 1964.

The technique of one dimensional starch-gel electrophoresis has made possible the resolution of human serum into more than 12 components, enabling a more exact study of the effect of metallic cations on the protein components of serum. When Pb nitrite or  $\text{CuSO}_4$  was added to human serum, the amount of precipitate increased with increase in the concentration of the cation. Some protein components of human serum were precipitated at lower concentrations and some resisted precipitation even at higher concentrations of a cation.

The precipitability of a component depended on the nature of the cation. The main components in the supernatant obtained, when serum diluted 50% contained 30 mM  $\text{Pb}^{++}$ , were transferrin and  $\gamma$ -globulin. Almost all the  $\gamma$ -globulin was precipitated when serum diluted 50% contained 6 mM  $\text{Cu}^{++}$ ; almost all the proteins were precipitated when the final concentration of  $\text{Cu}^{++}$  was 20 mM. It was observed that the zone of a particular component disappeared abruptly at a certain concentration of cation, while a new zone appeared, indicating probably, that the component was modified by the cation with a change in mobility. Also, that the intensity of staining of a particular component increased with increase in the cationic concentration. An explanation is that the metallic cation ( $\text{Pb}^{++}$  or  $\text{Cu}^{++}$ ) bound to the protein binds dye (eg,  $\text{protein}^- - \text{Pb}^{++} - \text{dye}^-$ ).

- 452 Beltshev, B.G.: (INFLUENCE OF BIVALENT METAL CATIONS ON THE DEGRADATION OF RNA IN RAT AND CHICKEN LIVER HOMOGENATES.) *Izvestiya na Tsentralnata Laboratoriya po Biokhimiya, Bulgarska Akademiya na Naukite* 2:47-56, 1964.

The degradation of ribonucleic acid (RNA) by ethylenediaminetetraacetate (EDTA), Mg and Pb in rat and chicken liver homogenates was studied. After 6 hr incubation at  $37^\circ$ , 40% of the whole-tissue RNA was degraded. EDTA at pH 8 blocked the activity of ribonuclease but had no influence on the enzyme in an acid medium (pH 5). Mg and Pb added in excess to EDTA removed the blocking effect both in rat and chicken liver homogenates. As the ribonuclease inhibitor was absent in the latter, the author concludes that the bivalent metal ions do not inactivate the inhibitor but act on the enzyme itself; also, that the mechanism of the mode of action is far from clear. (From *Chemical Abstracts* 62:13425, 1965)

- 453 Csillik, B., and Davis, R. (Univ. Pennsylvania, Philadelphia): ELECTRON MICROSCOPIC LOCALIZATION OF THE "LEAD-REACTIVE SUBSTANCE" IN THE MYONEURAL JUNCTION. *Acta Biologica Academiae Scientiarum Hungaricae* 15, No. 2:203-11, 1964.

Since Savay and Csillik (1958) had shown that the myoneural junction has a conspicuous affinity for Pb salts, an electron-microscopic study was undertaken to determine the localization of supravitaly administered Pb nitrate in the myoneural junctions of the intercostal muscle of adult mice. The dissected thorax of the mice was immersed for 5, 10, 20 and 30 min in a 0.1% solution of Pb nitrate, containing 10% formalin and sufficient Na nitrate to achieve isotonicity. Best results were obtained in samples kept in the solution for 30 min. As anticipated, the Pb-reactive substance of the myoneural junction was found in the postsynaptic membrane and its neighboring parts, ie, in the same submicroscopic structures which also contain cholinesterase activity. It is suggested that the postsynaptic membrane consists of a mosaic-like pattern of the acetylcholine receptor and displays the role of a postsynaptic amplified device of the action of presynaptically released acetylcholine.

- 454 Fisher, F.M., Jr. (Rice Univ., Houston,



Texas): THE PROPERTIES AND SPECIFICITY OF A  $\beta$ -GLUCOSIDASE FROM BLABERUS CRANIIFER. Biological Bulletin 126:220-34 (Apr.), 1964.

Pb was one of the 13 metal ions tested for the characterization of a  $\beta$ -glucosidase found to be localized mainly in the cecal complex of the alimentary canal of the roach, *Blaberus craniifer*. At a concentration of  $8.26 \times 10^{-6}M$ , Pb caused 50% inhibition of the activity of the enzyme. The range of inhibition by the other ions was from 2-100%.

- 455 Flerova, T.P., and Flerov, V.E.: (EXPERIMENT ON BIOCHEMICAL AND GEOBOTONICAL PROSPECTING IN THE DZUNGARIAN ALA TAU.) Materialy po Geol. i Polezn. Iskop. Yuzhn. Kazakhstana (Alma-Ata: Akad. Nauk Kaz. SSR) Sb. 1964, No. 2:144-52.

Results are given on surveys made in the areas of polymetallic deposits already explored in Koksui, Eastern Suuktyube, and Yablonovoe. In each survey unit (area  $5 m^2$ ), geobotanical, soil, and geological observations were made and biochemical and metallometric samples were taken. It was proved that: (1) the plants spirea, mint (*Mentha*), yarrow, St.-John's-wort, and vetch (*Vicia* spp.) concentrate large amounts of Ag, Ga, and Sb, while iris, hollyhock, thoroughwax (*Bupleurum*), and others concentrate little of the same elements; (2) the content of Zn, Pb, and Cu in the ashes of plants, growing over the ore bodies, is 1.5-4% (the background content is 0.0n-0.00n%) with a simultaneous increase in the content of Ag, Ga, Sb, and other elements; (3) the plant indicators of ore bodies are gypsophila, astragalus, eyebright (*Euphrasia*), dock (*Rumex acetosa*), (Koksu), and mountain bluet (*Centaurea montana*) (Eastern Suuktyube); and (4) on soil over the ore bodies the amount of plant species decreases and there is a sharp predominance of 1 or 2 species. The effect of ore bodies on plant shape is discussed and illustrated. The results of metallometric, biogeochemical, and geobotanical sampling are compared and interpreted. (From Ref. Zh., Geol. 1964, Abstr. No. 12D44; Chemical Abstracts 62:14351, 1965)

- 456 Goodman, I., and Hiatt, R.B. (Columbia Univ., New York, N.Y.): CHEMICAL FACTORS AFFECTING SPONTANEOUS MOTILITY OF THE SMALL INTESTINE IN THE RAT. I. SULFHYDRYL REACTANTS. Biochemical Pharmacology 13:871-9 (June), 1964.

To determine whether the sulfhydryl (SH) group is involved in the mechanism of intestinal smooth muscle contractility, relative reactivities of a variety of SH reactants with the cysteine SH group were evaluated by a modification of the indophenol method along with parallel studies of the effects of the same SH reactants on spontaneous motility and response to acetylcholine (ACh) of isolated segments of rat ileum in Ringer's solution. Compounds highly reactive toward the SH group included Pb acetate among others. Comparisons were made with compounds that do not react with the SH group. Pb acetate reacted rapidly with the isolated gut segment, causing inactivation at concentrations of  $10^{-3}$ - $10^{-4}M$  with inhibition of the normal ACh-in-

duced contraction. At lower concentrations they had no effect or even enhanced spontaneous intestinal motility, causing increased amplitude of contraction without inhibition of the ACh contraction.

- 457 Haider, G. (Inst. Technol., Stuttgart, Germany): HEAVY METAL TOXICITY TO FISH. I. LEAD POISONING OF RAINBOW TROUT (*SALMO GAIARDNERII*) AND ITS SYMPTOMS. Z. angew. Zool. 51, No. 3:347-58, 1964.

Rainbow trouts were chronically poisoned in an aquarium by adding small amounts of Pb acetate to the water for 2-3 mo or by giving lethal doses orally or by injection. In acute poisoning, the gill epithelium and inner organs were destroyed and the fish died of suffocation. Staining with Ag sulfide revealed the presence of Pb in bones, liver, kidneys, gills and spleen. (From Water Pollution Abstracts 39:Abstr. No. 1820, 1966)

- 458 Hirth, L. (Univ. Munich, Germany): Enzymschaden bei Schwermetallvergiftung. (ENZYMIC DAMAGE DUE TO HEAVY METAL INTOXICATION.) Münchener Medizinische Wochenschrift 106, No. 21:985-8, 1964.

In his introduction, the author states that also in this age of plastics and chemicals, the use of certain heavy metals, particularly Pb, provides opportunity for exposure to them by man. He cites a report of increased Pb levels in the blood of the urban population and questions whether Pb occurs in primitive people. As one of the main effects of heavy metals seems to be the inhibition of enzymes, he reports his in-vitro experiments of the effect of Hg on succinodehydrogenase and alkaline phosphatase in kidney tissue. A  $1 \times 10^{-3}M$  solution of Hg chloride completely inhibited succinodehydrogenase, and a similar though somewhat lesser effect was produced by a solution of Pb acetate, whereas even a  $1 \times 10^{-2}M$  solution of Hg chloride or Pb acetate did not affect the activity of alkaline phosphatase. In-vivo experiments were described only for Hg. The brief discussion of the mechanism of the enzyme-inhibiting effect revolves mainly around the affinity of Hg and Pb to the SH-groups.

- 459 Huff, J.W., Sastry, K.S., Gordon, M.P., and Wacker, W.E.C. (Univ. Washington; Dept. Med. Harvard Med. School; Peter Bent Brigham Hosp. Boston, Mass.): THE ACTION OF METAL IONS ON TOBACCO MOSAIC VIRUS RIBONUCLEIC ACID. Biochemistry (Wash.) 3: 501-6 (Apr.), 1964.

Added transition metal ions stabilize the secondary structure of tobacco virus RNA. In spite of this stabilization of secondary structure, heating in the presence of metal ions results in the loss of biological activity due to the hydrolysis of phosphodiester bonds. At pH 5.8 and room temperature Pb ions catalyzed the hydrolysis of RNA to 2'(3')-mononucleotides; on long standing, nucleosides were formed. (From authors' summary; 23 references)

- 460 Jonderko, G. (Acad. Med., Zabrze, Poland): Wpływ soli metali ciężkich na aktywność dehydrogenazy mleczanowej. (THE EFFECT OF

HEAVY METAL SALTS ON THE ACTIVITY OF LACTIC DEHYDROGENASE. *Polskie Archiwum Medycyny Wewnętrznej* 34, No. 12:1583-6, 1964. The effect of Mn sulfate, Cd sulfate, Hg chloride, Pb acetate and Co sulfate in concentrations of  $5 \times 10^{-6}$ ,  $1 \times 10^{-5}$  and  $2 \times 10^{-5}M$  on the activity of lactic dehydrogenase of human erythrocytes was studied in vitro. The results showed that the salts inhibited the action of the enzyme in a concentration as low as  $5 \times 10^{-6}M$ .

- 461 Jonderko, G., and Dabrowski, Z. (Silesian School Med., Zabrze, Poland): THE EFFECT OF HEAVY METAL SALTS AND CALCIUM DISODIUM AND MAGNESIUM DISODIUM VERSENATE ON THE ACTIVITY OF SERUM PHOSPHOMONOESTERASE. I. IN VITRO STUDIES. *Archivum Immunologiae et Therapiae Experimentalis* 12, No. 5:592-601, 1964.

The behavior of phosphomonoesterase I in the presence of equimolar concentrations of heavy-metal salts and chelating agents was studied in vitro with human blood serum. Two ml of the blood serum using sera of 17 patients with conditions unrelated to intoxication and healthy donors was incubated for 1 hr at  $37^\circ$  with Mn sulfate, Cu sulfate, Hg chloride, Pb acetate and Co sulfate in amounts giving serum concentrations of  $5 \times 10^{-6}$ ,  $1 \times 10^{-5}$  and  $2 \times 10^{-5}M$  after solution. The activity of phosphomonoesterase I was then determined in the test and in control samples. Sera of 10 individuals were used to study the "prophylactic" and "therapeutic" effect of Ca disodium versenate (EDTA) on the enzyme activity by incubating the sera with EDTA either before or after incubation with the heavy metals.

The degree of inhibition of the enzyme activity increased as the concentration of the heavy metals increased from  $5 \times 10^{-6}$  to  $1 \times 10^{-5}$  and  $2 \times 10^{-5}M$ , with Hg and Pb showing the strongest effect. After prophylactic application of EDTA, Hg and Pb also caused significantly greater inhibition of enzymatic activity than the other salts but significantly less than EDTA alone or than Hg and Pb without preincubation with EDTA. Incubation with EDTA for 1 hr after incubation with the heavy metals (therapeutic use) caused a significantly greater decrease of phosphomonoesterase activity than incubation with EDTA prior to incubation with the metal salts (prophylactic use of EDTA).

The conclusion was drawn that prophylactic use of EDTA is more effective than therapeutic use. There was little change in effect when serum was incubated with EDTA for 1, 2, or 24 hr. Since all heavy-metal salts including those of Pb inhibit phosphomonoesterase at concentrations above  $5 \times 10^{-6}M$ , determination of the activity of this enzyme may serve as a nonspecific diagnostic test in intoxications with these metals.

- 462 Laboureur, P., and Labrousse, M. (Joyer Josas, Seine et Oise, France): Propriétés d'une lipase fongique à haute activité. (PROPERTIES OF A HIGHLY ACTIVE FUNGAL LIPASE.) *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences* 259: 4394-6 (Dec. 9), 1964.

The exocellular lipase of a *Rhizopus* rootstock stimulates the hydrolysis of numerous glycerides

between pH 2.5-9.5, is active in temperatures from  $20^\circ$ - $50^\circ$  and is activated by Ca and albumin. Among the mineral substances  $Ca^{++}$  and to a lesser degree  $Mn^{++}$  are strong activators, while the inhibitors are:  $Zn^{++} > Hg^{++} > Pb^{++} > Cu^{++} > Sn^{++} > Fe^{+++} > Co^{++} > Al^{+++}$  in concentrations of  $2 \times 10^{-4}M$ . (From authors' summary)

- 463 Li, H.C., and Hu, Y.C.: EFFECTS OF LEAD ARSENATE SPRAYS ON THE PHYSIOLOGICAL FUNCTIONS AND FRUIT QUALITY OF SWEET ORANGE. *Yuan Yi Hsueh Pao* 3, No. 2:129-37, 1964.

Proper spraying of sweet orange with Pb arsenate improved quality, decreased acidity and increased the content of sugars, vitamin C and the ratio of sugar to acid. It also increased the weight of the fruit and promoted the vigor of the tree. Spraying sweet orange with 0.25% Pb arsenate 3 times between early young fruit drop and June drop is recommended. (From Chemical Abstracts 62:7050, 1965)

- 464 Min, K.S. (Coll. Med., Natl. Univ. Seoul, Korea): EFFECT OF LEAD ION ON THE POTASSIUM TRANSPORT OF RABBIT BLOOD CELLS. *Soul Uidae Chapchi* 5, No. 1:21-30, 1964)

The effect of Pb on the permeability of rabbit red cells to K were studied on the basis of the dose-response, time-response curves and osmotic fragility changes. Pb chloride induced a prehemolytic loss of K from the erythrocytes over a range  $0.5 \sim 20 \times 10^{-3} mM$  Pb chloride/l, and at concentrations above  $20 \times 10^{-3} mM/l$ , hemolysis began to appear. The K loss progressed rapidly for 1 hr and then slowed down. A recovery of cell membrane occurred with time after poisoning the cells; it was complete in 5 hr. The K loss was greatest at  $20-37^\circ$  and pH 7.0. Intracellular inorganic phosphate increased during the phase of rapid K loss and thereafter slowed down. Pb induced K leakage in the cells. The relation between sulphydryl groups and Pb binding on the cell membrane was discussed. (From Chemical Abstracts 65:7886, 1966)

- 465 Ogawa, K. (Univ. Kyoto, Japan): METALLOPHILIA (AFFINITY FOR LEAD) OF THE PLASMA MEMBRANES OF JEJUNAL EPITHELIAL CELLS IN THE RAT. Abstracts of 77th Session of the American Association of Anatomists, Denver, 1964. *Anatomical Record* 148, No. 2: 392, 1964.

In the course of electron histochemical demonstration of acid phosphatase in the jejunal epithelial cells of the rat, using the Gomori reaction, the nonenzymatic deposition of Pb in plasma membranes of microvilli and interdigitating plications between adjacent cells was observed. The mode of nonenzymatic Pb deposition did not differ from that of enzymatic Pb. Nonenzymatic Pb deposition was enhanced by fixation of tissues in cold formal-Ca at pH 7.4, and addition of sucrose. The phenomenon of metallophilia can be overcome by decreasing the Pb concentration in the Gomori medium from the original 3.7-1 mM. (Condensed abstract)

- 466 Papke, E., and Pohloudek-Fabini, R. (Pharmac. Inst. Ernst-Moritz-Arndt-Univ.,

Greifswald, Germany): Zur Kenntnis des Ketostoffwechsels von *Datura stramonium* L., var. *stramonium*. Teil V: Über die Wirkung einiger Stoffwechsellinhibitoren auf den Ketostoffwechsel von *Datura stramonium* L., var. *stramonium*. 25. Mitteilung: Beiträge zur Chemie und Physiologie einiger stoffwechselchemisch wichtiger Säuren. (METABOLISM OF KETO ACIDS IN *DATURA STRAMONIUM* VAR *STRAMONIUM*. V. EFFECT OF CERTAIN INHIBITORS ON THE KETO ACID METABOLISM. 25. CHEMISTRY AND PHYSIOLOGY OF SEVERAL METABOLICALLY IMPORTANT ACIDS.) *Pharmazie* 19, No. 11:718-22, 1964.

Healthy functioning leaves high on the stem of plants 4-5 mo old were treated with various metabolic inhibitors by suspending the leaves with their petioles in the respective solutions for 24 hr in darkness.  $\alpha$ -Ketoglutaric acid content was reduced by K metaarsenite, Pb nitrate (1% solution), NaF, p-fluorobenzoic acid, acetaldehyde, and butalidon (phenylbutazone), whereas pyruvic acid was increased by the same compositions. (22 references)

- 467 Patino, H. (Inst. Fomento Algodonero, Bogotá, Colombia): Efectos fitotóxicos del arseniato de plomo usado como insecticida en el cultivo de la soya. (PHYTOTOXIC EFFECTS OF LEAD ARSENATE USED AS AN INSECTICIDE IN SOYBEAN CULTURE.) *Bol. Notic. Inst. Fomento Algodonero Bogotá* 4, No. 5:4-5, 1964.

Toxicity symptoms observed on soybean plants sprayed with Pb arsenate for control of Lepidoptera larvae are described. (From Biological Abstracts 46:Abstr. No. 72893, 1965)

- 468 Pecora, L., Fati, S., Molé, R., and Pesaresi, C. (Univ. Naples, Italy): Azione del piombo sulla sintesi porfirinica nel midollo osseo. (EFFECT OF LEAD ON PORPHYRIN IN THE BONE MARROW.) In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. III, pp 1068-9.

Homogenates of bone marrow removed from the femur, shoulder and tibia of 20 young rabbits were prepared by the method of Morell (1958), and suspended in Krebs-Ringer phosphate solution. Aliquot portions were then treated with glycocoll and Pb acetate in concentrations of  $10^{-1}M$ ,  $10^{-4}M$ ,  $10^{-7}M$  and  $10^{-11}M$ . After an incubation of 4 hr at  $37^{\circ}$ , the protoporphyrin was determined by the method of Grinstein and Wintrobe (1950). In concentrations of  $10^{-1}M$  and  $10^{-4}M$  Pb acetate inhibited the synthesis of protoporphyrin by 38 and 61%, respectively, whereas concentrations of  $10^{-7}M$  and  $10^{-11}M$  increased the synthesis by 31 and 80%, respectively. The conclusion was drawn that, since the Pb concentration in the bone marrow of Pb-poisoned rabbits is always below that capable of causing inhibition, the increased porphyrin metabolism in Pb poisoning must be caused by a stimulating action of Pb on the bone marrow.

(The same paper was presented at a meeting of

the Society for Forensic Medicine, Indemnity and Industrial Medicine, Feb. 26, 1965, an abstract of which was published in *Medicina del Lavoro* 56:315-6 (Apr.), 1965.)

- 469 Pickering, Q.H., and Henderson, C. (Robert A. Taft Sanit. Eng. Center, Cincinnati, O.): THE ACUTE TOXICITY OF SOME HEAVY METALS TO DIFFERENT SPECIES OF WARM WATER FISHES. Proceedings of the 19th Industrial Waste Conference, Purdue University, Lafayette, Indiana, May 5-7, 1964, pp 578-91.

A comparative study was undertaken to determine the acute toxicity of the salts of Cu, Zn, Ni, trivalent and hexavalent Cr, and Pb to 4 species of warmwater fishes and the dependence of this toxicity on certain other water quality characteristics. The species used were fathead minnows, bluegills, goldfish and guppies. Ten individuals of a species were used for each of the concentrations tested and in the control. The test solutions were prepared in a logarithmic series of numbers such as 10, 5.6, 3.2, 1.8 and 1.0 mg of the metal salt/l of water, and from the mortalities at different concentrations the 24-, 48-, and 96-hr median tolerance limits ( $TL_m$ ) were computed. With all 4 species in soft water, Cu was the most, and  $Cr^{VI}$  the least toxic while with the other metals, relative toxicity varied with the test species. With Pb (as chloride and acetate), the mechanism of toxicity appeared to be different at high concentrations and short exposures than at low concentrations and long exposures. The 96-hr  $TL_m$  values in soft water for the fathead minnow (7.33 and 31.5 mg/l) and goldfish were significantly lower than the 24-hr values (11.5 and 45.4 mg), and the 96-hr  $TL_m$  in soft water was significantly lower for the fathead minnow than for the other species.

- 470 Ponert, J. (Czech. Bot. Soc., Csav, Prague, Czechoslovakia): Einfluss von Blei, Silber, Kupfer und Kalium auf den Gehalt an Cardenoliden in Blättern. (INFLUENCE OF LEAD, SILVER, COPPER, AND POTASSIUM ON THE CARDENOLIDE-CONTENT OF LEAVES.) *Naturwissenschaften* 51, No. 13: 320-1, 1964.

The content of cardenolides in leaves of *Conval-laria majalis* L., after addition of equimolar solutions of the nitrates of K, Cu, Ag and Pb, respectively, was found as follows,  $10^{-7}M/g$  of fresh leaves: 25; 13; 39; 6; controls 16. Thus, Ag and K caused an increase of cardenolides, Pb and Cu a decrease.

- 471 Rezaeva, L.T. (V.I. Vernadskii Inst. Geochem. Anal. Chem., Moscow, USSR): (VANADIUM VALENCE STATE IN BLOOD CELLS OF *AS-CIDIELLA ASPERSA*.) *Zh. Obshch. Biol.* 25, No. 5:347-56, 1964.

Spectral analysis revealed the following average content of elements (in  $\mu g/ml$ ) in blood cells of *A. aspersa*: Mg 20, Ca 20, Zn 30, Cu 3, Mo 0.6, Mn 0.8, Ni 4, Fe 140, Sr 12, Ba 6, Be 0.06, Cr 1.2, Bi 0.2, Pb 3, Sn 0.8, Ag 0.4, Zr 0.3, Al 160, and Ti 12; there was 0.31-1.66 mg V/ml. Analytical color reactions, spectrophotometric, and po-

tentiometric methods indicated a dynamic equilibrium of V(III) and V(IV) in the blood cells, connected with physiologic redox phenomena. (20 references) (From Chemical Abstracts 62:3129, 1965)

- 472 Studzinski, G.P., and Love, R. (Jefferson Med. Coll., Philadelphia, Pa.): NUCLEOLAR ORGANELLES SHOWN BY LEAD PRECIPITATION IN UNFIXED CULTURED CELLS. Stain Technology 39:397-401 (Nov.), 1964.

A simple method is described for the demonstration of nucleolar structure of HeLa cells, cultured on circular coverslips, then placed in 4 mM Pb acetate (or any other soluble Pb salt such as Pb nitrate) dissolved in Na acetate-Na barbiturate buffer at pH 5.5 for 30 min at 37°C. The phenomena described suggest that the retention of Pb in localized areas of the nucleolus is due to enzymatic reactions which produce inorganic phosphates from endogenous substrates.

- 473 Waldron, H.A. (Vauxhall Motors Ltd., Luton, Gt. Britain): THE EFFECT OF LEAD ON THE FRAGILITY OF THE RED CELL INCUBATED IN VITRO. Journal of Clinical Pathology 17:405-6 (July), 1964.

In a recent study, de Kretser and Waldron (1963) were unable to confirm the hypothesis of Aub et al (1926) that alteration of the red cell membrane by Pb was the cause of anemia in Pb poisoning.

In further exploration of this question, blood was collected from male volunteers who had had no occupational exposure to Pb. Volumes of a standard Pb acetate solution were added to give Pb concentrations of 10 and 20 µg/ml blood, and the mixtures were incubated for 24 hr at 37°. As a control, whole blood was incubated without Pb. Osmotic fragility tests were done by the method of Dacie (1956), using buffered saline solution, and the mechanical fragility index was determined as described by de Kretser and Waldron. The results showed that incubating whole blood without Pb caused the cells to become more fragile while the addition of Pb caused a marked resistance to hypotonic saline solutions which was especially noticeable in the samples incubated with 20 µg Pb/ml blood. Incubation per se resulted in an appreciable increase of the mechanical fragility index of the red cells; incubation with Pb raised the index only slightly above that of the controls.

The author concludes that although Pb caused a slightly greater increase in the mechanical fragility index of the red cells than that observed in controls, the difference was not great, and is in accord with his (and de Kretser's) finding that this index was about the same in Pb-exposed and control workers. Therefore, an increase in the mechanical fragility index is not a major factor in the production of Pb anemia.

## B. WARM-BLOODED ANIMALS

1950

- 474 Allcroft, R. (Vet. Lab., Weybridge, Surrey, England): LEAD AS A NUTRITIONAL HAZARD TO FARM LIVESTOCK. IV. DISTRIBUTION OF LEAD IN THE TISSUES OF BOVINES AFTER INGESTION OF VARIOUS LEAD COMPOUNDS. *Journal of Comparative Pathology and Therapeutics* 60, No. 3:190-208, 1950.

Blood, tissue, and fecal concentrations of Pb were determined after single lethal doses of various Pb compounds orally and after ingestion of small quantities over long periods. The experiments were carried out on young calves (a few days-10 mo old) using large numbers of animals and feeding trial methods. In order to obtain an indication of Pb in the liver and kidney of "normal" animals, these tissues were taken from 31 cattle and sheep (60 mo-7 yr) slaughtered for other purposes, with results showing no value  $>1.5$  mg/kg fresh tissue (similar to that in man). Analyses of Pb in whole blood of 30 young calves gave a mean of  $0.129 \pm 0.010$  mg/l (lower than that in man).

In the experimental animals, tissue concentrations of Pb after ingestion of various Pb compounds showed that the highest concentrations were found in kidney cortex and liver tissue (50.5-297.0, 9.3-126.0 mg/kg, respectively) while the spleen, lung, heart, and brain contained detectable but much smaller amounts ( $<1.0$ -5.7, 2.0-3.6,  $<1.0$ -1.3,  $<1.0$ -1.5 mg/kg, respectively). Comparison of blood and fecal levels made over a period of several weeks after ingestion of sublethal amounts of Pb as galena (0.5 g/kg body weight, total Pb 46.6 g) and acetate (0.2 g/kg body weight, total Pb 6 g) showed that even when fecal Pb values had returned to normal, blood values still remained abnormally high. In the experiment attempting the chronic poisoning of cattle, conditions that might occur on farms were simulated as far as possible (ie, contamination of water supplies, flaking of paint from food receptacles and stalls, rations contaminated by soils, etc). The results showed that relatively large quantities of Pb (1-2 g daily) ingested over a period of 2 yr had no ill effect.

- 475 Allcroft, R., and Blaxter, K.L. (Vet. Lab., Weybridge, Surrey, England): LEAD AS A NUTRITIONAL HAZARD TO FARM LIVESTOCK. V. THE TOXICITY OF LEAD TO CATTLE AND SHEEP AND AN EVALUATION OF THE LEAD HAZARD UNDER FARM CONDITIONS. *Journal of Comparative Pathology and Therapeutics* 60, No. 3:209-18, 1950.

Data are presented in 2 parts: (1) relating to acute poisoning and (2) relating to chronic poisoning. Summarization of data obtained on toxicity of Pb in various forms when given in single doses in-

dicated that ingestion of 0.2-0.4 g/kg body weight caused death in a few days. The fatal dose for older cattle and mature sheep was larger (0.6-0.8 g/kg body weight). In enumerating field cases of acute poisoning in cattle, it was suggested that large numbers of calves die annually throughout Great Britain as a result of the ingestion of toxic quantities of Pb, Pb paint and painters' material being the most frequent cause. In chronic poisoning experiments, on continued daily ingestion of Pb, a dose of 8 mg/kg body weight could be tolerated for many months and 6 mg/kg body weight could be tolerated for 3 yr, and it is concluded that cumulative poisoning rarely occurs in ruminants. On the basis of a single experiment it was suggested that much smaller amounts of Pb (1 mg/kg/day) were sufficient to cause abortion in the ewe if ingested during pregnancy by animals in poor condition.

Levels of Pb in pastures were discussed, and it was shown that the ingestion of herbage contaminated with Pb soil dust in certain areas could result in the ingestion of  $>130$  mg Pb/kg dry matter consumed. The average annual ingestion of Pb by sheep in the area of Derbyshire was high, the amount being much greater in winter than in summer. However, the Pb content of the blood of sheep in this area suggested that there was no real danger of any form of Pb poisoning. Diagnosis of acute Pb poisoning was also discussed briefly, emphasizing that a verdict on analytical data alone without additional evidence is often difficult.

- 476 Blaxter, K.L. (Veterinary Lab., Weybridge, Surrey, England): LEAD AS A NUTRITIONAL HAZARD TO FARM LIVESTOCK. III. FACTORS INFLUENCING THE DISTRIBUTION OF LEAD IN THE TISSUES. *Journal of Comparative Pathology and Therapeutics* 60, No. 3:177-89, 1950.

The internal transport and deposition of Pb absorbed in the bodies of sheep and rabbits were studied. Following the iv injection of 400 mg Pb acetate into sheep, the whole blood concentration of Pb dropped slowly (ie, 72.8-1.0 mg Pb/l blood for 0.08-282 hr after injection). Initially the Pb content of the serum fell more quickly than that of the erythrocytes. In sheep given Pb orally, 85-90% of the Pb in the blood was in cells. In rabbits the serum Pb was largely bound to protein. Pb given iv in increasing quantities (5-60 mg) to rabbits was distributed among the reticulo-endothelial cells, the most striking feature being the enormous increase in Pb content of spleen and bone marrow, compared with slower increase in the Pb content of kidney and compact bone. When given orally (1-4 g) most of the Pb was found in the skeleton with large concentrations in the kidney. After iv administration of Pb, 5-10% was present

in the tissues on the 59th day. Results were discussed in relation to the factors causing the differential distribution of Pb and its implication. (13 references)

- 477 Blaxter, K.L. (Veterinary Lab., Weybridge, Surrey, England): LEAD AS A NUTRITIONAL HAZARD TO FARM LIVESTOCK. II. THE ABSORPTION AND EXCRETION OF LEAD BY SHEEP AND RABBITS. *Journal of Comparative Pathology and Therapeutics* 60:140-59 (Apr.), 1950.

Experiments were carried out with 10 sheep from which feces samples were collected quantitatively for at least 4 days while the sheep were being fed a constant ration with a daily intake of Pb ranging from 1.9-115.5 mg. Analyses of excreta and food were made daily during this period. It was clear that within the range of 2-110 mg there was little change in the percentage of Pb which was apparently absorbed. Regardless of food source or amount of Pb given within this range, the mean excretion was 98.7%, absorption being 1.3% of Pb ingested with a S.E. of  $\pm 0.8\%$ . The fecal Pb was largely excreted as phosphate or sulfide.

In 5 experiments with sheep, blood analyses were carried out following the absorption of Pb from the digestive tract, with samples taken at intervals before and after dosage. In cases of massive doses of Pb, the maximum blood level was reached at the 4th-6th hr following dosage. Pb left the blood stream at a very slow rate thus indicating that absorption rate was low. Data for 1 sheep receiving 30 mg Pb acetate showed the following mg Pb/l blood for number of hours after dosage respectively: 0.08, 0; 0.78, 2; 1.46, 4; 1.37, 6; 0.94, 12; 0.63, 24; 0.40, 72. Two sheep receiving 400 mg Pb intravenously and 40 g Pb acetate orally died at comparable times. The greatest concentration of Pb was found in the kidneys and livers of both sheep. The calculated percentage of Pb absorbed by the tissues of the sheep which died as a result of the oral poisoning ranged from 0.5-2.2%.

In urine samples collected quantitatively, excretion of Pb depended on Pb intake, but even when large quantities were given, excretion did not exceed 0.8 mg/l daily. On low intakes (2 mg) urinary Pb excretion (0.07-0.08 mg/l) was of the same order of magnitude as the excretion reported in normal human beings. Pb was excreted in the milk of a ewe given 5 g Pb acetate in its diet 7 days before lambing in relatively large quantities (0.28, 0.18, 0.15 mg Pb/kg on 2nd, 4th, and 6th day of lactation respectively). A ewe given 100 mg Pb acetate commencing the 6th day of lactation showed the following results: 7th day of lactation, 0.38 mg Pb/kg; 14th, 0.55.

When large quantities of Pb were given to 2 sheep and 6 rabbits, the bile was the major channel of Pb excretion, the colon and wall of the intestine being of very little importance in excreting Pb which had gained access to the body. Data given to confirm the quantitative importance of the liver in the excretion of Pb showed that of the Pb injected, 1.27% was excreted in the urine of the sheep, 5.31% in the bile, and only 0.17% in the bile-free feces. Of the total Pb excreted (11.15 mg), 17.1% was in the urine, 80.7% in the bile, and 2.2% in the bile-free feces. Even 3 days after the injection of Pb, the concentration

in the bile was always greater than the concentration of Pb in the serum (1.16 and 0.11 mg/l respectively). It was suggested that Pb is actively excreted by the liver and that the excretion of large quantities involves the breakdown of the liver cells.

When <3 mg Pb were ingested daily by sheep, there was no retention of Pb. Above this quantity Pb was retained in increasing quantities by the tissues. These results differ markedly from those on mice, rats, and humans. The avidity of the tissues in retaining Pb was shown by the fact that when Pb was injected into the systemic circulation, only 4-10% of the amount injected was recovered over a period of 6 days following the injection. (33 references)

- 478 Chiodi, H., and Sammartino, R. (Inst. Exptl. Biol. Med.; Inst. Pathol., Buenos Aires, Argentina): RENOTROPHIC ACTION OF LEAD IN THE RAT. *Acta Physiologica Latino-americana* 1:32-45, 1950.

Chronic oral administration of 2 ml of a 0.5-12% solution of Pb acetate daily by stomach tube to rats for 10 days-11 mo produced renal hypertrophy at the expense of tubular cells. Percentage increases in kidney weight was 34-81 according to size of dose and number of days administered. This action of Pb was believed to be specific, the hypertrophy not being secondary to the destructive lesions caused by Pb. A protein-rich diet augmented the renotrophic action of Pb. Such a diet + Pb acetate showed a 91% increase in kidney weight after 4 mo. BAL, and to a lesser extent testosterone propionate, inhibited the renotrophic and renotoxic actions of Pb.

- 479 Di Porto, A. (Univ. Rome, Italy): Il metabolismo dei metili nella intossicazione sperimentale da piombo. (METHYL METABOLISM IN EXPERIMENTAL POISONING FROM LEAD.) *Policlinico (Rome), Sezione Medica* 57:359-68, 1950.

Six rabbits (1400-1600 g), after having been kept on a standard diet for 5 days, received iv injections of 5 mg Pb acetate in 2 ml distilled water daily for 12 consecutive days and, on the last day, received 4-5 times higher doses. Trimethylamine in urine was determined just prior to the injection, and every 3rd day thereafter (Monasterio's method, 1935). Two of the last 3 animals died shortly after injection. Histology was performed on liver, bone marrow and kidney.

The body weight decreased by the 12th day to 840-1050 g; basophilia ranged from 2-7/1000, and urinary trimethylamine increased from a normal of 1.80-2.89 to 4.03-7.56 mg/24 hr. The increase paralleled the degree of weight decrease, increase in basophilia, and that of organ damage.

- 480 Gray, L.F., and Ellis, G.H. (Agric. Res. Admin., Ithaca, N.Y.): SOME INTERRELATIONSHIPS OF COPPER, MOLYBDENUM, ZINC AND LEAD IN THE NUTRITION OF THE RAT. *Journal of Nutrition* 40:441-52 (Mar.), 1950.

A toxic state was produced in rats by additions of Mo to 2 different basal diets (mineralized whole milk powder (supplemented with Cu, Fe, and Mn) and rat chow). Using the milk powder diet,

the mineral levels selected for the interrelationship study were 0.01% Cu, 0.08% Mo, 0.05% Zn, and 0.005% Pb. Eighty weanling rats (3 males and 2 females (48-55 g weight) on each of 16 treatments) were used. Good growth was obtained for the rats on all diets containing no added Mo. Mo retarded growth; Zn produced anemia, and together with Pb caused lowest mean hemoglobin (Hb) of any treatment; Zn alone did not retard growth; but Mo + Zn resulted in poorer growth. From Hb results no certain conclusions could be drawn. Pb alone had no effect on growth or Hb. None of the minerals affected leukocyte count. (20 references)

- 481 Pecora, L. (Univ. Naples, Italy): Contributo allo studio del mielogramma nell'intossicazione sperimentale da piombo. (Ricerche eseguite con il metodo della mielobiopsia ripetuta). (THE MYELOGRAM IN EXPERIMENTAL LEAD POISONING. (RESEARCH PERFORMED BY THE METHOD OF REPEATED BONE-MARROW BIOPSY).) *Folia Medica* (Naples) 33:365-82, 1950.

On alternate days 5-6-mo-old male rabbits received 2 ml of 20% Pb acetate solution. Every 10 days bone-marrow punctures were made. The animals died ~30-50 days after the beginning of the experiments. Ten tables give the results of the bone marrow and blood tests. No characteristic variations were noted, although slight changes occurred after ~2 wk. (13 references)

- 482 Robert, P., and Zürcher, H. (Dermatol. Clin., Univ. Bern, Switzerland): Pigmentstudien. 1. Mitteilung. Über den Einfluss von Schwermetallverbindungen, Häm, Vitaminen, Aminosäuren, mikrobiellen Toxinen, Hormonen und weiteren Stoffen auf die Dopamelaninbildung in vitro und die Pigmentbildung in vivo. (PIGMENTATION STUDIES. I. THE ACTION OF HEAVY-METAL COMPOUNDS, HEMIN, VITAMINS, AMINO ACIDS, MICROBIAL TOXINS, HORMONES, AND OTHER SUBSTANCES ON DOPA-MELANIN FORMATION IN VITRO AND ON PIGMENT FORMATION IN VIVO.) *Dermatologica* 100, No. 4/6:217-41, 1950.

In all experiments a freshly prepared 0.5% dopa solution in carbonate buffer was used. Each series consisted of 4 individual tests, A, B, C, and D. A contained no addition; B, C, and D contained 0.001, 0.01, and 0.1 ml of the test substances, each with 3 ml dopa solution (= 15 mg dioxypheylanine). Of the metals tested in vitro, Ag, Co, Mn, Au, Fe and Cu considerably increased the formation of dopamelanin, while Cr, Pb, As, Zn, Th, and Ni were without influence. Pb was not tested in the in vivo experiments with rabbits; intracutaneous injections of solutions of Fe, Cu, Co, Ni, and As produced a local pigmentation and accelerated growth of hair, believed to be due to a raising of the local oxidation process.

- 483 Schmid, R., Schwartz, S., and Watson, C.J. (Univ. Minnesota Hosp., Minneapolis): PORPHYRINS IN THE BONE MARROW AND CIRCULATING ERYTHROCYTES IN EXPERIMENTAL ANEMIAS. Proceedings of the Society of Experimental Biology and Medicine 75:705-8, 1950.

As summarized by the authors, the coproporphyrin

(CP) and protoporphyrin (PP) of bone marrow and circulating erythrocytes in the rabbit exhibit dynamic changes under a variety of stimuli to erythropoiesis, including Pb poisoning, phenylhydrazine, hemorrhage, and reduced O<sub>2</sub> tension. The changes are a striking increase of CP in the developing erythrocytes of the bone marrow with a marked relative reduction of CP concentration in circulating red cells, and an inconstant but generally increased level of PP in the circulating as compared with the marrow erythrocytes. These observations point to a close relation between CP and hemoglobin (Hb) synthesis, and appear to be consistent with concepts which consider CP either as a direct precursor of Hb PP or as a by-product of the synthesis. The precursor concept seems to permit a more reasonable correlation of the porphyrin findings in bone marrow and blood with those in urine and feces.

- 484 Sümegi, I.: HAEMOCHROMATOSIS. THE PATHOGENESIS OF PORPHYRINURIA IN LEAD POISONING AND HAEMOCHROMATOSIS. *Orv. Hetil.* 91: 165, 1950.

The author carried out experiments to confirm his opinion that both in hemochromatosis and Pb poisoning, Fe and Pb respectively cause generalized damage to the reticuloendothelial system, the extent and principal site of the damage being reliably indicated by the presence and type of coproporphyrin in the urine. When white rats are given Pb acetate daily in a 1% solution intragastrically, in a dose of 1 ml/100 g body wt, porphyrinuria is found at the end of the 1st wk, although fluorescence in the bone marrow is detectable microscopically only; cultures of the marrow from these animals show much fluorescence within 48 hr. The author believes that when this porphyrin is formed in the marrow Fe is no longer taken up in the formation of hemoglobin and that the substance which is formed without Fe is coproporphyrin III; the anemia in Pb poisoning is partly due to this failure to take up Fe and partly due to the metallic damage to the reticuloendothelial cells which prevents them from releasing Fe normally for blood formation. When the reticuloendothelial cells of white rats are thoroughly blocked by Indian ink before administration of the Pb above, it is found that the animals show no evidence of porphyrin formation at the end of 1 wk and only 1/3 of them have a minimal production after 2 wk; anemia develops in these animals well before its appearance in the animals given Pb only. The author believes that in hemochromatosis the deposition of Fe in the liver damages the parenchymatous cells and Pb's to the appearance in the urine of coproporphyrin I; because of the liver's power of regeneration this appearance is inconstant in the early stages of the disease, which explains the variable findings of other authors. When the deposition of Fe is such as to affect seriously hemoglobin formation in the marrow, then coproporphyrin III is formed. The appearance of type I and III in hemochromatosis and heavy metal poisoning depends on whether the damage is predominately of the liver or the marrow. (From *British Journal of Industrial Medicine* 7:206, 1950)

- 485 Tomson, N.M.: TRACE ELEMENTS AS A MEDICO-

# 1951

- 486 Allcroft, R. (Ministry Agric., Weybridge, Surrey, England): LEAD POISONING IN CATTLE AND SHEEP. Veterinary Record 63:583-90 (Sept. 15), 1951.

A brief review on the absorption, excretion, retention, and general metabolic effect of Pb in farm animals is presented. The concentration of Pb found in various tissues depends considerably on the portal of entry as well as on the quantity and nature of Pb compound and length of exposure. In farm animals Pb enters the body most commonly through the mouth.

Because water-soluble Pb compounds react with alimentary contents to form insoluble Pb complexes, intestinal absorption of insoluble Pb carbonate is of the same order of magnitude as is absorption of water-soluble Pb acetate. In reviewing findings of the author's group, normal Pb contents in liver and kidneys of 31 cattle were 0.3-1.5 ppm (wet tissues); those in whole blood of 30 calves were 0.05-0.25 ppm (mean, 0.13 ppm); similar means were found in the whole blood of goats, sheep, horses, and cows. Fecal Pb values obtained from 14 normal calves were 1.5-30 ppm dry basis (mean, 12 ppm). The range for 12 normal cows was 6-35 ppm (mean, 13 ppm). Blood and tissue levels were given following ingestion of lethal and sublethal doses of Pb in different forms. Highest concentrations were found in the kidney cortex (50.5-297.0 ppm); the liver also contained high amounts (9.3-126.0 ppm). After ingestion of Pb compounds there was a considerable and rapid rise in the amount of Pb in the blood. In the case of sublethal doses of Pb acetate there was a fairly rapid fall to lower levels but the values did not return to normal for weeks.

Useful information could be obtained from the study of blood and fecal levels in surviving animals in which Pb poisoning is suspected. Illustrative data showed that after administration of sublethal doses of galena and Pb acetate, even when fecal Pb levels had returned to normal, blood values still remained abnormally high (ie, galena results: 0.10-1.0 mg Pb/l blood, 3-1220 mg Pb/kg dry fecal matter; Pb acetate: 0.08-1.22 mg Pb/l blood, 15-103,800 mg/kg dry fecal matter). If both blood and fecal values are elevated it can be assumed that ingestion of Pb was recent. If blood level is high and fecal level normal, then ingestion probably occurred a considerable time before.

In accumulative Pb-poisoning experiments, 1 steer died after 35 mo of Pb acetate feeding during which time ~1600 g of Pb was ingested. In another experiment 400 g of Pb shot was given to a calf over a period of 4 mo without ill effect; 84% of the shot was recovered from the digestive tract, chiefly the reticulum, 5 mo after the last dose. The lethal dose of Pb in cattle and sheep is ~0.2-0.4 g/kg body weight ingested on any 1 day for calves up to 4 mo of age, while in older cattle and sheep relatively larger doses are required. Values >40 ppm in the kidney cortex and >10 ppm in the liver are of definite diagnostic significance.

- 487 Coburn, D.R., Metzler, D.W., and Treichler, R.: A STUDY OF ABSORPTION AND RETENTION OF LEAD IN WILD WATERFOWL IN RELATION TO CLINICAL EVIDENCE OF LEAD POISONING. J. Wildl. Mng. 15:186-92, 1951.

Clinical symptoms diagnostic of Pb poisoning in ducks in relation to 2 levels of dosing are herein established.

The critical daily dosage level was found to be between 6-8 mg/kg. The average survival time for birds dosed at a level of 12 mg/kg was 3.5 days less than for birds receiving Pb at the 8 mg/kg level, but there was no significant difference in the deposition of Pb in the tissues of the 2 groups.

Pb metabolism studies for 3 consecutive periods showed comparable rates of retention for the 2 dosage levels, with no significant difference in Pb retention. The rate of deposition of Pb in the tissues, as indicated by metabolism tests, was found to be such that related clinical symptoms could be predicted.

Any 1 of 3 units, skeleton, liver, or soft tissues might be satisfactory as field samples for the determination of Pb poisoning by chemical analysis. (From Veterinary Bulletin 22:540, 1952)

- 488 Deán Guelbenzu, M., López de Azcona, J.Ma., and Santos Ruiz, A. (Inst. españ fisiol. y bioquim., Madrid, Spain): (TRACE ELEMENTS IN THE WHITE RAT.) Rev. españ. fisiol. 7: 63-79, 1951.

The food, feces, urine, bones, skin, muscle, brain, eyes, blood, heart, lungs, stomach (with contents), intestines (with contents), liver, spleen, kidneys, and testicles of lactating and other adult rats were studied spectrochemically. Pb was found very often in all organs but was distributed very irregularly in the muscle. Some bone samples lacked Pb. Most of the oligoelements were found in greater quantity in the feces than in the urine. (From Chemical Abstracts 46:2648, 1952)

- 489 Desoille, H., Derobert, L., LeBreton, R., and Martin, R. (Dept. Ind. Hyg., Natl. Inst. Hyg., Paris, France): Du danger de saturnisme au cours de l'utilisation des huiles de coupe plombifères. (DANGERS OF LEAD POISONING IN THE USE OF CUTTING OILS CONTAINING LEAD.) Proceedings of the Society of Industrial Medicine and Hygiene. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 12:416-23, 1951.

Guinea pigs were exposed to a mineral oil containing 0.8 g Pb/100 ml and the effects produced by inhalation, skin absorption and ingestion were periodically followed by determining basophilic stippling, Pb content in liver, and pathologic changes in lung, liver and kidney. Five guinea pigs, exposed to an aerosol containing 0.08 mg Pb/m<sup>3</sup> for 11 wk, showed significant basophilic stippling after 6 wk and liver Pb contents of 26-32 mg/100 g. In 2 separate experiments, the oil was applied to the back and neck of 5 animals. Examination showed evidence of basophilic stippling and liver Pb content of 8-10 mg/100 g. In feeding experiments, 3 out of 4 animals fed 1 ml oil/day died after 5-7 days and 4 out of 5 fed 0.25 ml/day



died after 1 mo. In both cases, the basophilic stippling was marked and the liver Pb content was 4-8 mg/100 g. The renal parenchyma showed hemorrhages in the intertubular and intraglomerular spaces, epithelial nephritic lesions on the convoluted tubules, erythrocytes inside the glomerulus, cellular edema of the vascular element, significant lesions of the epithelial element, marked lesions in the cortical regions and along the labyrinth. The hepatic parenchyma showed periportal hemorrhages with infiltration of intertrabecular erythrocytes. The pulmonary parenchyma showed thickening of the walls, as well as intraparietal edema, and lymphocyte proliferation causing typical lesions, mainly in the perivascular region. Emphysemic lesions, diffuse intraparietal hemorrhages, and fatty deposits around the bronchial openings and the alveolar parenchyma were also found.

The authors conclude that the introduction of Pb in any form into cutting oils be forbidden.

- 490 Fisher, H.J. (Connecticut Agr. Exptl. Sta., New Haven): COMMON TOXICOLOGIC FINDINGS IN CONNECTICUT. Journal of the American Veterinary Medical Association 118:309-11, 1951.

For many years, the Connecticut Agricultural Experiment Station has been examining animal viscera, feeds, foods, and miscellaneous materials suspected of containing poison. The highlights of the station's tests prior to 1936 are listed and include the findings in 1923 of a sample containing Pb arsenate poisoning and 159 pointing to Pb poisoning were analyzed of a total of 1387 examinations. There were 3 times as many cases of poisoning from Pb as from any other poison.

- 491 Gorsheleva, L.S.: Vliyanie tetraetils-vintsovoi intoksikatsii na vysshuyu nervnuyu deyatel'nost' zhivotnykh (belykh krysov). (EFFECT OF TETRAETHYL LEAD POISONING ON THE HIGHER NERVOUS ACTIVITY OF ANIMALS (WHITE RATS).) Zhurnal Vysshego Nervnogo Deyatel'nosti imeni I.P. Pavlova 1:727-38, 1951.

Subcutaneous injection of 0.04 g/kg of TEL into rats led to a 3-phase serious alteration of activity of the higher nervous system. In the 1st phase the cortical activity and stimulability were increased with decrease of latent period of conditioned reflexes. In the 2nd phase the blocking process mounted and its course spread to subcortical layers leading to chaotic motor functions. The last, 3rd, phase was that of restoration of functions, with normalization first of unconditioned, then the conditioned reflexes. Generally animals with weak level of nervous activity suffered more severe signs of such intoxication than did animals with a high level of nervous activity, or animals with nervous stability.

- 492 Graziani, G. (Univ. Naples, Italy): Azione del B.A.L. sulla crisi ematica e sul mielogramma nella intossicazione sperimentale da piombo. (ACTION OF DIMERCAPROL ON THE BLOOD PICTURE AND MYELOGRAM IN EXPERIMENTAL LEAD INTOXICATION.) Haematologica 35:159-75, 1951.

Rabbits received orally on alternate days 200 mg Pb acetate. One group received 10 mg BAL/kg body weight/day; every 5-6 days the red and white cells were counted, hemoglobin, leukocytic formula and globular resistance were determined. One group treated with BAL was sacrificed at the time the last control animal died, and the myelogram was examined; another group was observed beyond the death of the controls.

The results are shown in tables for each animal. The bone marrow after the BAL administration had conserved its erythroblastic activity, which appeared deeply affected in the controls. In the animals in which the poisoning was continued after the death of the controls a Pb anemia appeared finally, but the doses of poison required to produce it were much greater.

- 493 MacDonald, N.S., Ezmirlian, F., Spain, P., and McArthur, C. (School of Med. Univ. California, Los Angeles): THE ULTIMATE SITE OF SKELETAL DEPOSITION OF STRONTIUM AND LEAD. Journal of Biological Chemistry 189:387-99, 1951.

X-ray diffraction studies of the bone ash of rats receiving repeated injections of Sr chloride and of Pb acetate indicate that both of these cations ultimately enter into the internal structure of the inorganic salt crystallites. Powder patterns made with the Debye camera showed no evidence of a 2nd solid phase, even in bone samples containing as much as 8% Sr and 5% Pb. Determinations of the unit cell dimensions of such bones laden with Sr or Pb were made with a precision of  $\pm 0.01\%$  by the use of a symmetrical focussing back reflection camera. Cohen's method was used for extrapolation of the data to a Bragg angle of  $90^\circ$ . These determinations clearly demonstrated distortions of the unit cell as a result of the presence of foreign ions. It was impossible to ascertain by density determinations whether the foreign cations were present in the lattice interstices or had taken up lattice point positions by displacing the normal ionic occupants of those positions. Large ectopic calcifications were noted on the peritoneal surfaces of the rats receiving intraperitoneal injections of Pb acetate. The ash of this material showed the same crystalline structure as bone salt except that the lattice was distorted by the presence of Pb.

Although the evidence sheds little light on the initial phases by which Sr and Pb ions are accumulated in bone, it is concluded that some, and perhaps most, of the cations ultimately become part of the crystalline structure of the bone salt. The length of time during which such material remains fixed depends upon the rate of bone resorption and reformation.

- 494 Nordmann, M. (Pathol. Inst., Hannover, Germany): Zur Pathologie der Bleivergiftung. (PATHOLOGY OF LEAD POISONING.) Ärztlicher Dienst DB 12:116-8, 1951.

In this discussion, it is pointed out first that severe Pb poisoning is seldom seen nowadays by the pathologist. Most frequently the decision must be made as to whether any causal connection exists between serious organic changes and Pb poisoning. Primarily, the blood vessels that react through

specific contractions, are affected (high blood pressure, as well as Pb-produced epilepsy, muscular atrophy). In animal experiments, liver damage could be observed only in rats fed an unbalanced fatty diet which of itself made the animals sick. The development of hypertonia as a result of vascular spasm is easily explained, arteriosclerosis, however, more difficult; Pb contracted kidney is difficult to differentiate from the arteriosclerotic. Gastric ulcers can be explained by a complex of causes and it is possible that as an extreme factor Pb also can play a role. On the part of the nervous system, degenerative processes principally were observed but also reactive changes (granuloma). According to Speransky almost every type of poisoning acts on the nervous system. The author warns against a simplification which could be taken to be decisive by the expert witness. Only medical experience can be decisive. The question of Pb arteriosclerosis is considered along with the organic cirrhosis. Since there are a number of causes for the development of liver cirrhosis, angina pectoris, and ulcers, extreme caution is recommended. Still more questionable is the connection between liver cancer and gastric cancer.

- 495 Pimenta de Mello, R. (Univ. Minnesota Hosp., Minneapolis): EFFECT OF LIGHT ON URINARY COPROPORPHYRIN EXCRETION IN LEAD-POISONED RABBITS. Proceedings of the Society of Experimental Biology and Medicine 76:823-5, 1951.

Light exposure increased the urinary coproporphyrin excretion in rabbits with Pb poisoning produced by 100 mg/kg of Pb acetate ip or sc. The increase was especially marked after ultraviolet radiation. Subsequent radiation, however, failed to cause a renewed rise or was followed by only a small increase. Whether the increase following light is due to mobilization of preformed porphyrin, or to increased porphyrin formation, was not determined. (From author's summary)

- 496 Plum, C.M. (Univ. Inst. Pathol. Anat., Copenhagen, Denmark): LIVER AND SPLEEN IN HAEMATOPOIESIS. II. INVESTIGATIONS INTO THE INFLUENCE OF A NUMBER OF METALS ON THE PERIPHERAL BLOOD PICTURE, WITH SPECIAL REFERENCE TO ERYTHROCYTE DIAMETER AND THE INJURIES TO THE LIVER. Archives Internationales de Pharmacodynamie et de Therapie 86, No. 1:52-79, 1951.

Soluble salts of Al, Cr, Cu, Zn, Pb and Cd were injected or given orally in toxic doses to rabbits. When pronounced liver cirrhosis occurred there was an associated macrocytic anemia (with increase in the diameter of the red cells) suggesting that the liver has a function in regulating the size of the erythrocyte.

In the experiments with Pb, the oxide (PbO) was administered to rabbits (av 2500 g) in suspensions by mouth in doses of 0.25 g or iv at 10 ml of 2:1000 solution in saline daily. The animals became highly anemic, with marked anisocytosis, poikilocytosis and a few erythroblasts in the peripheral blood, and marked basophilic stippling. After 8-14 days the serum bilirubin was elevated in all animals. Post mortem examination showed extensive

changes in liver, kidneys, spleen, and bone marrow. Among the blood findings, the diameter of erythrocytes increased from 6.53-6.78 on day 0 to 7.00-7.59 on day 21. In experiments with Pb acetate given iv at 2 ml daily (5.55 g dissolved in 100 ml saline), similar results were obtained, but the liver injury appeared to be more severe and the rise of bilirubin greater. Erythrocyte diameter increased from 6.60-6.72 on day 0 to 7.02-7.73 on day 21. Poisoning by a suspension of Pb<sub>3</sub>O<sub>4</sub> (because of difficult solubility) in a dose of 0.25 g, produced changes similar to PbO, but the effect was somewhat weaker and a longer period passed before changes in the blood appeared. The cause of the variations in the effect are attributed to differences in solubility of the salts.

In discussing the histologic picture of the liver, the author states it to be different from the one seen in obstructive jaundice. There is distinct fatty degeneration and often distinct leukocyte infiltration, or incipient cirrhosis of the liver. (38 references)

- 497 Schubert, J., and White, M.R.: EFFECT OF SODIUM AND ZIRCONIUM CITRATES ON BLOOD LEVEL, DISTRIBUTION, AND EXCRETION OF INJECTED RADIOLEAD. AECU-1227, UAC-356, Feb. 1951.

See Abstract No. 523.

- 498 Schwartz, S., Keprios, M., and Schmid, R. (Minneapolis, Minn.): EXPERIMENTAL "PORPHYRIA" IN RABBITS. Proceedings of the Central Society for Clinical Research. Journal of Laboratory and Clinical Medicine 38:949, 1951.

Studies undertaken to develop extreme coproporphyrinuria in rabbits have led to the induction of a condition which is chemically similar to porphyria in human beings. Over 1,500 µg of both coproporphyrin (CP) and uroporphyrin (UP) have been recovered from 24-hr-samples of urine. As in acute intermittent porphyria, the urinary porphobilinogen reaction is positive. On the other hand, the excretion of the porphyrin in the free form (rather than as the Zn complex), and the presence of bone marrow are similar to the congenital or photosensitive type of porphyria in human beings.

Highest values of UP have followed the combined use of phenylhydrazide, Pb, and exposure to unfiltered light from a Hg arc lamp.

These rabbits have been found to be of great value for isotopic <sup>14</sup>C studies of porphyrin metabolism. Following the administration of 250 x 10<sup>6</sup> counts/min of glycine-2-<sup>14</sup>C, the UP of 1 rabbit showed 120 counts/min/µg. The relationships of this and other urinary and tissue porphyrins to one another and to hemoglobin synthesis are being investigated.

- 499 Soprana, C. (Univ. Padova, Italy): (THE ACTION OF SODIUM PYROCATECHOL DISULFONATE ON THE FECAL ELIMINATION OF LEAD IN EXPERIMENTAL POISONING.) Folia Med. (Naples) 34:456-60, 1951.

A 1% solution of Pb nitrate was injected intramuscularly daily for 8 days into 6 rabbits. Of these, 3 got 5 ml 5% Na pyrocatechol disulfonate (PD) intravenously 15 min after Pb. Feces were

analyzed spectrographically for Pb on the 3rd, 6th and 9th days. Rabbits which received PD excreted a significantly higher amount of Pb, which was probably complexed with PD and eliminated in this form via the bile. (From Chemical Abstracts 46:6269, 1952)

- 500 Sllmegi, I. (Hungarian State Railways (M.A. V.) Hosp.): THE PATHOGENESIS OF PORPHYRI-NURIA IN HEMOCHROMATOSIS AND IN LEAD IN-TOXICATION. *Acta Morphologica Academiae Scientiarum Hungaricae* (Budapest) 1:459-65, 1951.

In order to determine how coproporphyrin III is formed in the bone marrow in the course of Pb intoxication, 25 white rats were intoxicated with 1% solution of Pb acetate (1 ml/100 g body weight via stomach tube). Urinalysis revealed that in 50% of the animals porphyrin could be demonstrated in the urine by the end of the 1st wk; during the 2nd wk it could be demonstrated in all the rats. In the 1st wk the entire quantity of porphyrin corresponded to that of coproporphyrin III. In ~3 wk, upon sacrificing the animals that had lost a great deal of weight, it was seen on naked eye examination that the bone marrow showed a vivid red fluorescence and in studying tissue cultures immediately following implantation, the bone marrow particle was found to show intensive red fluorescence, becoming slightly more intensive after 48 hr.

In another experiment, 16 white rats were blockaded with iv injections of china ink (0.5 ml given on 4 consecutive days). Following this treatment Pb intoxication was initiated in the manner described above. Twelve animals poisoned with Pb only were used as controls. Again, at the end of the 1st wk porphyrin appeared in the urines of Pb intoxicated animals but not in that of the blockaded rats. Bone marrow revealed no porphyrin production in either group of animals. During the 2nd wk, coproporphyrin III appeared in the urine of the control rats and in every case the bone marrow showed vivid red fluorescence with the tissue cultures demonstrating production of large amounts of porphyrin. This was not demonstrated in the case of the blockaded rats. Blockaded animals tolerated intoxication much worse than the controls who lived longer. Anemia also developed earlier in the blockaded animals.

In conclusion, according to these animal experiments, the site of coproporphyrin III production in Pb poisoning is the bone marrow and its appearance in urine is indicative of a special lesion suffered by the bone marrow. This lesion may be, together with the disturbed Fe metabolism and metal-hemolysis, in part responsible for the anemia which develops in Pb poisoning. Coproporphyrin I is synthesized in the liver and its appearance in the urine is the consequence of a severe hepatic lesion. In cases of hemochromatosis the excretion of coproporphyrin I is dominant, and the appearance of small amounts of coproporphyrin III is indicative of a special bone lesion.

## 1952

- 501 Alexander, E.: THORIUM B LABELLED RED CORPUSCLES. *Arkiv Kemi* 4:363-8, 1952.  
The ThB produced in rabbit blood by decaying Tn

is found to be almost quantitatively taken up by the corpuscles. Only 2% of the total ThB content remains in the plasma phase. A similar result is obtained when a solution of ThB + C collected originally in an electric field is dissolved in blood. The distribution between plasma and corpuscles of RaD obtained from tubes which formerly contained Rn also was found to be essentially the same. The uptake of ThB-labeled Pb by the corpuscle phase was much less pronounced. The ThB content of the plasma phase amounted in this case to 16% of the total activity of the blood. The Bi isotopes ThC and RaE showed no pronounced preference for the corpuscle phase and were found in about equal amounts in equal weights of plasma and corpuscles. (From Nuclear Science Abstracts 7:Abstract No. 2254, 1953)

- 502 Barka, T., Pósalaky, Z., and Kertész, L. (Univ. Budapest, Hungary): DISTRIBUTION OF TRACED LEAD SALT COLLOID IN THE RETICULO-ENDOTHELIAL ORGANS. *Acta Morphologica Academiae Scientiarum Hungaricae* (Budapest) 2:267-74, 1952.

Mature female rabbits (2-3 kg body weight) were given 2 mg/kg colloidal Pb sulfide iv (ear vein). The isotope ThB with a half-life of 10.6 hr, atomic number 82, and atomic weight 212 was used for tracing. Blood was removed from the opposite ear vein at regular intervals for 3 hr and the animals were then killed. The colloid disappeared from the blood at an exponential rate during the 1st 60 min and after that the loss was linear. The colloid showed greatest affinity to the spleen, bone marrow, and liver, and to a lesser degree to the kidney, lungs, and adrenals. Thymus and pituitary glands did not contain any colloid. The mean Pb sulfide content of the organs was: spleen, 3.7 µg/100 mg wet weight; bone marrow, 3.37; liver, 1.7; lymph node, 0.08; thymus, under limit of measurability; kidney, 0.53; lungs, 0.29; adrenals, 0.12; hypophysis, under limit of measurability. Three hours after injection, the liver was found to contain an average of 27.0% of the 2 mg/kg body weight of Pb sulfide colloid injected, while the kidney contained 1.3%, the spleen 0.78%, and the lungs 0.57%. (12 references)

- 503 Bauer, R.O., Rullo, F.R., Spooner, C., and Woodman, E. (Univ. School Med., Boston, Mass.): ACUTE AND SUBACUTE TOXICITY OF ETHYLENE DIAMINE TETRAACETIC ACID (EDTA) SALTS. *Federation Proceedings* 11:321 (Mar.), 1952.

Considerable interest attaches to abstraction of metals from biologic systems by EDTA insofar as specificity can be obtained. Na<sub>2</sub>EDTA should remove Pb and certain other metals from the body with formation of PbNa<sub>2</sub>EDTA. Toxicity data are needed not only for EDTA but for PbEDTA formed in vivo. Acute toxicity determinations with EDTA is rendered difficult by solubility relations. The ip LD<sub>50</sub>'s in mice, rats and rabbits exceeded 4.5, 7, 6 g/kg respectively; iv in rabbits was below 4 g/kg with no death at 2 g/kg. Daily (5/wk) doses (0.1, 0.2, 0.3, 0.5, 1.0 g/kg) ip in Wistar rats (6/dose) have produced a graded weight depression during 14-wk administration. Daily (5/wk) ip injections of EDTA in rabbits (0.5 g/kg) and cats

(0.25 g/kg) resulted in time-50% mortality (LT<sub>50</sub>) and 95% confidence limits of 78 (59-103) and 78 (35-170) days. Dogs (20) challenged twice daily with 150, 250 and 500 mg/kg iv produced LT<sub>50</sub>'s of 40 (27-59), 18.5 (12-28) and 13 (12-20) days. In rabbits, 1 dose iv LD<sub>50</sub> of PbEDTA was 1000 mg/kg as Pb, whereas the ip LD<sub>50</sub> was 350 mg/kg. The latter value was unexpected in view of the approximate LD<sub>50</sub> equality of ip and iv EDTA. Daily (5/wk) ip administration, 20 and 40 mg/kg Pb as PbEDTA, was not toxic to rabbits over 105 days. PbEDTA in daily doses of 70 and 100 mg/kg as Pb produced LT<sub>50</sub>'s of 8.5 (5.3-13.7) and 1.3 (1.0-1.6) days. Chickens poisoned with metallic Pb deposited in crop sac were protected from weight loss, anemia, ataxia and wing drop when 0.5% CaEDTA was included in their drinking water. (From authors' abstract)

- 504 Beyers, J.A.: Loodvergiftiging. (LEAD POISONING.) Tijdschr. Diergeneesk. 77:587-605, 1952

Three cases of acute Pb poisoning of cattle herds are reported. The author has never found a "Pb line" around the teeth, nor has he seen porphyrinuria, or basophil granules in the red blood corpuscles, in acute or chronic Pb poisoning of cattle or horses. (From Biological Abstracts 27:17151, 1953)

- 505 Butt, E.M., Pearson, H.E., and Simonsen, D.G. (Los Angeles County Hosp.; Univ. Southern California School Med.): PRODUCTION OF MENINGOCELES AND CRANIOSCHISIS IN CHICK EMBRYOS WITH LEAD NITRATE. Proceedings of the Society for Experimental Biology and Medicine 79:247-9, 1952.

Injection of Pb into the albumen of fertile eggs may result in the production of meningoceles in chick embryos. Cu and Hg ions were noted to be as toxic as similar quantities of the Pb ion, but meningoceles were not seen in the embryos surviving 13 days incubation. Na salts of anion used in the metal experiments failed to produce meningoceles. (14 references)

- 506 Compton, L.S. (Clymer, N.Y.): LEAD POISONING. Michigan State College Veterinarian 12:161-65 (Spring), 1952.

Although Pb poisoning in animals is very common and its diagnosis should be relatively easy, many cases are treated otherwise. Examples of the difficulty encountered in diagnosing Pb poisoning in animals are cited. One case involving a herd of cattle was typical of how Pb poisoning can be camouflaged. The sick animals, which died during the course of treatment with dextrose-Ca preparation, showed a nervous form of parturient paresis or acetoneemia. Investigation revealed that the animals were grazed in an area where fencing had been painted recently and that they had gnawed painted boards and posts and had eaten paint-smear grass. Another case diagnosed as hemorrhagic septicemia was Pb poisoning due to water stored in heavily-coated 5-gallon paint pails. Another diagnosis of black leg was also Pb poisoning from empty paint pails used for feed and water. Other cases diagnosed incorrectly involved animals (cows, horses, goats) licking: freshly painted

sign boards, joints of new water lines sealed with red Pb oxide, paper that had been used to wrap arsenate of Pb, empty cans that had held spray material, wood preservatives containing Pb, and paint from freshly opened paint cans. Immediate autopsies are necessary to establish a definite differential diagnosis. Then the primary objective is to discover the source in order to prevent further losses. In all events, diagnosis must be correct, so that medication can be of value.

- 507 Graziani, G., Fusco, M., and Rossi, L. (Univ. Naples, Italy): Ferro serico e saturnismo. Nota I. Comportamento del ferro serico nella intossicazione sperimentale. (SERUM IRON AND LEAD POISONING. I. SERUM IRON IN EXPERIMENTAL POISONING.) Folia Medica (Naples) 35:964-77, 1952.

Rabbits of 3 kg were poisoned with daily doses of 0.2 g Pb nitrate given orally for ~3 wk when death occurred. The pretreatment Fe values were 100-140 µg/100 ml serum. During treatment the value increased by 2-300% during 15 days and then gradually dropped to levels below the original values. The porphyrins showed a continuous decrease. The phenomena are attributed to the failure of Fe utilization by the direct or indirect action of Pb.

- 508 Harashima, S., Miyoshi, Y., and Watanabe, G. (Keio-Gijuku Univ., Tokyo, Japan): (DISTRIBUTION OF LEAD IN BLOOD. IV. DISTRIBUTION OF LEAD BETWEEN PLASMA AND CORPUSCLES OF GOAT BLOOD IN VITRO.) Igaku to Seibutsugaku 24:189-91, 1952.

Oxalated goat blood was incubated at 37° for 2 hr with various amounts of Pb(OAc)<sub>2</sub> (in a concentration dilute enough to avoid precipitation of the plasma proteins). The Pb contents were determined on both corpuscles and plasma fractions. The distribution of Pb was expressed by an equation:  $y = 205.31x^{0.286}$ , in which y and x were Pb contents of corpuscles and plasma, respectively. (From Chemical Abstracts 47:10729, 1953)

- 509 Harbers, E.: (INVESTIGATION OF THE DISTRIBUTION AND ELIMINATION OF DECAY PRODUCTS OF THORIUM X PRODUCED IN VIVO.) Z. Naturforsch. 7B:363-5 (June), 1952.

The tissue distribution and excretion of decay products, even if short-lived, frequently differ greatly from those of the parent element and can constitute a hazardous complication in radioisotope therapy or tracer studies. Curves are drawn showing the variation with time of ThX (<sup>224</sup>Ra), ThC (<sup>212</sup>Bi), ThB (<sup>212</sup>Pb), and total activity in blood cells, serum, liver, kidneys, spleen, and urine of rabbits injected with ThX. An initial increase in total activity in blood cells and liver is noted as the ThC concentration builds up. (From Nuclear Science Abstracts 6:Abstract No. 6513, 1952)

- 510 Healy, G.M., Morgan, J.F., and Parker, R.C. (Univ. Toronto, Canada): TRACE METAL CONTENT OF SOME NATURAL AND SYNTHETIC MEDIA. Journal of Biological Chemistry 198:305-12, 1952.

Pb was determined in the following media (in µg/100 ml): Chicken plasma, 10; chicken serum

7.5; horse serum 20; chicken embryo extract 8. Determination of Pb content of redistilled and ion exchange water before and after storage for 2 wk showed in µg/1000 ml: Barnsted water redistilled in Pyrex, 0.9; Barnsted water redistilled in Pyrex then stored in Pyrex bottle, 3.0; Barnsted water redistilled in Pyrex then stored in paraffin-lined bottle, 4.1; Barnsted water passed through mixed bed ion exchange column, 0.5; water from ion exchange column stored in polyethylene bag, 1.5.

- 511 Hesse, E., and Marquardt, H. (Gen. Hosp. St. Georg, Hamburg, Germany): *Berichtung zur Arbeit von E. Hesse and W. Flöter: "Die Behandlung der Bleivergiftung mit Folsäure."* (CORRECTION OF WORK BY E. HESSE AND W. FLÖTER: "TREATMENT OF LEAD POISONING WITH FOLIC ACID.") *Klinische Wochenschrift* 30:1100, 1952.

In his former experiments (1950) the author had found survival time of rabbits suffering from Pb poisoning and treated with "Folsan" to be 30 days. In later experiments (1951), survival time of 5 rabbits was 18 days. In experiments with 61 rabbits, under various conditions and with several kinds of Folsan preparations, survival time was 8.2 days in comparison with 12 control animals, where it was 7 days. In earlier experiments (1937), Hesse had also determined the survival time in pigeons and rats. The authors assume that the antagonism of Folsan against Pb poisoning seen in rabbits either produced counter-effects in the specific animal species by virtue of unknown impurities, or that the favorable results seen earlier had been only accidental.

- 512 Jordan, J.S.: *LEAD POISONING IN MIGRATORY WATERFOWL, WITH SPECIAL REFERENCE TO THE MALLARD, ANAS PLATYRHYNCHOS L.* Thesis, University of Michigan, 1952, 155 pp.

The purposes of this study were (1) to evaluate losses from Pb poisoning in migratory waterfowl that ingest commercial shot pellets which have been expended over their feeding areas, and (2) to attempt to reduce these losses by developing and introducing a nontoxic shot. The study was divided into 2 phases: (1) Field investigations, and (2) pen experiments. The frequency of occurrence of various numbers of shot ingested by waterfowl was determined through fluoroscopy of live-trapped ducks and fluoroscopy of gizzards from samples of water fowl bagged by hunters throughout the US. Wild mallard drakes were trapped, banded, dosed with shot pellets, and released alternately with equal numbers of undosed control birds. Several species of waterfowl were held in captivity, and the effects of given doses of commercial and noncommercial shot pellets were observed. It was shown that the supply of available shot is largely limited to the quantity expended over the feeding areas by hunters each season. Fluoroscopy of more than 18,000 gizzards revealed that 6.57% of the ducks in 12 leading species had ingested 1 or more shot pellets; 65% of these had taken only one. Variations in the incidence of shot among species were attributed to differences in methods of feeding and in types of habitat preferred. Band returns from dosed mallards indicated that migration

was retarded, and Pb-poisoned birds were more vulnerable to the gun. The ingestion of not >1 shot pellet did not appear to materially lower the numbers of drake mallards from one year to the next.

As shown by results of pen experiments, Pb from ingested shot appeared to have a direct, damaging effect on smooth muscles of the digestive tract, and Pb-poisoned waterfowl failed to consume adequate amounts of food. Pb-induced starvation appeared to be the direct cause of death. The size and hardness of food items, and the amounts consumed had an important influence on the effect of ingested Pb. Food intake varied with sex and age, and the effect of Pb varied accordingly. Rates of mortality increased with the shot dose, but symptoms and survival periods did not change. Some severely affected birds apparently recovered from Pb poisoning following elimination of shot or renewal of appetite. Shot alloys containing Pb showed no promise of alleviating Pb poisoning in waterfowl. Fe shot was nontoxic when fed to mallards. This alloy is not now on the market commercially, but may be available to waterfowl hunters in the near future. Until Fe shot becomes obtainable, losses from poisoning may be reduced by (1) increasing the amounts of certain natural waterfowl food plant resources, (2) dispersing waterfowl from known focal areas of Pb poisoning, and (3) exercising greater care in shooting and thereby reducing the amount of shot expended on the feeding grounds of waterfowl. (From Dissertation Abstracts 12:370, 1952)

- 513 Karnofsky, D.A., and Ridgway, L.P. (Sloan-Kettering Inst. Cancer Res., New York, N.Y.): *PRODUCTION OF INJURY TO THE NERVOUS SYSTEM OF THE CHICK EMBRYO OF LEAD SALTS.* *Journal of Pharmacology and Experimental Therapeutics* 104:176-86 (Feb.), 1952.

Pb nitrate, injected into the yolk sac, produced a severe and characteristic injury to the central nervous system of the chick embryo; this began with widespread hemorrhage in the brain and was followed by necrosis of the brain tissue and hydrocephalus. The response, not seen when Pb was injected at the 2nd day of incubation, first appeared in embryos treated on the 3rd - 4th days. A dose of 0.10-0.15 mg/egg of Pb nitrate was consistently neurotoxic during the 4th - 10th day, but in contrast to this uniform dosage, the embryo developed a progressive tolerance of Pb, so that on the 8th - 12th days, it survived 5 - 10 mg of Pb, 50 - 100 times the lethal dose at 4 days. After the 12th day the brain became increasingly resistant to Pb, although Pb could still specifically damage the brain of the embryo at 15 days. The embryo continued to grow fairly well despite the Pb-induced brain injury, and it showed normal yolk sac retraction at the time for hatching, although it ordinarily failed to hatch.

Other organs of the embryo do not seem to be grossly affected by the minimum doses of Pb damaging the brain, but when large doses are given there may be severe stunting and abnormalities in bone and feather growth. Thallium, which interferes with bone growth, and Pb exert their specific and independent effects when given to the same embryo. (From authors' summary; 12 refer-

- 514 MacDonald, N.S., Ezmirlian, F., Spain, P., and Rounds, D.E.: INTRAVENOUS AGENTS DIMINISHING ACCUMULATION OF METAL IONS. I. LEAD. US Atomic Energy Commission Document No. UCLA-229, 1952, 12 pp.

A preliminary search for readily available chemical agents, suitable for iv administration and possibly of use in therapy of poisoning by metals which accumulate in bone, was carried out. Young rats were injected iv with 25 mg Pb/kg body weight, followed 1/2 hr later by an injection of the chemical agent. After 1 day, the femurs and livers were removed and analyzed for Pb++ by a polarographic technique. The same agents were also tested by administration 1/2 hr before the Pb. The materials tested were the Na<sub>4</sub>EDTA, casein hydrolysate, pectin, a copolymer of methyl vinyl ether and maleic anhydride, glucuronolactone, oxypolygelatin, polyvinyl pyrrolidone, dextran, Na thiosulfate, and a hydrolized polyacrylonitrile. The 1st 4 agents significantly reduced the bone burden of Pb and the 1st 7 agents showed enough promise to merit further detailed evaluation. The liver burden of Pb also tended to decrease in the cases where the bone burden was lowered. (From Nuclear Science Abstracts 7:Abstract No. 51, 1953)

- 515 Moeschlin, S., and Schechterman, L. (Univ. Zurich, Switzerland): Vergleichende Untersuchungen über den therapeutischen Effekt von BAL oder Natriumcitrat bei der experimentellen Bleivergiftung. (COMPARATIVE STUDY OF THERAPEUTIC EFFECT OF 2,3-DIMERCAPTOPROPANOL (BAL) OR SODIUM CITRATE ON EXPERIMENTAL LEAD POISONING.) Schweizerische Medizinische Wochenschrift 82, No. 45:1164-5, 1952.

Of 60 guinea pigs poisoned by intraperitoneal injections of a total dose of 240 mg of Pb nitrate/kg of body weight, 20 were given intramuscular injections of dimercaprol ("BAL") for 14 days, 20 were given a 5% Na citrate solution through a stomach catheter for 21 days, and 20 served as controls. Experimental results indicated that dimercaprol is not only ineffective in the treatment of guinea pigs with subacute Pb poisoning, but it apparently increases the toxicity of the Pb. Na citrate was an effective therapeutic agent by prolonging the duration of life in the animals, delaying and reducing the occurrence of characteristic changes in the blood, such as basophilia, anisocytosis, and poikilocytosis, and by exerting a favorable influence on appetite and increase in weight.

As a result of this experiment and of additional clinical experience, the authors consider the use of Na citrate as the method of choice for the treatment of Pb poisoning. For prophylactic purposes, they recommend for workers heavily exposed to Pb and suffering with recurrent illness, treatment with 5 mg Na citrate 3 times daily for 1 wk out of every month.

- 516 Mouriquand, G., Edel, V., Roche, L., and Chighizola, R. (France): Intoxication saturnine et chronaxie vestibulaire. (LEAD POISONING AND VESTIBULAR CHRONAXIE.)

The authors had been able to confirm Bourguignon's findings that in chronic CO poisoning vestibular chronaxie (VC) is increased (rise to  $\geq 50 \sigma$ ,  $100 \sigma$ ; normal,  $12-20 \sigma$ ), and they had found that this also occurred in Pb poisoning. In the experiments here reported, they subjected pigeons to both acute and chronic poisoning by oral administration of Pb acetate solution in a concentration of 0.02 g Pb/drop. As found in 6 pigeons, the VC, which rose progressively, produced death in 3-5 wk. The important finding was that long before appearance of signs of intoxication (asthenia, weight loss) the VC rise became evident. The authors wonder in conclusion whether this "chronaxie disease" does not also occur in excessive Pb exposure before the classical signs of poisoning appear and would thus indicate early treatment. For the above experiments they had chosen pigeons as the test animal because they had earlier seen that the response of VC to various drugs in pigeons was similar to that in man, children and adults.

- 517 Pardoe, A.U. (London Hosp. Med. Coll., England): RENAL FUNCTION IN LEAD POISONING. British Journal of Pharmacology and Chemotherapy 7:349-57 (Sept.), 1952.

Measurements of blood pressure, glomerular filtration rate, and tubular excretory mass were made on a group of rats during prolonged treatment with Pb acetate, and compared with measurements made in a control group receiving Na acetate. Pb and Na acetates were first given in a dose of 35 mg/100 g 3 times/wk; after 63 days the dose was increased 4-fold and continued for another 72 days; 89 days after the last dose of Pb, BAL was given to 4 of this group intraperitoneally at 4 mg/100 g, in NaCl solution, twice daily for 5 days. The 4 remaining Pb animals received NaCl solution only. A comparison of the fresh weights of various organs of rats from the Pb and control groups showed marked enlargement of the kidneys and livers, and some increase in weight of the hearts, spleens and adrenals of the Pb rats. Histologic lesions were observed in the kidneys of the Pb rats, and appeared to affect mainly the proximal limb of Henle's loops and the distal convoluted tubules. No significant rise in arterial blood pressure was observed in Pb rats, even after 4 mo exposure to Pb. Reports of positive results are criticized on the ground of inadequately controlled observations. Glomerular filtration rates showed no significant difference between the groups receiving Pb and the control group, throughout the period of dosing. Tubular excretory capacity, assessed as Tmp<sub>AH</sub>, rose in the group receiving Pb, showing a statistically significant increase after prolonged dosing. This effect appeared to be reversible; 100 days after dosing with Pb had ceased, the Tmp<sub>AH</sub> had fallen to the pretreatment level. Treatment with BAL possibly accelerated this recovery. (20 references)

- 518 Pardoe, A.U., and Weatherall, M. (London Hosp. Med. Coll., England): THE UPTAKE AND EXCRETION OF WATER IN RATS POISONED WITH LEAD. British Journal of Pharmacology and Chemotherapy 7:358-69 (Sept.), 1952.

Some functions of the kidneys and the amount of water in certain organs under various conditions were studied in male albino rats. Administration of Pb (as acetate) in Series 1 was 3.3 meq/kg 3 times/wk, over 63 days orally; (2) 13.3 meq/kg as above for 1st 18 doses, then 3 doses in 4 wk, then 2 times/wk over a total 98 days; (3) as in 2 in 2 doses over 7 days; 0.67 meq in 1 iv injection; 6.7 meq in 2 doses over 7 days, and 0.33 meq iv at 1st oral dose; (4) 0.67 meq iv. Controls received equivalent amounts of Na acetate. Additional experiments were carried out with frogs that had been kept for 2-3 wk in water containing 1 mM Pb chloride which was changed 3 times/wk. Of 24 frogs, 1 died; all 12 kept in distilled water survived. The onset of absorption of water from the alimentary canal was delayed in rats which had received Pb orally, but then proceeded normally. It was little affected when Pb was given iv. Absorption was possibly also somewhat delayed both in control and Pb rats by nicotine. In the Pb rats, the stomach, small intestine, liver, kidneys, and adrenals were heavier than in the controls. In at least the liver and kidneys there was both an increase in the dry weight and an increase in the water content of the organs. There was also an increase in the contents of the alimentary canal, particularly but not only in the rats which had received Pb orally. Water diuresis was slightly but not significantly accelerated in rats given Pb orally. The inhibitory effect of vasopressin on water diuresis in the Pb rats was variable. In the first few weeks of administering Pb, vasopressin had more effect than in controls. Later the animals became abnormally insensitive, at first reversibly and later apparently irreversibly. In rats which were receiving large doses of Pb frequently, the antidiuretic effect of nicotine was greatly increased. This increase was not related to an increased sensitivity to vasopressin. It disappeared within a few days of reducing the dose of Pb and reappeared when intensive dosing was resumed. Vasopressin in very large doses had highly significantly more effect on the weight of normal frogs than it had on the weight of frogs which had been kept in Pb-containing water. Possible causes of these changes were discussed, taking into consideration sensitivity to pituitary extracts and other factors.

- 519 Pirrie, R. (Univ. and Royal Infirmary, Glasgow, Scotland): THE EFFECT OF SPLENECTOMY AND RETICULOENDOTHELIAL BLOCKADE UPON THE ANAEMIA OF LEAD POISONING IN GUINEA PIGS. *Journal of Pathology and Bacteriology* 64, No. 1:211-22, 1952.

The anemia associated with chronic Pb poisoning was studied in 18 guinea pigs for periods of up to 150 days by the daily administration by pipette of Pb nitrate/100 mg. Stippling of erythrocytes and hemoglobinizing normoblasts occurred in the bone marrow of all animals, and to a higher degree than in the peripheral blood. A varying proportion of the basophilic granules gave the histochemical test for Fe. Splenectomy performed before or during Pb poisoning resulted in relatively high red-cell and stippled-cell counts but the associated increase in hemoglobin was small, so that anemia in splenectomized animals was hypochromic.

This effect lasted only 50-60 days, then the number of red cells and stippled cells gradually diminished. Reticuloendothelial blockage by trypan blue effected after this time caused rapid increase in these cells in circulation. The histological appearance of the spleen resembled that seen in hemolytic anemia in general. There was marked hemosiderosis in the liver of splenectomized animals examined after the secondary red-cell fall. The chemical Fe content of the spleen of Pb poisoned animals was higher than that of controls, and the amount of Fe in the liver varied with the prevailing blood picture. Urobilinogen, even in trace amounts, was not isolated from the feces.

The author concludes that these findings support the contention that Pb exerts its hematological effect primarily on the red-cell precursors in the bone marrow, and that the resultant defective erythrocytes are removed from the circulation by the spleen and reticuloendothelial system in general. Dyshematopoiesis and hemolysis both appear to play a part in producing the anemia in chronic Pb poisoning. (From author's summary; 12 references)

- 520 Pletscher, A., Richterich, R., Thoenen, H., Lüdin, H., and Staub, H. (Med. Univ. Clinic, Basel, Switzerland): Über das Verhalten von Aminosäuren und Fermenten bei Schwermetallvergiftungen. 2. Mitteilung. Die Wirkung von Calcium und Levulose bei der akuten experimentellen Bleivergiftung. (THE BEHAVIOR OF AMINO ACIDS AND ENZYMES IN HEAVY METAL POISONING. II. THE ACTION OF CALCIUM AND LEVULOSE IN ACUTE EXPERIMENTAL LEAD POISONING.) *Helvetica Physiologica et Pharmacologia Acta* 10:328-38, 1952.

The effects of Ca and levulose on acute experimental Pb poisoning in rats were studied by the following methods: Microbiological determination of cystine, methionine, serine, phenylalanine and leucine in liver and blood; histochemical demonstration of the alkaline phosphatase and histological examination of liver and kidneys; microscopical examination of the erythrocytes in blood. The results were (1) Favorable influence of Ca on all changes caused by Pb. (2) Levulose has a favorable effect on Pb disturbances of the amino acid and enzyme metabolism as well as on changes of the erythrocytes, while it produces unfavorable effects on histological damage to liver and kidneys. (3) The results point to a detoxifying function of cystine in acute experimental Pb poisoning. (From authors' summary)

- 521 Ridgway, L.P., and Karnofsky, D.A. (Sloan-Kettering Inst. Cancer Res., New York): THE EFFECT OF METALS ON THE CHICK EMBRYO: TOXICITY AND PRODUCTION OF ABNORMALITIES IN DEVELOPMENT. *Annals of the New York Academy of Sciences* 55, Art. 2:203-15, 1952.

This is a review of experimental abnormalities produced in chick embryos by injection of TI, Pb, Co, B, As, Rh, Bi, and Se salts. (For the study conducted by the authors, see Karnofsky, D.A., and Ridgway, L.P. (1952).)

- 522 Schmid, R., Hanson, B., and Schwartz, S. (Univ. Minnesota Hosp., Minneapolis): EXPERIMENTAL PORPHYRIA. I. ISOLATION OF UROPORPHYRIN I FROM BONE MARROW OF LEAD POISONED RABBITS. Proceedings of the Society of Experimental Biology and Medicine 79:459-62 (Mar.), 1952.

Of 23 rabbits used, 5 received 1 single sc injection of 100 mg Pb acetate (63.7 mg Pb)/kg body weight, and were killed 25-44 days later. The 2nd group of 5 received daily iv injection of an aqueous solution of 5 mg crystalline riboflavin phosphate, and sc injection of 100 mg Pb acetate/kg body weight for 25 days; 2 of this group also received iv 500 mg ascorbic acid daily. Two rabbits were given repeatedly over several weeks prior to the examination small amounts of Pb acetate iv, the total being 85 mg and 100 mg respectively. A group of 11 rabbits received repeatedly sc injections of 20-40 mg phenylhydrazine over periods of 6-45 days. The total dosage ranged from 110-400 mg. On the last day of phenylhydrazine administration they received iv 20 mg Pb acetate/kg body weight; they were sacrificed from 3-9 days later. As summarized, crystalline uroporphyrin I was isolated from the bone marrow and found to be identical with uroporphyrin I isolated from the urine of a patient with photosensitive (erythropoietic) porphyria. The bone marrow of rabbits with acute or chronic Pb poisoning was found to contain uroporphyrin I from 15-844 µg/100 ml. In experimental Pb poisoning, significant amounts of uroporphyrin are found in the circulating red blood cells only during the very acute stage when the erythrocyte coproporphyrin is likewise markedly increased. (13 references)

- 523 Schubert, J., and White, M.R. (Chicago, Ill.): EFFECT OF SODIUM AND ZIRCONIUM CITRATES ON DISTRIBUTION AND EXCRETION OF INJECTED RADIOLEAD. Journal of Laboratory and Clinical Medicine 39:260-6, 1952.

The effects of Zr and Na citrates on the blood disappearance, tissue distribution, and excretion of soluble Pb salts injected iv into rats at 2 concentrations (carrier-free and with added carrier) were studied. Of the injected dose, ~10% of the carrier-free <sup>210</sup>Pb was in the blood (essentially the cellular fraction) after 25 min, from which it disappeared with a 1/2 time of 30 hr. When injected with carrier Pb, only 6% of the injected <sup>210</sup>Pb was in the cells and ~22% in the plasma. The Pb in the plasma left rapidly, <2% of the dose remaining after 3 hr. Na or Zr citrate injected after carrier-free <sup>210</sup>Pb did not affect the rate of disappearance of <sup>210</sup>Pb from the blood, the tissue distribution, or the fraction excreted. In rats injected with carrier amounts of Pb labeled with <sup>210</sup>Pb, Zr and Na citrate both caused some redistribution of <sup>210</sup>Pb, but neither affected the immediate rate of disappearance of <sup>210</sup>Pb from the blood. Zr citrate caused at least a 3-fold increase in the <sup>210</sup>Pb excreted during the 1st 24 hr and a decrease in the kidney concentration. The authors conclude that the action of many drugs used to treat Pb poisoning is explained by the supposition that they slow down the rate of transfer of Pb from the skeleton into the circulation; the ensuing natural rapid drop in the plasma Pb

level relieves the symptoms of Pb poisoning.

- 524 Schwartz, S., Keprios, M., and Schmid, R. (Univ. Minnesota Hosp., Minneapolis): EXPERIMENTAL PORPHYRIA. II. TYPE PRODUCED BY LEAD, PHENYLHYDRAZINE AND LIGHT. Proceedings of the Society of Experimental Biology and Medicine 79:463-8, 1952.

Treatment of rabbits with phenylhydrazine, Pb acetate and light produced a temporary condition similar to porphyria in man. Uroporphyrin I (UI) appeared in the urine. Values of up to 3466 µg/day were observed. The major portion of the urinary porphyrin was excreted as the free form rather than as the Zn complex. Bone marrow U- and coproporphyrin values were elevated to 1500-2000 µg% as compared to normal values of ~0 to 50-10 µg% respectively. Liver porphyrin concentrations were generally normal. (From authors' summary; 21 references)

- 525 Sedlmeier, H., and Dahme, E.: Die Veränderungen der Serumweißkörper bei der experimentell erzeugten Bleivergiftung. (CHANGES IN THE SERUM ALBUMIN IN EXPERIMENTAL LEAD POISONING.) Berl. Münch. tierärztl. Wschr. 65:181-4, 1952.

The authors produced subacute and chronic Pb poisoning in rabbits by the intravenous injection of 5.5 mg Pb acetate/kg body weight in aqueous solution. There was a decrease of albumin and an increase of α- and β-globulins in the blood serum. (From Veterinary Bulletin 23:2910, 1953)

- 526 Slobodchikova, A.I. (Republic Specialties Hosp., Ufa, USSR): Intoksikatsiya etilrovannym ili svintsovyim benzinom. (THE TOXIC EFFECT OF LEADED GASOLINE.) Zhurnal Nevropatologii i Psikiatrii imeni S.S. Korsakova 52, No. 4:27-31, 1952.

The concept by many authors that the action of TEL-containing gasoline or kerosine is due to the TEL molecule appears erroneous to the author. She holds that in combination with gasoline, ethyl fluid exerts new properties, differing from those of pure TEL. In her experiments, cats were exposed to the inhalation of TEL-gasoline (aviation grade containing 4-8 ml/l) by applying with a soft brush to all paws 3-4 times/day for 8-9 days when death occurred (150-170 g TEL gasoline, in acute experiments). In chronic experiments, the same procedure was used by applying to 2 paws a total of 200-210 g TEL-gasoline over a period of 67 days. As summarized, the effects seen were those on the central nervous system as indicated by the changes which took place in the behavior of the cats as the poison accumulated in the organism. At first a short period of excitement appeared, followed by a state of inhibition accompanied by the usual concomitants of the vegetative nervous system and by cerebral effects. The cats manifested toxic effects in all the regions of the central nervous system but mostly in the cortical and subcortical formations, in the cerebellum, and in the spinal cord. This is not characteristic of TEL-gasoline only, since similar effects result from exposure to other poisons. In TEL gasoline poisoning the cortical elements appear to be the first to become affected. In chronic intoxication



with small doses a satisfactory functional compensation took place and the pathomorphologic changes were not as profound.

- 527 Thoelen, H., Richterich, R., Pletscher, A., and Staub, H. (Univ. Basel, Switzerland): Über das Verhalten von Aminosäuren und Fermenten bei Schwermetallvergiftungen. I. Die experimentelle, akute und subakute Bleivergiftung. (AMINO ACIDS AND ENZYMES IN HEAVY-METAL INTOXICATION. I. EXPERIMENTAL ACUTE AND SUBACUTE LEAD POISONING.) Archiv für Experimentelle Pathologie und Pharmakologie 215:389-401, 1952.

Adult rats were poisoned with a 0.5% Pb acetate solution by being given either 0.4 ml of solution 9 times intraperitoneally within 14 days, or 0.4 ml 2 times weekly for 3 mo. After decapitation, amino acids were determined by microbiological methods. In the rats with acute poisoning blood and liver showed an increased cystine content and serine was unchanged. The alkaline phosphatase was increased in the liver and decreased in the kidneys. In subacute poisoning there was no change in the liver cystine, but most of the other amino acids were reduced. The alkaline phosphatase in liver and kidneys was lowered.

- 528 Van Klaveren, F.W., and Shrivastava, P.C. (Teddington Chem. Factory, Ltd., Andheri, Bombay, India): LEAD ANEMIA IN THE RABBIT AND THE POTENCY OF LIVER EXTRACTS.

Indian J. Med. Research 40:495-504, 1952.

The hematopoietic potencies of 2 liver extracts were evaluated by their ability to stimulate red-cell regeneration in rabbits made anemic by Pb acetate injection. Both preparations gave a maximum response on the 7th day after administration and had a greater potency than expected from their vitamin B<sub>12</sub> content. A purified liver concentrate free of vitamin B<sub>12</sub> gave a marked hematopoietic response. (From Chemical Abstracts 47:10731, 1953)

- 529 Weatherall, M. (London Hosp. Med. Coll., England): THE FATE OF INTRAVENOUSLY ADMINISTERED COPROPORPHYRIN III IN NORMAL AND LEAD-TREATED RABBITS. Biochemical Journal 52:683-90, 1952.

Experiments were performed to discover why coproporphyrin (CP) III appears in the urine, but not in the feces, in Pb poisoning. It was found that at least 1/2 the urinary CP in Pb-treated rabbits is formed from a precursor after the urine is passed. CP III was obtained from the urine of Pb-treated rabbits, crystallized as its methyl ester, hydrolyzed and injected in 100 µg doses iv into conscious and anesthetized normal and Pb-treated rabbits. No additional urinary excretion of CP III was found. In anesthetized rabbits, the mean rate of excretion of CP in the bile was  $1.3 \pm 0.6$  µg/hr for normal rabbits and  $1.7 \pm 1.1$  µg/hr for Pb-treated rabbits. When 100 µg CP were injected iv, this rose to 18-36 µg/hr and 35-75% of the dose was accounted for in 4 hr after injection. No difference was apparent between the biliary excretion of the normal and that of Pb-treated rabbits.

The author suggests that the CP found in the urine in Pb-treated rabbits is excreted entirely

as a precursor, and that the metabolic disorder produced by Pb is an overproduction or failure of utilization of a precursor of CP and not of CP itself. CP had no effect on the behavior, blood pressure or water diuresis of either normal or Pb-treated rabbits. (From author's summary; 27 references)

- 530 Weatherall, M., and Comfort, A. (London Hosp. Med. Coll., England): URINARY PORPHYRINS IN EXPERIMENTAL LEAD POISONING. Nature 169:587-8, 1952.

Rabbits were poisoned by the iv administration of 13.7 mg PbCl<sub>2</sub>/kg and subsequent feeding of 250 ppm Pb(CO<sub>3</sub>)<sub>2</sub> for 4 mo. Porphyrins in urine were determined spectrophotometrically and characterized by paper chromatography. Coproporphyrin (CP) excretion of normal rabbits was 4.8 µg/kg/day; after PbCl<sub>2</sub> it rose to 79.5 µg/kg/day, then declined gradually. The bulk of the porphyrin from normal and poisoned animals ran with an RF corresponding to the presence of material with 4 carboxyl groups, identical with that of the pure CP marker. 3-, 4-, and 5-carboxyl porphyrins were also observed in all but the smallest fractions. There was no evidence that chronic Pb poisoning affects the balance between the urinary 3-, 4- and 5-carboxyl porphyrins compared with the normal rabbit. Four Pb-poisoned rabbits were treated with 5 mg/kg of folic acid, pyridoxine, cyanocobalamin, or 0.9% NaCl (0.5 ml/kg) im twice daily for 3 days, repeated at 5 weekly intervals until each animal had received each treatment. Porphyrin excretion was not altered significantly by any of these treatments.

## 1953

- 531 Cibic, B. (Ljubljana, Yugoslavia): Bazo-filno punktirani eritrociti in porfirinurija pri eksperimentalnem in poklicnem saturnizmu. (STIPPLED CELLS AND PORPHYRINURIA IN EXPERIMENTAL AND OCCUPATIONAL LEAD POISONING.) Zdravstveni Vestnik 22, No. 7-8:189-95, 1953.

Pb poisoning was produced in rabbits by giving Pb oxide or Pb chloride in food for 10-60 days, or by injecting a solution of Pb chloride intravenously (the dose of Pb given is not clearly stated). Blood films were made at intervals and examined for punctate basophilia by dark-ground illumination. The affected red cells were larger than normal (8.30 µ diameter, compared with 6.70 µ), and contained fine, medium and coarse basophilic granules. The proportion of basophilic cells began to increase on the 3rd day of treatment and porphyrinuria appeared a few days later; the basophilia attained a maximum of 5% between 15 and 25 days and then fell although the administration of Pb was continued. It rose again when the dose of Pb was increased. The porphyrinuria was increased by provoking acidosis by giving ammonium chloride. In acute Pb poisoning produced by intravenous injection marked porphyrinuria appeared immediately; poikilocytosis and anisocytosis were seen, but there was little or no increase in basophilia. After repeated injections hemoglobinuria and basophilia appeared. Observations were also made on miners who had worked for long periods in the Pb

mine at Mezica; basophilia up to 2.2% was seen and symptoms of Pb poisoning appeared at levels >0.8%. It is suggested that the production of acidosis may be used as a test for latent saturnism in mass investigations, a positive result being indicated by the appearance of porphyrinuria. A test of this kind would be easier to carry out than the mass examination of blood films for punctate basophilia. (From Bulletin of Hygiene 29:173, 1954)

- 532 Comfort, A., and Weatherall, M. (London Hosp. Med. Coll., England): URINARY PORPHYRIN IN LEAD-TREATED RABBITS. *Biochemical Journal* 54:247-52, 1953.

Chromatography has made it possible to separate and identify porphyrins not previously described. The ether-soluble porphyrins in urine from animals exposed to Pb were always thought to be coproporphyrin III but recent studies have revealed di-, tri-, penta-, hexa-, and heptacarboxylic porphyrins. In rabbits maintained on a porphyrin-producing Pb intake the chief ether-soluble porphyrin extracted from the urine is coproporphyrin III, and possibly a very small amount of coproporphyrin I. By means of kercene chromatograms evidence was obtained for the existence of porphyrins with 2, 3, 6, and possibly 5 COOH groups. Evidence was also obtained for the existence of a tetracarboxylic porphyrin, which is not identical with coproporphyrin I or III.

- 533 Comfort, A., Weatherall, M. (London Hosp. Med. Coll., England): PORPHYRINS FROM THE URINE OF RABBITS EXPOSED TO LEAD.

*Journal of Physiology* 119, No. 1:5P, 1953. The urine of rabbits treated with Pb contains several other porphyrins besides the well-known coproporphyrin III. Porphyrins probably containing 3- and 6-carboxyl groups are detectable by paper chromatography of the ether-extracted and partially purified free porphyrins; these porphyrins are also demonstrable in normal rabbit urine. Additional fractions are found by chromatography on alumina columns and by paper chromatography of the methyl esters of porphyrins obtained from Pb-treated animals. It seems likely that these fractions include 2- and 5-carboxyl porphyrins and that >1 type of some of these porphyrins may be present.

- 534 Cottier, P., Kunz, H.A., and Zollinger, H. U. (Univ. Zurich, Switzerland): Experimenteller Beitrag zur Frage der Bleihypertonie. (EXPERIMENTAL CONTRIBUTION TO THE PROBLEM OF LEAD HYPERTONIA.) *Helvetica Medica Acta* 20, No. 4/5:443-9, 1953.

In the 1st series of experiments 3 groups of adult albino rats of 10 each received sc Pb phosphate (1 g = 0.69 g Pb) in pectin suspensions as follows: (1) 2 times/wk 2-10 mg; (2) 1 dose of 20 mg/wk; (3) 1 dose of 40 mg/wk. In the 2nd series 4 groups of 5-10 rats received sc 1 dose/wk of (1) 20 mg; (2) same; (3) 40 mg; (4) 2-10 mg. Other groups served to determine the Pb content of kidney and other organs. Their blood pressure (BP) was measured by an indirect plethysmographic method under light ether narcosis. Doses up to 20 mg/wk had no effect on BP. An optimum dose of 20 mg/wk led to labile intermittent increases in the BP.

Higher doses, 40 mg/wk, caused a normotonic to hypotonic reaction of the BP. A partial factor for the hypotonia was the anemia with its impairment of the circulatory organs. The individual BP frequency coefficient was single-dose dependent, independent of total dosage and survival period. The hypertonia preceded the hypertonic vascular changes (hypertrophy of the arteriole media) in the kidneys, intestines, pancreas, and brain. The degree of the hypertrophy of the media depended on the survival period of the hypertonic animals. Even with prolonged survival (92 wk), no arteriosclerotic chronic nephritis was observed histologically. However, the possibility could not be excluded that in human beings, especially in those with prolonged hypertonia, an arteriosclerotic chronic nephritis might gradually develop.

The percentage of basophilic stippled erythrocytes and time of their appearance in the blood represented an approximate index of intoxication at the dosages used. In all Pb-intoxicated animals, stippled erythrocytes were present.

The authors conclude that the experiments demonstrate the importance of an optimum dose for the achievement of a high BP in the rat, since a similar situation is assumed to hold true for human beings; at least, they seem to explain the fact that an elevated BP is not one of the chief symptoms observed in cases of human Pb poisoning and that hypertonia as well as normo- and hypotonia can be found in chronic Pb poisoning. However, the experiments do not explain the mechanism by which Pb causes an elevation of the BP.

- 535 De Rosa, R. (Univ. Naples, Italy): L'Azione dell'alfa-tocoferolo nella intossicazione sperimentale da piombo. Comportamento della coproporfirinuria e della crasi ematica. (ACTION OF  $\alpha$ -TOCOPHEROL IN EXPERIMENTAL LEAD POISONING. COPROPORPHYRINURIA AND BLOOD PICTURE.) *Bollettino della Società Italiana di Biologia Sperimentale* 29:1439-41, 1953.

Two groups of 4 rabbits each were given orally 200 mg Pb acetate every other day and, in the test group, im injections of 200 mg  $\alpha$ -tocopherol every 4th day. The vitamin treated animals showed after 7 days a coproporphyrin excretion in the urine of an average of 7  $\mu$ g/100 ml or 21  $\mu$ g/24 hr. Toward the end of the 37 days' test, the figures were 28 and 72.8  $\mu$ g. The animals receiving no vitamin started with excretion within a similar range, but the figures increased rapidly to 112 and 358 and finally to 135 and 378  $\mu$ g/24 hr. The vitamin-treated group lived an average of 10 days longer than the others.

- 536 De Rosa, R. (Univ. Naples, Italy): L'Azione dell'alfa-tocoferolo nella intossicazione sperimentale da piombo. - Comportamento del quadro anatomico-istologico. (ACTION OF  $\alpha$ -TOCOPHEROL IN EXPERIMENTAL LEAD POISONING. THE ANATOMICAL HISTOLOGICAL PICTURE.) *Bollettino della Società Italiana di Biologia Sperimentale* 29:1441-3, 1953.

Two lots of 6 rabbits each were administered orally 200 mg Pb acetate on alternate days; 1 of the groups received simultaneously 200 mg  $\alpha$ -tocopherol

(vitamin E) every 4 days. Rabbits of both groups were sacrificed at predetermined times, ie, every 5 days, so that the organic changes could be observed in the different phases of intoxication. Animals treated with tocopherol survived up to the 30th day; those not treated died within 20 days. Pathologic changes in kidneys, liver, spleen, intestine, lungs, heart and adrenal glands were followed. The results showed that tocopherol exerted a protective action which, while not modifying to a significant extent the morphology of the lesions, limited their progression and consequent anatomic and functional damage. The mechanism of this protective action is attributed to the improvement of circulation in the tissues which becomes compromised in Pb poisoning by vasospasm.

- 537 Ganguli, H.D., and Chowdhuri, S. (Govt. West Bengal, Calcutta, India): ACUTE LEAD POISONING IN CATTLE AND LEAD CONTENTS OF SOIL AND GRASS IN GRAZING GROUNDS. *Journal and Proceedings of the Institution of Chemists, Calcutta* 25:165-70 (July & Oct.), 1953.

Five of 25 Pb poisoned dairy farm cattle died within the course of a few days near Calcutta (1952). Symptoms were: Abdominal pain, low temperature, salivation, bloody discharge from nostrils, convulsions, coma and death. Autopsy revealed subcutaneous hemorrhage, blood and metal particles in congested stomach and intestinal mucosa, easily detachable mucous membrane in rumen, blood fluid in the peritoneal cavity, etc. Stomach contents included metallic bits mostly of Pb shot. The dairy farm was situated near a shooting range. Since Pb poisoning of cattle is rare in India and to establish correctness of diagnosis, soil, subsoil and grass (or herbage) samples were taken from parks, grazing and agricultural fields in and near Calcutta, from 4 sides of various shooting grounds and from plots away from shooting grounds, near military areas and paint works, and from common grazing fields, to be examined for Pb. The colorimetric method of Lynch et al (1934) was used. In the agricultural, grazing and park samples, Pb contents ranged from 0.001-0.008 ppm in soil, from trace to 0.005 in subsoil, and from trace to 0.002 in grass or herbage. In the shooting range samples, Pb values ranged from 0.22-0.88 ppm in soil, from 0.011-0.42 in subsoil, and from 0.53-2.24 in grass. In the plots remote from shooting grounds, the highest values for the 3 groups of samples were 0.28, 0.03, and 0.53 ppm, near military fields and paint works, 0.82, 0.28 and 1.88 ppm, and in common grazing fields, 0.008, 0.005 and 0.002 ppm, respectively. Pb content in normal cattle ranged from 0.03 ppm in muscles to 0.52 in liver. In the Pb poisoned animals the maximum Pb values were: liver, 5.0; kidney, 11.7; spleen, 3.5; stomach walls, 7.1 and intestines 4.5 ppm. The investigation confirmed the diagnosis of Pb poisoning caused by grazing near a shooting range.

- 538 Gerlich, N., and Remy, R. (Munic. Hosp., Bielefeld, Germany): Antiperniciöses wirksame Stoffe bei der Bleianämie. (SUBSTANCES ACTIVE AGAINST PERNICIOUS ANEMIA AND LEAD ANEMIA.) *Naunyn-Schmiedeberg's*

*Archiv für Experimentelle Pathologie und Pharmakologie* 220:351-7, 1953.

Male rabbits of 2-3 kg weight injected on 3 consecutive days with 5.5 mg Pb acetate/kg developed anemia reaching on the 5th day a low of 2.5 million erythrocytes and 50% hemoglobin. Onset of the anemia was delayed by simultaneous administration of liver extract and vitamin B<sub>12</sub>. Comparing on the basis of vitamin B<sub>12</sub> content, liver extract is 4-5 times as potent as vitamin B<sub>12</sub>. The effect of folic acid was less marked and of shorter duration. Fairly large doses of Co 0.08 µg/g had a favorable influence on the anemia, but quantities corresponding to those contained in efficacious doses of vitamin B<sub>12</sub> were without effect. (41 references)

- 539 Graziani, G., Fusco, M., and Rossi, L. (Univ. Naples, Italy): Ferro serico e saturnismo. Nota II: La ferremia da carico nel saturnismo sperimentale. (SERUM IRON AND LEAD POISONING. II. IRON TREATMENT IN EXPERIMENTAL LEAD POISONING.) *Folia Medica (Naples)* 36:218-33, 1953.

Rabbits were poisoned by doses of 0.1 g Pb acetate given every 2nd day. One group of animals received 50 mg reduced Fe, another group 0.5 mg Fe as an intravenous preparation. In the latter case, the plasma Fe was markedly higher than before the Pb poisoning, which proved a deficiency in Fe utilization. Oral administration did not have this effect which is explained by impaired gastrointestinal absorption.

- 540 Harwood, P.D. (Dr. Hess & Clark, Inc., Ashland, O.): THE USE OF LEAD ARSENATE MIXED WITH PHENOTHIAZINE FOR THE REMOVAL OF TAPEWORMS FROM SHEEP AND GOATS. *Proc. Helminthol. Soc. Wash., D.C.* 20:29-31, 1953.

The results of tests with Pb arsenate-phenothiazine mixtures on sheep and goats support the assumption that the mixture is as effective against tapeworms as each drug administered independently. There was very little difference in the toxicity of the mixture and of Pb arsenate alone, as a dose of 5-7 g Pb arsenate killed all animals to which such a dose was given. However, a dosage level of 25 g phenothiazine + 1 g Pb arsenate was safe for all but extremely debilitated animals. (From *Chemical Abstracts* 48:7192, 1954)

- 541 Hermann, H., Chatonnet, J., and Vial, J. (Univ. Lyon, France): Modifications de la réactivité vasculaire par divers sels métalliques. (MODIFICATION OF VASCULAR REACTIVITY BY VARIOUS METALLIC SALTS.) *Comptes Rendus des Séances de la Société de Biologie et de ses Filiales* 147:1804-6, 1953.

In dogs with spinal cord destroyed, 0.0044 meq/kg of the salt was injected iv and the effect on the action of vasomotor agents (adrenaline, noradrenaline, heptedine, histamine, acetylcholine) was studied. Salts of Pb were among those which decreased the action more or less.

- 542 Holm, L.W., Wheat, J.D., Rhode, E.A., and Firch, G. (Univ. California, Los Angeles): THE TREATMENT OF CHRONIC LEAD POISONING

IN HORSES WITH CALCIUM DISODIUM ETHYLENE-DIAMINETETRAACETATE. Journal of the American Veterinary Medical Association 123:383-8 (Nov.), 1953.

Seven horses (6-8 yr old) were presented to the University clinic, 3 at first and 4 2 wk later. They had been quartered on a pasture 2 mi from a smelter and within its smoke zone. The owner stated that several horses had died earlier; livers taken from the dead animals were submitted for toxicologic examination. One of the 3 was edematous in belly and legs; 2 and 3 had pharyngeal paralysis and were roarers; 3 also showed Pb line on gums, pneumonic signs, and died 48 hr after admission. From preliminary analyses of blood, urine, feces and liver and clinical examination, a diagnosis of chronic Pb poisoning was made. The 2 survivors and the 4 admitted later, showing the same signs but not as marked, were treated with CaEDTA in a 2% solution, administered iv at 1.0 g/30 lb body weight at a drop rate of 6-80/min. No untoward effects were noted except in 1 that had first received the injection at 80-100 drops/min. The edematous animal did not respond to treatment as did the others. The authors believed that the edema was due to Pb-induced nephritis, although no function tests were made.

- 543 Holm, L.W., Rhode, E.A., Wheat, J.D., and Firch, G. (Univ. California, Davis): TREATMENT OF ACUTE LEAD POISONING IN CALVES WITH CALCIUM DISODIUM ETHYLENEDIAMINETETRAACETATE. Journal of the American Veterinary Medical Association 123:528-33 (Dec.), 1953.

Seven calves were poisoned orally with a single dose of Pb acetate (1 g/5 lb body weight) to study the effect of CaEDTA therapy. Blood, urine, and feces samples were taken before and during the experimental period. Subcutaneous CaEDTA treatment (1 g/30 lb body weight as a 25% solution) was started when marked central nervous system disturbances were observed and when the animals were considered to be in grave danger. A table showing the schedule of treatment for each animal is given. Four of the animals survived. Marked clinical improvement was noted soon after initiation of treatment; nervous signs disappeared after 24 hr; dullness persisted for 3 days; animals began eating on 2nd-4th days after treatment was started; vision began to return 4-5 days after treatment, becoming normal within a week. One calf recovered after a single course (4 days) of treatment; 3 were given a 2nd course after a 9-day lapse. One calf died before any treatment could be instituted, 1 died with typical signs of Pb poisoning 3 days after the 1st treatment, and 1, after having made an apparent recovery, fell dead on the 13th day after poisoning as she was being prepared for a 2nd series of treatment. One calf that recovered was killed 41 days after treatment to determine residual Pb in the tissues. Necropsy of these 4 animals showed the Pb contents to range in mg/100 g: kidney cortex, 0.29-6.88; liver, 0.34-4.10; rumen contents, wet and dry, 5.5-76.0 and 40-380. A striking difference in the Pb level of rumen contents between 2 of the animals was attributed to the use of Mg sulfate, which presumably caused purgation and the lowering of the rumen reservoir.

Distribution curves of Pb in blood, urine, and feces for the surviving calves during the course of Pb poisoning and CaEDTA treatment are given. The 2nd course of treatment with 1 calf raised the urinary output of PbEDTA significantly, but the increase in excretion of the other 2 was not marked, indicating more complete complexing of the tissue Pb with CaEDTA during the course of the 1st treatment of these 2.

In conclusion the authors state that the 4 calves that survived made remarkable recoveries, urinary and fecal Pb levels indicating that CaEDTA promoted rapid urinary excretion and enhanced biliary excretion of Pb complexed as PbEDTA.

- 544 Horiuchi, K., and Miki, M. (Osaka City Univ., Japan): INDUSTRIAL LEAD POISONING. VI. DISTRIBUTION OF LEAD IN EXPERIMENTAL ANIMALS. 1. LEAD CONTENTS IN BLOOD AND URINE OF GUINEA PIGS. Igaku to Seibutsugaku (Med. and Biol.) 27:197-9, 1953.

The contents of Pb in blood and urine of guinea pigs, as determined by the flame spectrophotometric method were 23 (SE,  $\pm 2.02$ ) and 15.6 (SE,  $\pm 2.29$ )  $\mu\text{g}/100\text{ g}$ , respectively. From observed values theoretical distribution curves for Pb in blood and urine were presented. (From Chemical Abstracts 48:1581, 1954)

- 545 Horiuchi, K., Owada, K., Takada, I., Ida, N., Fukumura, S., Imamura, Y., and Tamori, E. (Osaka City Univ., Japan): INDUSTRIAL LEAD POISONING. VII. UPTAKE, DISTRIBUTION, AND ELIMINATION OF LEAD. 1. AN EXPERIMENT WITH RaD. Igaku to Seibutsugaku (Med. and Biol.) 28:226-9, 1953.

RaD was used as a tracer in the study of the fate of Pb in Pb-poisoned guinea pigs. RaD was much increased in the blood at 2-6 hr after injection, and decreased thereafter; it was more abundant in blood cells than in serum. RaD was excreted in the urine immediately after injection, and the amount of excretion decreased with time, while the excretion of RaD in the feces showed a maximum at 3-4 days after injection. At a later stage of the experiment, excretion of RaD in the feces was usually larger than in the urine. Little RaD was found in brain and muscle after injection. The contents of RaD in the spleen and kidney increased gradually with time, while in the liver the content was larger in the early stage than later. More RaD was found in bone than in any other organ tested. (From Chemical Abstracts 48:1581, 1954)

- 546 MacDonald, N.S., Ezmirlian, F., Spain, P., and Rounds, D.E. (Univ. California Med. School, Los Angeles): AGENTS DIMINISHING SKELETAL ACCUMULATION OF LEAD. A.M.A. Archives of Industrial Hygiene and Occupational Medicine 7:217-20 (Mar.), 1953.

A preliminary search for readily available chemical agents, suitable for iv administration and possibly of use in therapy of poisoning by metals which accumulate in bone, was carried out. Young male rats (mean weight 78 g) were placed in 11 groups of 25 each; 10 from a group each received iv 25 mg Pb/kg (as aqueous Pb acetate solution), followed 1/2 hr later by test agent; another 10

received the test agent, followed 1/2 hr later by Pb; the remaining 5 served as controls, receiving Pb but no agent. After 1 day, the femurs and livers were removed and analyzed for Pb by a polarographic technique. The materials tested were  $\text{Na}_4$  salt of ethylenediaminetetraacetic acid, casein hydrolysate, pectin, a copolymer of methylvinyl ether and maleic anhydride (PVM-MA), glucuronolactone, oxypolygelatin, polyvinylpyrrolidone, dextran, Na thiosulfate, and a hydrolyzed polyacrylonitrile ("krildium"). The first 4 agents significantly reduced the bone burden of Pb and the first 7 agents showed enough promise to merit further detailed evaluation. The liver burden of Pb also tended to decrease in the cases where the bone burden was lowered.

- 547 MacDonald, N.S., Nusbaum, R.E., Ezmirlian, F., Barbera, R.C., Spain, P., and Rounds, D.E. (Univ. California, Los Angeles): MECHANISMS IN SKELETAL ACCUMULATION OF IONS. Archives of Biochemistry and Biophysics 43:118-26 (Mar.), 1953.

The deposition of Sr and of Pb in the femurs of white male rats (120 used for Sr and 60 used for Pb) as a function of parenteral dosage was studied. A single intraperitoneal injection was administered and the content of metal ion determined after 24 hr. Dosages ranged from 0.10-75.00 mg of  $\text{Sr}^{++}$ /200 g body weight and from 0.03-6.00 mg/200 g body weight in the case of Pb. The uptake indicated that at least 2 modes of accumulation occurred. The dominant process at low doses was described satisfactorily by an equation of the same form as the Langmuir gas adsorption isotherm. However, an abrupt discontinuity in the graph of the data appeared as the dose was increased. This departure from linearity was interpreted as the point where saturation of the initial mode of deposition was attained. The values of these saturation levels for Sr and Pb were 125 ppm and 60 ppm, respectively. The various compartments in which the cation might conceivably be found in bone were discussed. It was estimated that if the 1st stage saturation were the result of adsorption or ionic exchange at surfaces of bone salt crystals, the average burden would be  $\sim 32$  atoms of Sr/crystal and 6/crystal in the case of Pb. However, the combining power of the sulfate present in the organic matrix of bone could equally well account for the binding of the saturation levels of Sr and Pb.

- 548 Matusevich, Ya.Z.: (THE THERAPEUTIC BEHAVIOR OF ASCORBIC ACID IN EXPERIMENTAL LEAD POISONING OF RABBITS.) Trudy Leningrad. Sanit.-Gigien. Med. Inst. 14:62-5, 1953.

In Group 1, 8 rabbits received daily doses of 15 mg/kg of Pb. In Group 2, 7 rabbits received, in addition to Pb, ascorbic acid at 10 mg/kg. Loss of weight due to Pb poisoning in the 2 groups was 17.7 and 17%, respectively. Average longevity from the 1st day of Pb administration was 41.9 and 48.3 days. During the period of intoxication Pb elimination in urine was an av 0.420 and 0.312 mg. Daily elimination of ascorbic acid in the urine of Group 1 was 2.442 mg, and in Group 2 1.243 mg during the period of intoxication as compared with 1.380 mg and 2.440 mg before Pb admin-

istration. In the muscles, lungs, liver, spleen, and kidneys of Group 2 the Pb content was 8 times as great as in Group 1. Administration of ascorbic acid prolonged the life of the Pb poisoned rabbits, increased the tissue tolerance to Pb by allowing more of the Pb to be retained by the tissue and resulting in a lesser elimination of it via the urine. (From Referat. Zhur. Khim. Biol. Khim. 1955, No. 7277; Chemical Abstracts 50:5916, 1956)

- 549 Morelli, A., and Preziosi, P. (Univ. Naples, Italy): Variazione di alcuni indici biologici per intossicazione da piombo tetraetile. (VARIATION OF SOME BIOLOGICAL INDEXES IN THE INTOXICATION WITH TETRAETHYL LEAD.) Bollettino della Società Italiana di Biologia Sperimentale 29:1453-5 (July), 1953.

After intoxication of 3 rabbits with TEL (50 mg/kg, 10 mg/kg, solvent only), there were changes in glycemia (decrease), azotemia (increase), cholesteroemia (decrease), and proteinemia (great decrease); no change was noted in bilirubinemia. Reactions of Takata and Hanger were impossible to determine on account of the low protein content.

- 550 Morelli, A., and Preziosi, P. (Univ. Naples, Italy): L'azione del piombo tetraetile sulla pressione arteriosa e sul respiro. (ACTION OF TETRAETHYL LEAD ON ARTERIAL PRESSURE AND ON RESPIRATION.) Folia Medica (Naples) 36, No. 7:526-37, 1953.

Intravenous injection of small doses of TEL caused in the unanesthetized rabbit hypotension and respiratory stimulation; larger doses caused hypertension and respiratory depression. The hypotensor effect was proportional to the dosage, but the pressor effect was quite inconstant. (From authors' summary)

- 551 Morelli, A., and Preziosi, P. (Univ. Naples, Italy): L'azione del piombo tetraetile sul sistema nervoso vegetativo. (ACTION OF TETRAETHYL LEAD ON THE AUTONOMIC NERVOUS SYSTEM.) Folia Medica (Naples) 36, No. 7:538-50, 1953.

Intravenous injection of 0.001-10 mg TEL/kg in acacia-gum suspension caused in the nonanesthetized rabbit an increase of the depressor action of acetylcholine (ACh); higher doses prolonged but reduced the intensity of the ACh action. The hypotensive effect of histamine was accentuated, but the pressor effect, if present, was abolished. Small doses accentuated the pressor effect of adrenaline, high doses reduced it. Small doses increased the effect of the stimulated peripheral vagus; large doses prolonged the duration but reduced the intensity of this effect. It augmented progressively with dose and reflex effect of the depressor nerve. Small doses increased, large doses decreased the vasomotor reflexes of the carotid sinus. The central vagus end was progressively stimulated. The respiratory inhibition by adrenaline, ACh, and histamine was abolished, but that produced by stimulation of the central vagus or depressor end was stimulated.

- 552 Morelli, A., and Preziosi, P. (Univ. Na-

ples, Italy): Rilievi sull'intossicazione subacuta da piombo tetraetile. (THE SUB-ACUTE TOXICITY OF TETRAETHYL LEAD.) Folia Medica (Naples) 36:551-6, 1953.

Ten rabbits were placed in 5 groups of 2 each. One group served as controls; the others received sc from 1-100 mg TEL in alcohol/kg body weight for 10 consecutive days to induce subacute poisoning. From the results it appeared that the individual resistance to TEL varied widely. Symptoms were usually not very characteristic, even when death approached, in contrast to acute poisoning. Hypotension was observed only in some animals. The autonomic nervous system was not markedly affected at the end of treatment.

- 553 Morelli, A., and Preziosi, P. (Univ. Naples, Italy): La fosfatasi acida encefalica in corso di intossicazione subacuta con piombo tetraetile. (ACID PHOSPHATASE IN THE BRAIN DURING SUBACUTE POISONING WITH TETRAETHYL LEAD.) Folia Medica 36:718-22, 1953.

No great variation of acid phosphatase was determined in the various parts of the brains of rabbits which were either acutely or subacutely intoxicated with TEL by iv injection in doses of 60-90 mg/kg in gum arabic or 10 and 50 mg/kg in a 95% alcohol solution for 10 consecutive days sc. The control group received the solvent equal in amount to that received by the TEL-poisoned group in 10 days.

- 554 Morelli, A., and Preziosi, P. (Univ. Naples, Italy): Rilievi ematologici nell'intossicazione subacuta da piombo tetraetile. (HEMATOLOGY IN SUBACUTE POISONING WITH TETRAETHYL LEAD.) Folia Medica (Naples) 36:723-8, 1953.

Rabbits, 1100-1500 g in weight, were placed in 5 groups of 2 animals each, which received sc TEL, dissolved in 95% alcohol, in doses of 1, 10, 50, or 100 mg/kg daily for 10 days; controls received the solvent only. The following were examined: hemoglobin content, red and white blood cells, basophilic stippling, form and color of erythrocytes, differential formula, cellular resistance, and the bone marrow. The results, presented in 2 tables, led the authors to conclude that the peripheral blood picture and the bone marrow are not markedly affected by TEL, nor is the resistance of the blood cells changed.

- 555 Morelli, A., and Preziosi, P. (Univ. Naples, Italy): Ripartizione del piombo in animali intossicati in modo acuto e subacuto con piombo tetraetile. (DISTRIBUTION OF LEAD IN ANIMALS POISONED ACUTELY OR SUBACUTELY WITH TETRAETHYL LEAD.) Folia Medica (Naples) 36:788-800 (Oct.), 1953.

The amounts of Pb recovered from the organs of rabbits poisoned with TEL, iv (1.111-150 mg/kg) or sc (1-150 mg/kg, both for 10 days, in gum arabic), to induce acute and subacute poisoning respectively did not differ appreciably in the 2 groups. The highest values were found in the adrenals and the lungs, and the lowest, except for 1 rabbit, in the brain. In acute intoxication the lung predominated in deposition of Pb (except for 1

rabbit on the lowest dosage), followed by the adrenal. In subacute poisoning this order was reversed. In the other organs examined (kidney, liver, spleen, heart, bones, and embryo), no noteworthy differences between the organs were observed. The data are presented in 4 tables both quantitatively and relatively, by assigning 100 to the adrenal content of Pb, and in bar graphs. The high amount found in the adrenal indicated to the authors a selective distribution in some organs and tissues. The relationship between Pb content and histologic findings is reported in the following publication.

- 556 Morelli, A., and Preziosi, P. (Univ. Naples, Italy): Reperti istopatologici nell'intossicazione subacuta da piombo tetraetile. (HISTOPATHOLOGY IN SUBACUTE POISONING WITH TETRAETHYL LEAD.) Folia Medica (Naples) 36:801-32 (Oct.), 1953.

Detailed histologic studies were performed on the kidneys, liver, spleen, pancreas, lung, heart, brain and adrenals of rabbits (1.100-1.400 kg weight) subjected to subacute poisoning by the administration of 1, 10, 50, and 100 mg TEL (in 95% alcohol)/kg; 2 rabbits were used at each dosage; controls received the solvent only. Particular attention was paid to relationships between histologic findings and the amount of dose, quantity of Pb found in the organs, and biological changes. In their conclusions, the authors point to the congestive hemorrhagic and degenerative lesions which were of marked severity in the adrenals, lung, liver, myocardium and kidney. They also point out that in the brain lesions such as would have been expected from the neurologic syndrome characterizing human poisoning, were not encountered or were only little evident. The most severe degeneration was seen in the adrenal cortex. Also conspicuous were the myocardial lesions, accompanied by noteworthy quantities of Pb; kidney exhibited diffuse bilateral nephrosis. The liver lesions were less intense. The authors consider that these findings could explain some of the disturbances encountered in human poisoning. (15 references)

- 557 Mosinger, M., and Fiorentini, H.: Sur la pathologie de l'intoxication saturnine expérimentale. (PATHOLOGIC FINDINGS IN EXPERIMENTAL LEAD INTOXICATION.) Travaux du 26 Congrès International de la Médecine Légale, Médecine Sociale et Médecine du Travail de Langue française 1953:491-7.

Eighteen guinea pigs received 2-6 subcutaneous injections per week of 1% aqueous Pb acetate solution in doses of 0.1-1 ml for 4 mo. Three of the animals which had been given 13 injections of 0.5 ml Pb solution/mo, received in addition daily injections of 5 mg ACTH. The pathologic and histologic findings illustrated by photographs were characteristic. These were: (1) in the liver changes pointing to diffuse parenchymatous damage, insular necrotic processes and parenchymatous as well as periportal histiolympoid infiltrations. With simultaneous administration of ACTH the lesions were still more intense and approached the picture of acute liver atrophy. (2) In the adrenal cortex there was diffuse hypertrophy with hyperlipoidosis of the funicular zone; the latter

was absent when ACTH was administered, but in contrast, more degenerative changes. (3) In the medulla of the adrenal gland, the volume of which was not changed, there were large cells with spongy, vacuolated plasma and nuclear hypertrophy or pyknosis; with ACTH on the other hand, a degenerative medulla atrophy. (4) In the reticuloendothelium of the lymph nodes, of the bone marrow, the lungs, liver and kidneys, typical reactions which could be designated as Pb reticuloendotheliosis, intensified by ACTH, was especially noteworthy. (5) Hematologically, there was a marked, progressive anemia with red cells dropping to 1.6 million, and a leukocytosis (108,000) with partial relative lymphopenia. The other cellular constituents (eosinophils, basophils, and monocytes) remained unchanged. ACTH had no effect on the hematologic changes. (From *Deutsche Zeitschrift für die gesamte gerichtliche Medizin* 45:107 (Abstracts), 1956)

- 558 Miyoshi, Y. (Univ. Tokyo, Japan): DISTRIBUTION OF LEAD IN BLOOD CONSTITUENTS: II. LEAD DISTRIBUTION IN BLOOD OF EXPERIMENTALLY LEAD-POISONED GOATS. *Journal of the Science of Labor* (Japan) 29:557-62, 1953.

The ratio of Pb concentration in plasma to that in corpuscles increased with the amount of Pb in whole blood. The relation between the 2 was expressed by  $y = 51.01 X x^{0.540}$  (similarly parabolic with human blood whose corpuscles, however, take less Pb). With the same y, x was slightly higher in vivo than in vitro, explainable by the assumption that the plasma and corpuscles of Pb-poisoned goat blood changed more physicochemically than those of normal blood. (From *Chemical Abstracts* 48:7803, 1954).

- 559 Ottaviano, G., and L'Abbate, S. (Univ. Catania, Italy): Prime ricerche sull'azione della 4-mercapto-benzensulfonamide nell'avvelenamento acuto e cronico da piombo. (FIRST STUDIES ON THE EFFECT OF 4-MERCAPTO-BENZENESULFONAMIDE ON ACUTE AND CHRONIC LEAD POISONING.) *Bollettino della Società Italiana di Biologia Sperimentale* 29:1219-22 (June), 1953.

The experiments described showed that 4-mercapto-benzensulfonamide (MBS) reacts with Pb acetate in vitro, forming an insoluble compound, which, after administration in vivo (to guinea pigs) is not separable and is thus nontoxic. MBS, administered orally and sc, does not protect the guinea pigs from the toxic effects of Pb, but does not aggravate the toxic syndrome. It is believed that MBS, while reacting with Pb ions with the formation of Pb 4-(sulfonamido) thiobenzene, as has been shown, could form intermediary organometallic compounds that are more soluble and more toxic, or that the administration of MBS could predispose an easier and more rapid absorption of Pb ion. The first hypothesis seems to be more acceptable since BAL also, according to the experiments of Braun, Lusky and Calvery, appears to aggravate the toxic syndrome of Pb by the formation of more toxic complexes.

- 560 Pardoe, A.U., and Weatherall, M. (Dept.

Pharmacol., London Hosp. Med. Coll., England): ANTIDIURETIC ACTIVITY OF EXTRACTS OF THE PITUITARY GLANDS OF LEAD-POISONED RATS. *Journal of Physiology* 119, No. 1:16P, 1953.

Nicotine delays diuresis considerably more in Pb-poisoned rats than in normal rats. Among possible factors concerned in the increased response is a greater formation and liberation of antidiuretic hormone in the pituitary gland. The amount of antidiuretic activity in saline extracts of the pituitary glands of rats poisoned with Pb acetate and of controls treated with Na acetate has therefore been assayed by iv injection into rabbits and sometimes into rats. The pituitary glands of the Pb-poisoned rats nearly always had more antidiuretic activity than the controls (av 540 compared with 420 milliunits/100 g body weight) and the mean difference was statistically significant ( $t = 4.275$ ,  $P < 0.01$ ). Differences in body weight were small and did not account for these differences. The increase in antidiuretic activity is comparable in magnitude to that seen in rats which have been dehydrated for 48 hr (Ames and Van Dyke, 1950). Its occurrence in Pb poisoning may represent a direct effect on the cells of the hypophysis or be secondary to changes in water metabolism elsewhere in the body (Pardoe and Weatherall, 1952).

- 561 Pribilla, W., and Achenbach, W. (Univ. Köln, Germany): Experimenteller Beitrag zur Bleianämie des Kaninchens. (THE ANEMIA OF LEAD POISONING IN RABBITS.) *Ärztliche Wochenschrift* 8:204 (Feb. 27), 1953. Treatment with Co and folic acid of Pb-induced anemia was attempted in 16 rabbits of approximately the same weight. In preliminary tests, their sensitivity to Pb varied markedly, but with 4 x 10 mg/kg Pb acetate (1% solution intravenously for 4 days) it was possible to achieve an anemia of approximately even severity in all animals. This dose was given to all 16 animals. Of the 16, 8 received, in addition, Co (9 mg/day intramuscularly) and 4, folic acid (15 mg/kg/day). The injections were started 1 day before Pb administration and were continued until a distinct increase in the blood values was observed. One Pb-folic acid animal died early, leaving 15 animals for evaluation.

Erythrocytes and hemoglobin (Hb) decreased: The lowest Hb value in the 4 untreated animals occurred after 5-9 days, reaching 32-45% of its initial value. Of the 8 Pb-Co animals, 7 reached their lowest Hb value between the 5th and 7th days, 1 animal on the 11th day amounting to 15-53% of the initial value (mean decrease 30%). The 4 Pb-folic acid animals reached their lowest Hb value (25-31% of the initial value) on the 5th-7th days. There was no significant difference in the time during which the Hb returned to its initial values in the 3 groups of animals; thus, an influence of Co or folic acid upon Pb-induced anemia was not observed.

For inducing fatal Pb intoxication, the animals, after an interval of several weeks and return of their blood levels to normal, received 20 mg/kg Pb acetate on the 1st day, and 30 mg/kg on the following days until their death. Co and folic acid were again given as above. The survival time

of the untreated animals was 4-6 days, of the Pb-Co animals, 4-10 days (av 6.5 days), and of the Pb-folic acid animals, 4, 7, and 10 days. Thus, neither Co nor folic acid proved to be of efficacy in prolonging the survival span of the Pb intoxicated animals. The authors, therefore, do not believe that prophylactic folic acid administration to Pb exposed workers is useful.

- 562 Rieders, F. (Jefferson Med. Coll., Philadelphia, Pa.): ACTION OF DIMERCAPROL (I) AND OF ETHYLENEDIAMINE TETRAACETIC ACID (II) ON LEAD IN TISSUES. Federation Proceedings 12:1188 (Mar.), 1953.

Affinities of (I) and (II) for Pb were compared at various pH values, in presence and absence of plasma by electrometric measurements and by partitioning Pb between chloroform solutions of dithione and buffered aqueous solutions of (I) or (II). Abilities of (I) and (II) to remove Pb from isolated tissues of rabbits which had received Pb by slow intravenous infusion (10 mg/kg) were compared. Erythrocytes, long bones and slices of liver, kidney, striated muscle, small intestine, brain and spleen were incubated with (I) or (II) in buffer. Aliquots of supernatant were withdrawn at 1/2 hourly intervals; these and tissue residues were analyzed for Pb content. In conjunction with data on the effects of (II) on urinary excretion of Pb and coproporphyrin III and on blood levels, the relative efficiencies of (I) and (II) with respect to de-leading of tissues in vitro and in vivo will be discussed. Dependence of rate and extent of complexation of Pb by (I) or (II) on pH, drug concentration and presence of plasma components as well as cell accessibility and permeability will also be considered.

- 563 Sano, S. (Kyoto Univ., Japan): THE EFFECT OF BAL UPON LEAD POISONING. Japanese Journal of the Nation's Health 22:266-75, 1953.

Animals treated with BAL showed a Pb excretion in urine and feces 2-3 times greater than untreated animals did, and the Pb contents in blood, bones, livers and kidneys decreased remarkably after treatment of acute Pb poisoning. In subacute and chronic cases Pb excretion appears to be unaffected after BAL treatment. The increase of Pb excretion was due to the increased excretion of Pb from the blood and soft tissues, and was not due to the mobilization of the Pb in bones.

- 564 Sano, S. (Kyoto Univ., Japan): THE EFFECT OF SODIUM CITRATE UPON LEAD POISONING. Japanese Journal of the Nation's Health 22:276-9, 1953.

An injection of 5 mg Pb as Pb acetate into the heart of a guinea pig or exposure of rats to inhalation of Pb powder and oral administration of 1 g Na citrate daily to guinea pigs or 0.3 g Na citrate/kg to rats did not give sufficient effect on Pb excretion; in chronic cases, treatment of Na citrate caused marked increase of Pb excretion in urine while there was no change in fecal excretion of the Pb.

- 565 Taylor, A., Carmichael, N.: THE EFFECT OF METALLIC CHLORIDES ON THE GROWTH OF TUMOR

AND NONTUMOR TISSUE. University of Texas Publication No. 5314, Biochemical Institute Studies 5, Cancer Studies 2:36-79 (July 15), 1953.

A series of 33 metallic chlorides (Cl) and 4 metallic nitrates (N-O) were tested at various dosages for their effect on the growth and survival of chick embryos, and the tumors and embryos of eggs bearing yolk sac implants of a mouse mammary adenocarcinoma. The same series of compounds was also tested at various dosages for their effect on dba mice, and dba mice bearing transplants of a sarcoma.

Eleven-day chick embryos were used in 222 experiments involving 2484 eggs, and tumor-bearing eggs were used in 118 experiments with 2403 eggs. In the mouse experiments, nontumor-bearing mice were used in 41 experiments involving 490 animals, and mice bearing sarcoma transplants were used in 152 experiments including 2283 animals.

The 10 most toxic compounds in 5-day tests with 11-day chick embryos, and 1-day tests with the embryos of tumor-bearing eggs were, beginning with the most toxic CdCl, HgCl, PbN-O, AgN-O, TlCl, PbCl, CuCl, CoCl, LiCl, RhCl. In the tests with PbN-O (some were also made with PbCl), a dose of 0.1 mg injected into the yolk sac caused development of meningoceles in many of the chick embryos. The growth of tumors was accelerated by injection over the chick membrane of 0.1 mg; the same dose injected into the yolk sac inhibited tumor growth.

The growth of egg-cultivated tumors was inhibited 70-99%, and the host embryos, 10-29%, by CoCl, MgCl, HgCl, NdCl, RbCl, AgN-O, SnCl, and SrCl.

- 566 Tsuchiya, K., Kondo, H., Hoshi, Y., and Nakai, S. (Keio Univ., Tokyo, Japan): CORRELATION BETWEEN HEPATIC FUNCTION AND LEAD IN BLOOD, URINE AND FECES IN EXPERIMENTAL LEAD POISONING. Journal of Science of Labour 29:484-7, 1953.

In goats injected subcutaneously with 10-20 mg Pb/kg body weight every other day for 10 days Pb was excreted mostly in feces while the hepatic function was not impaired. After the impairment Pb in urine decreased below normal, the serum albumin/globulin ratio decreased, and bilirubin in plasma increased. The urinary coproporphyrin was variable. With an increase of Pb in blood the erythrocyte and hemoglobin counts decreased, and reticulocytes and basophilic stippled cells appeared.

- 567 Valade, P., and Coste, E. (Bouchet Res. Center, Paris, France): Toxicité de sels organiques de plomb. (Étude expérimentale.) (TOXICITY OF ORGANIC LEAD SALTS. EXPERIMENTAL STUDY.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 14:584-93, 1953.

Eight groups of animals, each containing 1 dog and 2 rabbits, 2 also containing 2 guinea pigs, were exposed to dusts of Pb stearate and Pb acetyl-salicylate 20 times for 30 min over a period of 2 mo. Dust concentrations were 333 mg/m<sup>3</sup>; 95% of the particles were 1μ in diameter and 5%, 3μ. The effects of the 2 compounds were similar. Loss of weight was the only clinical sign noted. Hemato-



logic studies showed nucleated erythrocytes, polychromatophilia, anisocytosis, basophilic stippling, but no anemia. The liver was enlarged, yellow and showed fatty degeneration leading to degenerative hepatitis and cirrhosis. Renal lesions were found in the glomeruli and convoluted tubules, and the lungs showed the general signs of defense against the presence of foreign particles. The microscopic appearances of these lesions were illustrated.

Pb salts were detected histochemically in the tissues and organs (method of Frankenberger, Cretin), mainly in the cells of the reticuloendothelial system.

The authors concluded that organic Pb salts were toxic to animals, and thus probably to man.

- 568 Wanntorp, H., and Brickman, S.: Blysulfidens och blyslagens toxicitet för idisslare. (TOXICITY OF GALENA AND OF LEAD SULPHIDE FOR RUMINANTS.) Nord. Vet. Med. 6:306-30, 1953.

The authors mentioned 6 outbreaks of Pb poisoning in sheep and cattle, caused by the ingestion of galena (a mineral containing Pb sulfide) which had fallen from motor or railway trucks, and described the experimental reproduction of poisoning by administering the mineral to 6 sheep and a calf. The dose of galena necessary to produce symptoms depended on the time that had elapsed since the mineral was dug; galena which had been stored for 4 yr or longer was considerably more toxic than the freshly-dug material, probably as a result of oxidation of sulfide to sulfate. (From Veterinary Bulletin 24:3621, 1954)

- 569 Zaitseva, A.F. (Dept. Communal Hyg., Lenin Med. Inst., Moscow, USSR): Eksperimental'nye issledovaniya k gigenicheskomu obosnovaniyu predel'no dopustimoi kontsentratsii svintsa v vode vodoemov. (EXPERIMENTAL DETERMINATION OF PERMISSIBLE TOLERABLE CONCENTRATION OF LEAD IN WATER-STORAGE RESERVOIRS.) Gigiena i Sanitariya 1953, No. 3:7-11.

In experiments with mice which received aqueous solutions of 5, 0.5, 0.05, and 0.005 mg Pb/kg body weight for 4 mo, changes in conditioned reflex response were observed at the lowest dose used. The author finds the limit concentration set for drinking water by the USSR standard of 0.1 mg/l, beyond which it may affect self-purification by biological means, to be correct. Taste of the water is not affected by even higher concentrations.

- 570 Zollinger, H.U. (Univ. Zürich, Switzerland): Durch chronische Bleivergiftung erzeugte Nierenadenome und -carcinome bei Ratten und ihre Beziehungen zu den entsprechenden Neubildungen des Menschen. (KIDNEY ADENOMAS AND CARCINOMAS IN RATS CAUSED BY CHRONIC LEAD POISONING AND THEIR RELATIONSHIP TO CORRESPONDING HUMAN NEOPLASMS.) Virchow's Archiv für Pathologische Anatomie und Physiologie und für Klinische Medizin 323:694-710 (July), 1953.

In addition to 270 white rats weighing 150-180 g, that were injected subcutaneously once a week with 1 ml of a 2% Pb phosphate suspension providing 20

mg, 40 controls were used. The total dose received varied from 40-760 mg. A part of the rats were sacrificed during the injection period, but a large number died spontaneously. Among the latter, histologic examination was possible in 112. Of these, 21 had neoplasms. In those that survived 10 mo or more a very high percentage (19 of 29) showed adenomas, papillomas, and cystadenomas of the kidney cortex. In 3 cases adenocarcinomas were detected. The first appearance of tumors occurred in the 4th mo. There was no direct relationship between time of exposure and frequency of neoplasms. The smallest dose producing a tumor was 120 mg. Investigations of changes in the kidneys showed increase in size of kidneys, increase in the size of the nuclei, disturbance of mitosis, polymorphia, deposition of Pb salts in the distal tubules, pigment droplets in the tubular epithelium, little fibrosis of the stroma, occasional hypertrophy of arterioles, and no changes in the glomeruli. All indications pointed to a direct action of Pb on nuclear metabolism followed by an inhibition of mitosis.

The author concludes that in regard to renal damage, Pb seems to have a radiomimetic ability in the way it disturbs the metabolism of the nucleus with secondary hyperplasia. However it is most probable that processes of regeneration after epithelial necrosis play a part in the development of tumors. However these processes as a cause for tumor development are far less important in rats than in human kidneys. Hormonal stimulation of hyperplasia seems not to be present. Kidney tumors resembling hypernephroma were not detected in the experiment.

## 1954

- 571 Adam, K.R., and Weatherall, M. (Univ. Edinburgh; London Hosp. Med. Coll., England): OBSERVATIONS ON DITHIOLS AND THE DISTRIBUTION OF LEAD IN RABBITS. Journal of Pharmacology and Pharmacology 6:403-9 (June), 1954. Dimercaprol (BAL) promotes the excretion of Pb from the body. It is a dithiol, and there are others which might be more effective. Dimercaprol glucoside (DG), which has a low toxicity, dimercaptopropionic acid (DP), 1,3-dimercaptopropanol, and 1,4-dimercaptoerythritol were chosen for an examination of their effect on the distribution of Pb in the body. Pb chloride or Pb acetate, containing  $^{210}\text{Pb}$  or  $^{212}\text{Pb}$ , was injected iv into rabbits in doses of 0.01 mM (2.07 mg Pb)/kg or 0.1 mM (20.7 mg Pb)/kg. Either 1 and 5 hr later, the dithiols were injected im in 2 doses of  $\mu\text{M/kg}$  as follows: BAL, 400 and 100; the above thiols, 600 and 150; 90 and 22.5; 100; 500 and 125, respectively. DG was studied more extensively, with repeat dosage at 19 and 23 hr after poisoning. The animals were killed 24 hr later, Pb in the tissues was estimated by measurement of their radioactivity by means of a Geiger counter. DG produced a total excretion in 23 hr of up to 30 or 40% of the Pb given. The quantity of Pb was reduced not only in the liver and bone marrow, but also in the kidneys, blood cells and bone. In the urine and bile considerable increases occurred, accounting for most of the Pb removed from the tissues.

The overall results showed DG and DP to be sub-

stantially more effective than BAL in promoting the excretion of Pb in the urine. The other dithiols were not more effective. After DG, the Pb remaining in the body was distributed more uniformly than in the control animals. After a 10-fold increase in the dose of Pb inequalities in distribution were exaggerated. BAL and DG caused a bigger absolute increase in the excretion of Pb after this dose than after the smaller dose. Relatively to the dose of Pb, they were less effective.

The authors discuss the results on the basis that Pb combines reversibly with various receptors in the soft tissues, or with dithiols, and in each reaction an equilibrium is reached. Bone takes up Pb more slowly than the soft tissues and Pb so taken up is much less dissociable. More Pb is excreted while the dithiol is given, and the rise in tissue-Pb thereafter is to a lower level than before treatment; similarly the bone-Pb reaches a lower final level.

- 572 Aleksieva, Ts. (Sci. Res. Inst., Ind. Hyg. Occup. Dis., Bulgaria): Ultravioletovoto oluchvane kato profilaktichno sredstvo pri olovno otravyane. (Predvaritelno sobshchenie.) ULTRAVIOLET IRRADIATION AS A PREVENTIVE MEASURE IN LEAD POISONING; PRELIMINARY COMMUNICATION.) *Suvremenna Medicina* (Sofia) 5, No. 6:17-26, 1954.

Pb-poisoned guinea pigs exposed to ultraviolet irradiation survived longer than those not so exposed.

- 573 Ambrosio, L., and Mazza, V. (Univ. Naples, Italy): Comportamento del lisozima nel siero di sangue e negli organi nelle intossicazioni sperimentali (piombo, benzolo, manganese). (BEHAVIOR OF LYSOZYME IN THE BLOOD SERUM AND IN SOME ORGANS IN EXPERIMENTAL POISONING (LEAD, BENZENE, MANGANESE).) *Rivista dell'Istituto Sieroterapico Italiano* 29:252-62, 1954.

Above poisonings were induced in groups of 4 dogs each. Pb was given by gastric tube (aqueous solution with 0.10 g Pb acetate) on alternate days for 50 days; 1 dog died on day 41 and 1 on day 35. Lysozyme activity, determined by Caselli's method, decreased progressively, with severity of poisoning. In 1 dog, it dropped from 61-16 units after 10 days and remained at this level. In the organs, greatest decrease was in the spleen, followed by the kidney and liver. Hardly any reduction was seen in the lungs, heart and gastric mucosa. Decreases were also observed in the experiments with benzene and Mn. Those by benzene were correlated to decreases in neutrophils; as to Pb and Mn, reticuloendothelial tissue disorders were held responsible.

- 574 Aub, J.C. (Massachusetts Gen. Hosp., Cambridge): BONE METABOLISM STUDIED BY RADIOACTIVE LEAD AND RADIUM. *Indian Journal of Child Health* (Bombay) 3:601-7, 1954.

In reviewing his studies, the author shows that bones are not static, but are rapidly changing in their structure throughout life. This change is more marked in children than in adult life, but

the exchange of salts goes on in both periods. The metabolism of the trabeculae is very rapid and can be dramatically influenced by changes in the rate of Ca metabolism. The metabolism of the cortex is very slow. Great influences on it or on dental dentine would be difficult to produce except with a very long lasting strain on bone metabolism.

His group used radioactive Pb or Ra for the studies discussed, because their metabolism runs parallel to Ca in bones and their radioactivity lasts for years. Experiments with animals (cats and dogs) showed that in cats on a 12 wk long low-Ca diet the trabeculae practically vanished from the bones while the hard structure of the cortical bone remained essentially unchanged. Films taken after treatment with radioactive Pb showed that fresh inorganic salts were deposited and the location of this deposition. Pb radiation was greatest in the trabeculae while there is little activity in the cortex. As the bone grew the Pb which was present in the spongiosa near the epiphysis continued to be redissolved and redeposited. Bone growth, therefore, has a rapid metabolism of inorganic salts which is analogous to that found in the bone trabeculae. An equilibrium between the salts and the bone spongiosa and in the cortex can be reached, after many years. In teeth of animals after radioactive Pb was injected, the amount of the isotope concentrated in dentine was analogous to that concentrated in the cortex of the bone.

In man this can be studied in children who have ingested painted surfaces. The epiphyseal lines are more dense due to an increased accumulation of Pb and Ca, this phenomenon is known by the name Pb-line.

- 575 Baikie, A.G. (Univ. Dept. Med. Royal Infirmary, Glasgow, Scotland): THE FECAL EXCRETION OF UROBILINOGEN OF NORMAL AND LEAD POISONED GUINEA PIGS. *Blood* 9:461-72, 1954.

The method of Watson for the estimation of fecal urobilinogen (UBG) was modified for use in guinea pigs. Estimations on 3 or 4 day fecal collections gave less variable results than estimations on single day collections. Loss of UBG upon storage to the 3rd or 4th day was small. For normal guinea pigs a mean daily excretion of  $0.23 \text{ mg SD } \pm 0.10$  was found. Serial estimations were carried out of the UBG excretion of guinea pigs before and during experimental poisoning with Pb nitrate. During Pb poisoning there was a statistically significant increased excretion of UBG. This was shown to be correlated with the fall in Hb levels which occurred in the poisoned animals. It is concluded that these results provide confirmatory evidence for the view that hemolysis plays an important part in the anemia of chronic Pb poisoning. (From author's summary)

- 576 Baikie, A.G., and Valtis, D.J. (Royal Infirmary, Glasgow, Scotland): THE OXYGEN CONSUMPTION OF THE BLOOD IN EXPERIMENTAL LEAD POISONING. *British Journal of Experimental Pathology* 35:434-8 (Oct.), 1954.
- Guinea pigs were poisoned by the oral administration of Pb nitrate in doses varying from 75-150

mg daily. Reticulocytosis was produced in other guinea pigs either by repeated withdrawal of blood by cardiac puncture or by administration of anti-guinea-pig red cell serum resulting in hemolytic anemia. Blood for study of O consumption was obtained by cardiac puncture, and after proper preparation, the O content was determined in 1 ml samples, with determination of packed cell volume, red cell count, and total nucleated cell count being carried out in duplicate. The O uptake of the blood of Pb-poisoned guinea pigs was much higher than that of normal animals, and this correlated with the presence of stipple cells, which are a form of reticulocyte. (15 references)

- 577 Bianchi, C., Ambanelli, U., and Salvi, G. (Univ. Parma, Italy): *Ricerche sperimentali sulla azione della beta-mercaptoetilamina nella intossicazione da tetraetile di piombo. (EXPERIMENTAL STUDIES ON THE ACTION OF BETA-MERCAPTOETHYLAMINE ON INTOXICATIONS BY TETRAETHYL LEAD.)* L'Ateneo Parmense 25, No. 6:419-45, 1954.

The technique of Ambanelli and Salvi (1953-4) was used to expose 35 rabbits, in groups of 2 or 3 for 10-35 min to inhalation of air containing 3.5-5.0 mg TEL/l or to TEL-saturated air. Half of the rabbits were treated with  $\beta$ -mercaptoethylamine (MEA; cysteamine,  $\text{NH}_2\text{-CH}_2\text{-CH}_2\text{-SH}$  (Lambratene, Cilag)). Throughout the experiments, the animals were examined as to weight and body temperature. In the 1st experiment, using 20 animals exposed to high concentrations of TEL half of whom were treated with 10 or 14 cg MEA/day iv, 9 survived while all of the 10 controls died in 3-4 days, under constant progressive hypothermia. In a 2nd experiment, in 15 animals exposed to low concentrations for up to 11 days, iv injection of MEA at 10-18 cg/day brought about a greater elimination of Pb in the urine than in nontreated animals or in those treated with a diuretic (urea, iv, 1-1.2 ml of 30% solution). The authors attribute the action of MEA to its metal-chelating properties.

- 578 Calhoun, J.A., McLean, R., Hudson, J.C., and Aub, J.C. (Harvard Univ. Massachusetts Gen. Hosp., Boston): *COMPARATIVE EXCHANGE OF CALCIUM, LEAD, AND RADIOACTIVE LEAD IN DOGS.* A.M.A. Archives of Industrial Hygiene and Occupational Medicine 9:9-22 (Jan.), 1954.

As concluded by the authors, radioactive Pb, used experimentally as an indicator for inert Pb, was toxic to dogs when injected intravenously (iv) in amounts ranging from  $0.2\text{-}2.3 \times 10^{-1}$  mCi/kg. Varying the amount of inert Pb from 0.6-6.7 mg/kg did not seem to influence the survival time. Toxicity appeared to be dependent upon the amount of radioactivity. The average urinary excretion of the tagged Pb analyzed as Ra D was roughly 67% of the total excretion. Parathyroid hormone, low Ca diet, or high Ca diet had no effect on excretion of tagged Pb. This was not in agreement with their previous findings with inert Pb. A possible explanation is discussed. It was doubtful that the toxic effects of radiation seriously impaired the mechanism involved in the response to parathyroid hormone, because this medication caused a satisfactory increase in Ca excretion. As much as 60-

60% of the injected Pb was excreted during the lifetime of the animals which survived some months. Only a small fraction of the stored Pb was present in organs other than bone. Dogs given radioactive Pb appeared to develop uremia after some months. Apparently the azotemia, leukopenia, and physical deterioration in these animals were due to the radioactivity, since the injection of 1.9 and 2.7 mg/kg of inert Pb had no apparent deleterious effects on the health of 2 other animals. The clinical evidence of renal failure was more obvious than the pathological evidence. There were 5 cases of known terminal azotemia, yet only 3 of them showed histological evidence of kidney damage. In fact, 1 animal had a histologically normal kidney in spite of increased permeability of this organ for 2 months before death. (15 references)

- 579 De Rosa, R. (Univ. Naples, Italy): *L'azione dell'alfa-tocoferolo nella intossicazione sperimentale da piombo; comportamento della coproporfirinuria e della crisi ematica. (ACTION OF  $\alpha$ -TOCOPHEROL IN EXPERIMENTAL LEAD POISONING. COPROPORPHYRINURIA AND BLOOD PICTURE.)* Acta Vitaminologica (Milan) 8:167-72 (Aug.), 1954.

See Abstract No. 535.

- 580 Dhar, D.C., and Pradhan, S.N.: *ANEMIA. I. EXPERIMENTAL LEAD ANEMIA IN RATS.* J. Sci. Research (India) 13B:25-30, 1954. Pb acetate injected into rats ip and iv (6 mg/100 g body weight) reduced erythrocyte and hemoglobin values 33 and 30% and with repeated doses 60 and 54%. The anemia reached its peak after 7-8 days and was macronormoblastic in nature. (From Chemical Abstracts 49:508, 1955)

- 581 Elder, W.H.: *THE EFFECT OF LEAD POISONING ON THE FERTILITY AND FECUNDITY OF DOMESTIC MALLARD DUCKS.* J. Wildlife Mgmt. 18:315-23, 1954.

In an attempt to assess the effect on fertility following consumption of Pb shot by ducks, experimental birds were given Pb shot in gelatin capsules, sufficient to produce signs of Pb poisoning. It could not be shown that ingested Pb shot decreases fertility or increases early embryonic mortality. (From Veterinary Bulletin 26:578, 1956)

- 582 Fisher, L.E. (Lincoln Park Zoo, Chicago, Ill.): *LEAD POISONING IN A GORILLA.* Journal of the American Veterinary Medical Association 125:478-9, 1954.

On May 29, 1954, a 9-yr-old male gorilla in the Chicago Zoo showed symptoms of a developing neurological syndrome. It was learned that on April 5 the animal had eaten some red Pb paint from the bars of his cage, which was being repaired. He vomited a short time later and some of the red paint was seen in the vomit. Urine collected on May 30 was positive for Pb at the level of 0.290 mg/l of urine. A second specimen collected June 4 contained 1.235 mg/l. After May 30 the gorilla showed a slight but definite daily improvement. The vitamin B complex factors in his supplement feed were greatly increased and liver was given daily in the diet. By June 13, he seemed entirely normal and no other symptoms had developed.

The author points out that while Pb poisoning has not been commonly recognized in zoo animals, the possibility should be suspected in cases of obscure neurological disorders, especially in those animals that have had access to Pb-containing paints. The diagnosis is made by combinations of Pb determinations in urine, basophilic stippling of the red cells, Pb lines in the gums and in the radiographs of long bones of young growing animals, and by the clinical neurological findings, all in the presence of a clinical history of exposure.

- 583** Graziani, G., Fusco, M., and Rossi, L. (Univ. Naples, Italy): Le variazioni del citocromo c nella intossicazione sperimentale da piombo. (VARIATIONS IN CYTOCHROME C IN EXPERIMENTAL LEAD POISONING.) Abstracts of Meeting of the Campana Society of Legal Medicine, Insurance and Labor, Naples. *Medicina del Lavoro* 45:53 (Jan.), 1954; *Folia Medica* (Naples) 37:73-81 (Feb.), 1954.

The behavior of cytochrome c in the hearts of 8 rabbits poisoned orally on alternate days with 0.20 g of Pb acetate was studied. In preliminary experiments cytochrome c was determined in the hearts of 10 normal rabbits. The method used was that of Fujita with some modifications in order to adapt to photometry with the Beckmann spectrophotometer. A distinct and constant increase in the liver cytochrome c was seen in the poisoned animals. This increase of cytochrome c can be interpreted to mean a compensation and the diminution of oxygen transport in the tissues, either by the anemia caused by the toxic action of Pb or by the diminished activity of codehydrases that enter into the cytochrome chain in the oxidation-reduction reaction of cellular respiration.

- 584** Günther, H. (Veterinary Med. College, Hanover, Germany): Fütterungsversuche mit Flugstaub einer Metallhütte an Pferden und einem Schaf. (FEEDING EXPERIMENTS IN HORSES AND A SHEEP WITH FUME DEPOSITS FROM A METAL WORKS IN GERMANY.) Inaug. Diss. Hanover, 1954, 47 pp.

The author investigated the symptoms in livestock in a region affected by fumes from a metal foundry. These included a condition resembling rickets, swelling of the joints leading to stiffness, and a poor state of nutrition. He reported an experiment in which fume deposits from the foundry in question or from another foundry were mixed with the diet of 3 foals. The result suggested that the Pb content of the fume deposits played an important role in the poisoning. (From *Veterinary Bulletin* 25:4142, 1955)

- 585** Holm, L.W. (Univ. California, Davis): THE USE OF CALCIUM DISODIUM SALT OF VERSENE IN HEAVY-METAL POISONING OF LIVESTOCK. *Proceedings of the American Veterinary Medicine Association* 1954:33-6.

Although intravenous and subcutaneous administration of  $\text{CaNa}_2\text{EDTA}$  was effective in the treatment of Pb poisoning of cattle and horses, it was of no value in treating organic Hg poisoning in swine. The complex formed is probably as toxic to the animal as the Hg itself.

**586**

- Kaloyanova-Simeonova, F. (Sci. Res. Inst. Ind. Hyg., Bulgaria): Vliyanieto na fizicheskoto natovarvane vurkhu protichaneto na otravyaneto s nyakoi olovni suedineniya. (Sobshchenie I). (EFFECT OF PHYSICAL EFFORT ON RESISTANCE TO POISONING WITH CERTAIN LEAD COMPOUNDS. I.) *Suvremenna Meditsina* (Sofia) 5, No. 6: 12-7, 1954.

In the 1st experiment, animals trained physically (by swimming) for 16 days responded to Pb poisoning induced by oral doses for 60 days of 0.2 ml 20% Pb acetate/100 g body weight and observed for 4 mo by 4 survivals out of 9 (1 drowned), while only 1 of 4 untrained animals survived. In experiments with rats, TEL was administered sc 0.008 g/kg daily, and the conditioned reflex to light and sound stimuli was observed in trained and untrained rats. The authors conclude that physical training may have an influence on the response of the organism to poisons.

**587**

- Kleinsorge, H., Morigerowski, E., and Rösner, K. (Univ. Jena, Germany): Bleianämie und Vitamin B<sub>12</sub>. (ANEMIA IN LEAD POISONING AND VITAMIN B<sub>12</sub>.) *Zeitschrift für Innere Medizin und Ihre Grenzgebiete* 9:903-6, 1954.

The authors studied the bone marrow and blood in rabbits that had been rendered anemic by injection of an aqueous solution of Pb acetate into the ear vein on 3 successive days. Since difficulties had been encountered in obtaining marrow specimens from the vertebral bodies of rabbits, they tried a new method by puncture of the ilium crest. They explain that if the rabbit is placed in a certain sitting posture, the ilium crest is readily accessible. They found that the administration of vitamin B<sub>12</sub> either simultaneously with or immediately after the Pb dosage, resulted in a much more rapid recovery from the anemia. Stimulation of the regenerative power of the bone marrow was demonstrated to be the cause of this more rapid recovery. Vitamin B<sub>12</sub> also prevented deterioration of the general condition of the rabbits with Pb poisoning. Furthermore, when Pb was given simultaneously with vitamin B<sub>12</sub>, the development of basophilic stippling of the erythrocytes was prevented. The authors feel that either normal maturation is stimulated so that supposedly immature erythrocytes with basophil stippling are not flushed out, or a pathological process of ripening (perhaps resulting from the inhibition of the nucleic acid metabolism by Pb) is normalized, because vitamin B<sub>12</sub>, an important factor in the nucleic acid metabolism, is present in large quantities. (14 references)

**588**

- Kocsár, L., Kesztyűs, L., Szalay, S., Kertész, L., and Vályi-Nagy, T. (Inst. Pharmacol. Exptl. Pathol. Med. Univ., Debrecen, Hungary): STUDIES ON EXPERIMENTAL LEAD POISONING. III. THE EFFECTS OF ALCOHOL IN ACUTE LEAD POISONING. *Acta Physiologica Academiae Scientiarum Hungaricae* (Budapest) 5:543-7, 1954.

Cats of 1.5-2 kg body weight were used. One group was pretreated by gastric tube with 3 ml/kg of alcohol/day over 3 wk. Two days after pretreat-

ment, all cats received 15 mg Pb acetate in aqueous solution and labeled with 0.6-1.2  $\mu$ Ci ThB by stomach tube in  $\sim$ 5 ml fluid, and the activity in the organs was determined 10-11 hr thereafter. Blood samples were taken from the external jugular vein at 5, 15, 30, 60, 90, 120, and 180 min, respectively, and the cats were killed after the last sampling. In additional experiments, 2.5 ml/kg of 20% alcohol was injected intravenously, followed by 15 mg Pb in 5 ml iv 5 min later. Controls were given Pb only. The results on the organs are shown on the basis of radioactivity measurements (percentage of activity shown by 1 g of the last blood sample). In the controls, activity of blood reached its peak at 30-120 min after administration of Pb, and was not affected appreciably by alcohol. The means of Pb contents of 6 poisoned controls and of 6 alcohol pretreated cats, as tabulated, showed no Pb deposits in the cerebral cortex and hypothalamus in the controls, but 15 and 37% activity respectively in these structures in the alcohol group. This was thought to be due to an acceleration by alcohol of Pb absorption and increase of cellular permeability. In animals pretreated with alcohol and given Pb iv the Pb content was increased in every organ except the spleen, kidneys, and bones. The increase amounts to 100% in the liver and brain. Upon iv injection of Pb immediately following the iv administration of alcohol the amount of Pb deposited in various organs was  $\sim$ 200-400% higher than without previous alcohol injection. The authors conclude that alcohol accelerates the absorption of Pb from the gastrointestinal tract and promotes the transfer of Pb from the blood into the cells.

- 589 McLean, R., Calhoun, J.A., and Aub, J.C. (Harvard Univ., Massachusetts Gen. Hosp., Boston): MIGRATION OF INORGANIC SALTS IN BONE AS MEASURED BY RADIOACTIVE LEAD AND BY ALIZARIN. A.M.A. Archives of Industrial Hygiene and Occupational Medicine 9:113-21 (Feb.), 1954.

In earlier studies of bone metabolism, considerable evidence had been obtained demonstrating a difference in the rate of turnover of Ca between trabecula and cortex in bone and between dentin and enamel in teeth. Such studies had been based on the distribution of dyes (alizarin) or madder which is selectively deposited with Ca, or on the deposition of Pb which behaves similarly to Ca. Natural radioisotopes of Pb and Ra, and suitable products of the cyclotron have been used more recently.

The dogs used in these experiments came from those used earlier (Calhoun et al, 1954); 2 had 3 intravenous injections of radio-Pb (r-Pb) over a period of 6 or 7 days and died in a few days apparently as a result of radiation; the rest received r-Pb in 5 or 6 doses over 12 or 18 days; 2 dogs received Pb in 6 doses over 15 days. The surviving dogs remained on a high Ca intake from 8-51 days after Pb was injected, then received a meat diet low in Ca. Four dogs and the Pb dogs were then given parathyroid medication; 10 days later they were returned to high Ca intake for 10 days. After injection of r-Pb and at the end of the high Ca intake 1 tooth was removed from each of 5 dogs; 1 also had a leg amputation, and another, a rib resection. At necropsy bone samples

were taken from all animals as well as teeth corresponding to those drawn during life. The amount of radioactivity given to all dogs was certainly fatal; all died within 246 days. In addition, long bones of cats which had been fed madder were made available for this study.

Soon after administration Pb is deposited in the trabeculae (5-16 times the deposition in the cortex) from where it is slowly, with varying rapidity, removed to the cortex. From 1/5 to 1/3 of the Pb given was found in the skeleton. The way in which Pb is transferred is shown pictorially by what happens to madder; immediately after administration of madder, the dye was found in the trabeculae, the shafts of the bone being unstained; months later the trabeculae were pearly white, and the cortex was stained a deep pink. The dosage of radioactivity did not impair the rate of deposition or transfer of Pb in bone. The amount of tagged Pb deposited in bone and in the dentin of teeth varied with the total dosage and with time; but there was much less in dentin. Alizarin staining indicated exchange of Ca between trabeculae and circulating blood. (14 references)

- 590 Morelli, A. (Univ. Naples, Italy): Alterazioni elettrocardiografiche nell'intossicazione da piombo tetraetile. (ELECTROCARDIOGRAPHIC CHANGES INDUCED BY POISONING WITH TETRAETHYL LEAD.) Folia Medica 37: 541-61, 1954.

A 1% TEL solution in 95% alcohol was administered sc to 12 rabbits of both sexes, ranging in weight from 1.35-2.40 kg in doses of 1, 10, 50, or 100 mg/kg/day (2-4 rabbits/dose) over 2-10 consecutive days in order to induce subacute intoxication. Electrocardiographic alterations were produced which showed pronounced damage to the coronaries and myocardium, frequently indicating infarction. Marked bradycardia was noticed in all cases.

- 591 Morelli, A. (Univ. Naples, Italy): Modificazioni elettroforetiche nell'intossicazione da piombo tetraetile. (ELECTROPHORETIC CHANGES INDUCED BY POISONING WITH TETRAETHYL LEAD.) Folia Medica 37: 562-73, 1954.

Eight rabbits, 1350-2400 g body weight, were injected sc with TEL in doses of 1, 10, 50, or 100 mg/kg, dissolved in 95% alcohol. Two controls received the solvent only at a dose of 100 mg/kg, and 2 received no treatment. Injections were made daily for 2-4 days at the highest dose, and for 5-10 days at the lower doses. The results showed changes in the electrophoretic picture of the serum proteins consisting of an inversion of the ratio albumin/globulin, an increase of  $\alpha_1$ -globulins, an increase, decrease, or even disappearance of the  $\alpha_2$ -globulins, an increase of  $\beta$ -globulin, and a decrease of  $\gamma$ -globulins. The author interprets the results confirm that TEL causes a denaturation and aggregation of blood proteins.

- 592 Morelli, A. (Univ. Naples, Italy): Consumo di O<sub>2</sub> e processi di fosforilazione nel tessuto epatico, polmonare e cerebrale di animali intossicati con piombo tetraetile. (OXYGEN CONSUMPTION AND PHOSPHORYLATION PROCESSES IN LUNG, LIVER, AND BRAIN TISSUES

OF ANIMALS POISONED BY TETRAETHYLLEAD.)  
Rassegna di Medicina Sperimentale 1:48-50,  
1954.

As determined in the tissues of rabbits poisoned sc with 1-100 mg TEL/day for 2-10 days (acute and subacute intoxication, as in earlier experiments), the results showed no differences in the O consumption nor in the inorganic P (in tests according to Warburg in the presence of NaF and succinate and of ATP), as compared with control animals.

593 Morelli, A.: (CYTOCHROME OXIDASE ACTIVITY OF MYOCARDIUM IN ANIMALS TREATED WITH LEAD CHLORIDE.) *Rass. med. sper.* 1:65-8, 1954.

In experiments with rabbits no change was found in the cytochrome oxidase activity (method of Boeri, et al) on treatment with Pb chloride (technique of Weatherall, *Biochem. J.* 52:683-90, 1952). (From *Chemical Abstracts* 51:8299, 1957)

594 Morelli, A., and Preziosi, P. (Univ. Naples, Italy): Modificazioni istochimiche surrenaliche nell'intossicazione da piombo tetraetile. (HISTOCHEMICAL CHANGES IN THE ADRENALS IN POISONING WITH TETRAETHYL LEAD.) *Folia Medica* (Naples) 37: 654-73, 1954.

Rabbits (1.300-2.400 kg) were subacutely poisoned sc with varying doses of TEL (1, 10, 50, 100 mg/kg/day in alcohol solution). Most animals were sacrificed after 5 and 10 days for histochemical examination, or so examined shortly before death. Controls were treated only with the solvent. In the latter, only slight edema was observed; the sudanophil band was well preserved, though in some areas it appeared pale. The changes observed are described in some detail for each dosage used, and illustrated in 9 photomicrographs. As a whole, within certain limits, they were proportional to the dosage. The adrenals showed variable lesions mainly in the fascicular zone. The histochemical examination showed a marked reduction or disappearance of the sudanophil band and decrease, in polarized light, of the birefringent lipid quota. Minimal doses produced contrariwise an increase in the sudanophil zone and of the birefringent lipids. The gland was depleted by the poisoning of the precursors of hormone formation and of the reserve lipids which included both cholesterol fractions.

595 Morelli, A., and Preziosi, P. (Univ. Naples, Italy): Il colesterolo surrenalico nell'intossicazione da piombo tetraetile. (ADRENAL CHOLESTEROL IN POISONING FROM TETRAETHYLLEAD.) *Rassegna di Medicina Sperimentale* 1:43-7, 1954.

Rabbits, 1350-2400 g body weight, in groups of 2-4, received sc TEL daily in doses of 1, 10, 50, or 100 mg/kg (dissolved in alcohol) for 2-10 days; controls received the solvent only. The 2 higher doses caused a considerable drop (to as low as 5%) of both the free and the esterified fractions of adrenal cholesterol. The 2 rabbits receiving 10 mg/kg had almost normal levels, and the lowest dose caused a sharp increase in both fractions.

596 Narpozzi, A. (Univ. Padova, Italy): Influenza di un sale di Pb sulla circola-

zione vasale endorenale. (EFFECT OF A LEAD SALT ON INTRARENAL CIRCULATION.) *Archivio Italiano di Anatomia e Istologia Patologica* 28:159-63, 1954.

Twelve rabbits received daily iv injections of 1-2 ml 0.5% solution of Pb nitrate; 4 died between the 7th-9th day of experiment, and the rest were sacrificed on the 10th. After opening the abdomen, the kidney was allowed to remain in situ, and dye was injected into the renal artery to study the effects on the intrarenal circulation. Histologic examination showed that the circulation is reduced or abolished in the superficial area of the cortex and maintained in the deeper layers.

597 Niederstadt, D. (Univ. Göttingen, Germany): Harngewinnung, Aufbereitung und quantitative Porphyrinbestimmung an chronisch bleivergifteten Ratten. (COLLECTION OF URINE, PREPARATION AND QUANTITATIVE DETERMINATION OF PORPHYRINS IN RATS WITH CHRONIC LEAD POISONING.) *Zentralblatt für Arbeitsmedizin und Arbeitsschutz* 4:118-9 (July), 1954.

The author describes a method of collecting urine from individual male rats. In addition to the quantitative porphyrin determination, the specific gravity of the urine is determined by weighing 2 and 5 ml pycnometers against water. Extraction of porphyrins proceeds according to H. Fischer's method, and quantitative determination by use of the Pulfrich-Photometer. The author concludes that the rat is particularly suited for studies of chronic Pb poisoning.

598 Rossi, L., Vitacca, L., and Pagano, R. (Univ. Naples, Italy): Azione del citrato di sodio nell'intossicazione da piombo. Contributo clinico e sperimentale. (ACTION OF SODIUM CITRATE IN LEAD POISONING. CLINICAL AND EXPERIMENTAL CONTRIBUTION.) *Folia Medica* (Naples) 37:967-86, 1954.

Ten rabbits (av 2.5 kg weight) received 200 mg Pb acetate/day orally; 3 were kept as controls, the others were treated with 5% Na citrate at doses of 4 ml/kg orally twice a day, beginning at the same time as Pb administration. Hematology and coproporphyrin elimination were followed every 5 or 6 days from the time before Pb administration until death. The results showed that Na citrate delayed the appearance of signs of Pb poisoning and prolonged life of the animals, ie, the controls died between the 20th and 30th day of poisoning, and the treated survived up to 50 days.

The authors also administered to 10 hospitalized Pb poisoning patients 10 ml of a 10% Na citrate solution iv daily for 15 days. Some of them had high blood Pb values before treatment, 110-200 µg%, which were reduced after treatment to 100-150 µg%; Pb in urine was negative in all cases before treatment and positive in 6 after treatment. This was considered as confirmation of the therapeutic efficacy of the drug.

599 Pecora, L. (Univ. Naples, Italy): Studio sul comportamento di varie porfirine (protoporfirina libera eritrocitaria, coproporfirine e uroporfirine I e III) nella intossicazione saturnina sperimentale.

- tale. (BEHAVIOR OF VARIOUS PORPHYRINS (FREE PROTOPORPHYRIN OF THE ERYTHROCYTES, COPROPORPHYRIN AND UROPORPHYRINS I AND III) IN EXPERIMENTAL LEAD POISONING.) Abstracts of Meeting of the Campana Society of Legal Medicine, Insurance and Labor, Naples. *Medicina del Lavoro* 35:53 (Jan.), 1954; *Folia Medica* (Naples) 37:82-92, 1954.
- The behavior of free protoporphyrin (PP) in erythrocytes and of urinary coproporphyrin (CP) and uroporphyrin (UP) was studied in rabbits poisoned chronically with Pb. A noteworthy and early increase in free PP was found as well as a noteworthy but more delayed increase in the level of urinary CP. UP III formed in small quantities only in advanced phases of intoxication, and UP I only in some cases and in the extreme phases of the intoxication.
- The author concludes that the results show that the toxic effects of Pb involve, even though in varying measure, all the different porphyrins. This can be explained only by a general inhibitory action on the enzymatic process of dehydrogenation and decarboxylation which connect the individual porphyrins. (19 references)
- 600 Pecora, L., Piccoli, P., and Calabro, F. (Univ. Naples, Italy): *Analisi elettroforetica del siero di sangue nell'intossicazione sperimentale saturnina. (ELECTROPHORETIC ANALYSIS OF BLOOD SERUM IN EXPERIMENTAL LEAD POISONING.)* *Folia Medica* (Naples) 37:709-22 (Sept.), 1954.
- Progressive poisoning leading to death on the 40th day was induced in 12 male rabbits (2.5-3.0 kg weight) by oral administration on alternate days of 2 ml 20% Pb acetate. Electrophoretic analyses of proteins were performed before intoxication and at 8-10-day intervals during administration. The results showed that during the first phase of chronic Pb poisoning in rabbits an increase of the  $\alpha$ - and  $\beta$ -globulin fractions was observed. In the advanced stage the total proteins decreased markedly and the  $\alpha$ - and  $\beta$ -globulins increased considerably more, while  $\gamma$ -globulin was variable. (16 references)
- 601 Rieders, F. (Jefferson Med. Coll., Philadelphia, Pa.): *EFFECT OF ORAL  $\text{Na}_2\text{Ca}$  ETHYLENEDIAMINE TETRAACETATE ON URINARY AND FECAL EXCRETION OF LEAD IN RABBITS.* *Federation Proceedings* 13:Abstract No. 1303 (Mar.), 1954.
- Pb poisoning was caused in rabbits by 1 mg Pb/kg/day given iv for 3 wk as 0.05% Pb acetate in physiologic saline. Subsequently, half of the poisoned animals and a group of nonpoisoned animals were force-fed 0.25 g  $\text{Na}_2\text{CaEDTA}$ /kg/day for 2 wk. During this 5-wk period, daily urinary and fecal Pb excretion was measured in these animals as well as in a group of animals which had received neither Pb nor  $\text{Na}_2\text{CaEDTA}$ . At the end of this period all animals were killed. Erythrocytes, plasma, liver, kidney, brain, spleen, abdominal muscle, washed small intestine, flat bone of the skull and long bone of the hind limb were analyzed for Pb. In the rabbits which received  $\text{Na}_2\text{CaEDTA}$  the excretion of Pb shifted markedly from the fecal to the urinary route during the 2 wk of treatment. However,
- the total amount of Pb which was excreted (urinary and fecal) and the amount of Pb which remained in the tissues did not differ significantly from the Pb values found for the corresponding group which was not treated with  $\text{Na}_2\text{CaEDTA}$ . (From author's abstract)
- 602 Rothlin, E., Taeschler, M., and Cerletti, A. (Pharmacol. Lab. Sandoz AG, Basel, Switzerland): *Beitrag zur biologischen Wirkung von komplexgebundenem Calcium. (BIOLOGICAL ACTION OF CALCIUM COMPLEXES.)* *Schweizerische Medizinische Wochenschrift* 84:1286-9, 1954.
- Pharmacological comparison of  $\text{CaNa}_2\text{EDTA}$  with dissociable  $\text{CaCl}_2$  and Ca gluconate demonstrated that only  $\text{CaCl}_2$  and Ca gluconate exert physiological Ca effects, i.e., inhibit the elimination of cardiovascular reflexes by veratridine in the whole animal; compensate the hypocalcemic insufficiency of heart-lung preparations; coagulate oxalated or citrated plasma. Lack of Ca effects with  $\text{CaCl}_2$  is due to its stability in the body, as evidenced by its hypocalcemic symptoms upon in vivo administration. Whereas  $\text{CaCl}_2$  cannot be utilized for specific Ca therapy, it is valuable as a cation-exchange agent in heavy-metal (Pb, Fe, Hg) poisoning, as previously reported. (16 references)
- 603 Rubino, G.F., and Chiesura, P. (Univ. Turin, Italy): *Effetti del trattamento con acido etilendiaminetetracetico sulla tossicita del nitrato di piombo. (EFFECTS OF TREATMENT WITH ETHYLENEDIAMINETETRAACETIC ACID ON THE TOXICITY OF LEAD NITRATE.)* *Minerva Medica* 45, No. 69:404-6 (Aug. 29), 1954.
- The use of the Na salts of EDTA ( $\text{Na}_2$  and  $\text{CaNa}_2$ ) in the treatment of Pb intoxication is first discussed, and then compared briefly with other sequestering and chelating agents. The therapeutic coefficient, i.e., the relation between the minimum lethal dose and the therapeutic dose, is almost 6. Experiments performed with rats showed that the best prophylactic dose of EDTA is the one which is equimolecular to the Pb content of the salt in consideration. EDTA doubled the tolerance of the rats against intoxication with Pb nitrate.
- 604 Sano, S. (Kyoto Univ., Japan): *STUDIES ON THE DISTRIBUTION OF LEAD IN ANIMAL TISSUES.* *Japanese Journal of the Nation's Health* 23:59-72, 1954.
- The iv injection of large doses of aqueous solution of Pb acetate (100-5000  $\mu\text{g}$  Pb) to guinea pigs and mice gave 50-60% of the Pb deposition in the liver within 2 hr. The Pb storage was highest in bones after 24 hr. The injection of the same dose to mice but different in concentration caused at the higher concentration of Pb acetate 50-60% of the Pb deposition in the liver and only a small amount in bones and very little in kidneys, while 20-25% of the Pb was found in the liver and much in bones and kidneys of the lower concentration. A single injection of the Pb caused much deposition in the liver and a small amount in excreta, while repeated injections caused a small amount of deposition in the liver and relatively large amount in kidneys with no change of deposition in

bones. The Pb adsorbed on serum protein was deposited in the liver, while that adsorbed on erythrocytes gave low deposition of the Pb in the liver and high in kidneys. (From author's English summary; 21 references)

- 605** Sapeika, N. (Univ. Cape Town, South Africa): LEAD EDTA COMPLEX, A WATER-SOLUBLE CONTRAST MEDIUM. South African Medical Journal 28: 759-62 (Sept.), 1954.

In tests involving the use of PbEDTA complex as a contrast medium in diagnostic radiology, 25 and 50% concentrations were administered to animals. A 25% solution was applied to rabbit conjunctiva and to the mouth and skin of human subjects. Rabbits received 100 mg/kg iv, rats 1 ml 25% solution (1 g/kg) sc and iv. The 25 and 50% solutions were also administered to numerous animals by mouth through a stomach tube (2 ml to rats weighing 160-200 g). In parenteral administration, 0.5 ml of 25% solution in water and 3.5% solution in polyvinylpyrrolidone (PVP) was injected in rats in 2 places sc on each side of the middle line of the anterior abdominal wall.

For microradiography, a warmed solution of PbEDTA 50% in 10% gelatin solution was injected into the renal arteries of a rabbit killed by a blow on the head and bled from the jugular vessels. No ill effects or deaths resulted when PbEDTA was administered by mouth or injected; autopsies on animals which received large doses by injection showed kidneys to be paler than normal. No signs of irritation followed applications of the solutions to the conjunctiva and the peritoneal membrane, or to human mouth and skin.

With different concentrations, varying degrees of contrast were obtained in radiography. By mouth, the 50% concentration produced dense shadows in the stomach and intestines; good radiographs were also obtained with the 25% concentration. All evidence of the medium had practically disappeared in 24 hr. With injection sc, the complex was removed almost completely in 1 hr and was not delayed beyond this by administration of PVP. However, within 1/2 hr the kidneys and bladder were demonstrable on the radiograph and were more clearly shown at the end of 1 hr, along with the renal pelvis, the ureters, and the urethrae. Injection into the rabbits' ear demonstrated the vessels. Sections of kidney injected into the renal artery with Pb complex in gelatin solution also indicated that the medium could be used in microradiography.

In conclusion, the investigation of the PbEDTA complex as a radiopaque medium showed it to have many useful features which may make it of value in radiographic diagnosis.

- 606** Taira, H.: STUDY ON LEAD POISONING. ON LEAD CONTENT OF BLOOD OF RABBIT ADMINISTERED LEAD. J. Kyoto Prefect. Med. Univ. 55:1-3 (English Summary), 1954.

Rabbits received various doses of Pb acetate orally, percutaneously or intravenously over different periods of time. The Pb content of blood did not decrease (sic) regularly, but showed interesting extreme values which differed somewhat according to method of administration, and are explained on the basis of varying absorbability depending upon the type of administration. (From Deutsche Zeit-

schrift für die Gesamte Gerichtliche Medizin 44: 299 (Abstracts), 1955)

- 607** Vályi-Nagy, T., Kocsár, L., Kelentei, B., and Csernyánszky, H. (Inst. Pharmacol. Exptl. Pathol. Med. Univ., Debrecen, Hungary): STUDIES ON EXPERIMENTAL LEAD POISONING. I. EFFECTS OF ALCOHOL-INGESTION ON CHRONIC LEAD POISONING IN THE RAT. Acta Physiologica Academiae Scientiarum Hungaricae (Budapest) 5:531-6, 1954.

Clinical reports have indicated that by repeated ingestion of alcohol, persons exposed to Pb become sensitized to the damaging effects of Pb intoxication which manifests itself in increased sensitivity to Pb, decreased tolerance, and aggravation of toxic symptoms. Pb mobilization from bones is said to be promoted and abusive use of alcohol may change latent Pb poisoning into acute, with regard to nervous symptoms and colics. Three groups of 10 rats each (150-180 g), fed on a uniform diet during the experiment were used to test the validity of these findings. Group 1 received by stomach tube 300 µg Pb (as nitrate)/100 g body weight for 2 wk, the dosage then was increased every 2 wk to 600, 1200 and 2000 µg/day. Group 2 received the same amounts of Pb plus 1 ml of 20% ethanol. Group 3 received only 1 ml of 20% ethanol and no Pb. The results showed that a considerable retention of water occurred in all organs in the Pb group, varying between 2 and 10%; it was further increased by alcohol which by itself decreased water retention. It was also found that there was no constancy of the Pb levels in the different organs (liver, lung, heart, kidney, brain, colon, spleen, testicles) in relation to the amount of Pb ingested. In 60% of the organs examined the Pb level increased due to combined Pb and alcohol effect. In 31.1% a decrease was observed and in 8.9% no change. However, an increased retention in the heart and brain after alcohol ingestion, was seen regularly. The liver Pb content was strikingly lower than in other organs.

In a 2nd series, rats of 120-160 g weight received 4 mg Pb nitrate/day for 6 wk. All were sacrificed at the same time and the organs examined as in series 1. The tabulated results showed that by simultaneous alcohol ingestion Pb content of all organs except kidneys increased. This difference, in comparison with series 1, was attributed to the higher amount of Pb ingested (140 vs 10-80 mg). A 3rd experiment of 5 wk duration was set up to decide whether in consequence of ingested alcohol storage is increased in the parenchymatous organs only or whether total Pb retention is enhanced. Animals were treated with Pb, both with and without alcohol. The results showed that the increase amounted to 93.6% on the average due to alcohol ingestion.

In summarizing, the authors conclude that Pb storage in the organs is increased by alcohol, most regularly in the heart, brain, adrenals, testicles, and muscles. There is no demonstrable connection between Pb storing capacity of the single organs and the amount of Pb ingested, nor is there between water and Pb storage.

- 608** Vályi-Nagy, T., Kelentei, B., and Kocsár, L. (Inst. Pharmacol. Exptl. Pathol. Med.



Univ., Debrecen, Hungary): STUDIES IN EXPERIMENTAL LEAD POISONING. II. FURTHER STUDIES ON THE INFLUENCE OF ALCOHOL INGESTION UPON LEAD POISONING. *Acta Physiologica Academiae Scientiarum Hungaricae* (Budapest) 5:537-42, 1954.

Guinea pigs of about same weight in 3 groups of 14 each were used as follows: Group 1, controls (untreated); Group 2 was exposed 3 times/day for 30 min for 14 wk to a Pb nitrate spray calculated to give a daily intake of 700 µg Pb; Group 3 prior to being exposed to Pb was given by stomach tube 2 ml of 20% alcohol daily. From every group 1 animal was sacrificed every week and brain, lungs, heart, liver, spleen, colon, kidneys, adrenals, testicles, bones and a sample of striated muscle were weighed and examined.

As in the experiments with rats alcohol ingestion modified and aggravated chronic Pb poisoning in guinea pigs. Accumulation of Pb was primarily in organs of high-lipoid content; brain, adrenals, and testicles were most seriously affected. A marked hypertrophy of the adrenal cortex was noticed, more so in animals treated with Pb only than in those that also received alcohol. On this basis the authors assumed that Pb poisoning effects some change in the metabolism of cortical ketosteroid. The marked Pb storage in the testicles may explain the occurrence of male sterility reported in chronic Pb poisoning, and confirms the clinical experience that alcohol abuse aggravates the symptoms of chronic Pb intoxication.

- 609 Vályi-Nagy, T., Kocsár, L., Kelentey, B., Kesztyus, L., Csernyánczy, H., Kertész, L., and Ökrös, S. (Inst. Pharmacol. Exptl. Pathol., Med. Univ., Debrecen, Hungary): Vizsgálatok az experimentális ólommérgezés tárgyköréből. (EXPERIMENTAL LEAD POISONING.) *Kiserletes Orvostudomány* 6:124-37, 1954.

In the course of experimental chronic Pb poisoning in rats and guinea pigs, by oral administration and by inhalation, the water content of the organs was generally increased; by the administration of alcohol, it was decreased. When Pb and alcohol were administered enterally at the same time, the Pb content of the organs increased in both acute and chronic poisoning. This increase was particularly pronounced in the adrenals, testes and brain. In comparison with the controls, a hypertrophy of the adrenal cortex was apparent. (From German summary)

- 610 Van Klaveren, F.W. (Res. Dept., Teddington Chem. Factory, Andheri, India): THE LEAD-ANAEMIA IN THE RABBIT AND THE POTENCY OF LIVER EXTRACTS. Proceedings of Symposium on Standardization and Therapeutic Use of Liver Extracts. *Indian Journal of Pharmacy* 16:14-6, 1954.

The total potency of liver extracts can be determined by administering liver extract and different doses of vitamin B<sub>12</sub> to rabbits with Pb anemia and then extrapolating the red blood cell counts resulting from the former on a graph obtained from the latter. (21 references)

- 611 Van Klaveren, F.W., and Shrivastava, P.C.

(Teddington Chem. Factory, Ltd., Bombay, India): LEAD ANEMIA IN THE RABBIT AND THE POTENCY OF LIVER EXTRACTS. II. *Intern. Z. Vitaminforsch.* 25:139-47, 1954.

Whole liver extracts were assayed (1) biologically, by determination of the hemopoietic potency in Pb anemia of the rat, and (2) photometrically for vitamin B<sub>12</sub> content by concentration with PhOH-CHCl<sub>3</sub> and measurement of the purple color developed by reaction with KCN in aqueous solution. The results of the 2 methods were in agreement, and each method apparently measured the whole vitamin B<sub>12</sub> complex. Liver extract, treated with PhOH-CHCl<sub>3</sub>, lacked hemopoietic potency; and the total potency was recovered from the organic solvent. (From Chemical Abstracts 48:5955, 1954)

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- 612 Ardelean, I., Gontea, I., Suțescu, P., Vintila, P., and Vaida, I. (Inst. Hyg., RPR Acad., Bucharest, Romania): Cercetări asupra acțiunii trofophilactice a alimentatiei in plumbismul experimental cronic. II. Rolul vitaminelor. (STUDY OF THE TROPHOPHYLACTIC EFFECT OF FOOD IN EXPERIMENTAL CHRONIC LEAD POISONING. II. ROLE OF VITAMINS.) *Buletin Stiintific, Sectia de Stiinte Medicale* 7, No. 4:1339-49, 1955.

Pb poisoning was induced in 358 rats, injected sc with 10 mg Pb acetate/kg body weight on alternate days over 3-4 mo. One group was maintained on cereals and vegetables but received no milk, while another group received the same diet with milk. Others received on alternate days, sc, vitamins A, D<sub>2</sub>, B<sub>2</sub>, PP, and C. Comparison of the results showed that the administration of vitamins did not increase the resistance of the rats to Pb poisoning. However, the addition of milk to the diet increased resistance to Pb 2-3 times; there was less loss of weight and anemia was more moderate; mortality also was greatly reduced. The authors conclude that the provision of milk to workers exposed to Pb is justified.

- 613 Austoni, M., Ziliotto, D., and Candiani, G. (Univ. Padua, Italy): II ferro radioattivo nello studio citochimico del midollo. I. Il comportamento del midollo di ratti normali (ricerche citoautoradiografiche). II. Il comportamento del midollo dei ratti tiroidectomizzati (ricerche citoautoradiografiche). III. Il comportamento del midollo di ratti intossicati con piombo. (RADIOACTIVE Fe IN THE CYTOCHEMICAL STUDY OF BONE MARROW. I. THE BONE MARROW IN NORMAL RATS (CYTOAUTORADIOGRAPHY). II. THE BONE MARROW IN THYROIDECTOMIZED RATS. III. THE BONE MARROW IN LEAD-POISONED RATS. *Acta Med. Patav.* 15, No. 3:343-65, 1955.

I. After ip injections of 0.5 µg/g of <sup>59</sup>Fe (as ferrous citrate; specific activity 3.79 µCi/µg of <sup>59</sup>Fe) in the rat, radio-Fe content of the red cell series in bone marrow was followed from hour to hour by a semiquantitative cytoautoradiographic method. Erythroblasts showed maximal radioactivity at ~3 hr and the mature erythrocytes after ~24 hr,

the activity of the latter, however, being much less than that of the former. The immature erythrocytes (polychromatophils) showed intermediate behavior. The significance of the findings is discussed in connection with the maturation time and the probable function of accumulated Fe.

II. With the technique described in I it was shown that in thyroidectomized rats the uptake of  $^{59}\text{Fe}$  in all elements of the red cell line was smaller and slower than in normal rats.

III. In rats made anemic by administration of 5 mg/100 g of Pb acetate 3 days before the experiment the uptake of  $^{59}\text{Fe}$  was earlier, more intense and more prolonged in the erythroblasts, whereas the mature erythrocytes showed lower than normal activity. This points to a retardation of maturation and a limited utilization of Fe for Hb synthesis. (From *Excerpta Med. Sect. 2*, 10, No. 2:777, 1957)

- 614 Beccari, E., Bianchi, C., and Felder, E. (Res. Lab. Cilag Italiana, Milan; Univ. Turin; Univ. Parma, Italy): Chemisch-physikalische, pharmakologische und klinische Untersuchungen über  $\beta$ -Mercaptoäthylamin, besonders im Hinblick auf die Bleivergiftung. (CHEMICAL, PHYSICAL, PHARMACOLOGIC AND CLINICAL INVESTIGATIONS ON  $\beta$ -MERCAPTOETHYLAMINE, ESPECIALLY IN REFERENCE TO LEAD POISONING.) *Arzneimittel-Forschung* 5:421-8, 1955.

The stability constants of various complex compounds which are produced by combining cysteamine with different metal ions were examined. In animal experiments, the toxicity and compatibility of cysteamine was determined. Following these experiments, the influence of cysteamine on the distribution of Pb in tissues and on the urinary excretion of Pb was studied. The results are discussed in view of the problem of whether the protective action of cysteamine in poisoning by organic and inorganic Pb compounds may be explained by the formation of a complex compound, ie, by a chelating effect. Comparative investigations performed with EDTA and microrespirometric investigations of organs isolated from normal and poisoned animals indicate that the formation of complex compounds is certainly one important component, but not the only factor, responsible for the protective action of cysteamine. (From authors' summary; 34 references)

- 615 Beccari, E., and David, I. (Univ. Turin, Italy): Azione della  $\beta$ -mercaptoetilamina sul consumo di ossigeno negli organi di animali intossicati cronicamente con Pb ( $\text{NO}_3$ )<sub>2</sub>. (THE EFFECT OF  $\beta$ -MERCAPTOETHYLAMINE ON OXYGEN CONSUMPTION IN THE ORGANS OF ANIMALS POISONED CHRONICALLY WITH Pb ( $\text{NO}_3$ )<sub>2</sub>.) *Bollettino della Società Italiana di Biologia Sperimentale* 31:52-4, 1955.

The stimulation of O consumption produced in both the liver and kidney of the rat is optimum at a concentration of  $10^{-2}$  of 2-mercaptoethylamine. The increase in O consumption of both tissues is decreased in the presence of Pb( $\text{NO}_3$ )<sub>2</sub>. (From authors' summary)

- 616 Beck, E., Lanini, G., and Béraud, T.

(Univ. Med. Clinic, Lausanne, Switzerland): Le métabolisme du fer dans l'intoxication au plomb. (IRON METABOLISM IN LEAD POISONING.) *Helvetica Medica Acta* 22, No. 4/5:442-5, 1955.

Iron metabolism was studied in 7 rabbits intoxicated by Pb, in 6 normal rabbits, and in 6 rabbits poisoned by Sedormid (compound causing porphyria of nonmedullary origin). Fe was administered in the form of 100-120  $\gamma$   $^{59}\text{Fe}$  bound to  $\beta_1$ -globulin. The incorporation of  $^{59}\text{Fe}$  into the erythrocytes was not changed either by Sedormid, nor by Pb. In the rabbits poisoned by Pb, there was considerable accumulation of Fe in the spleen and very high fixation of Fe in the bone marrow.

- 617 Bekes, M.: Beiträge zur therapeutischen Beeinflussung der experimentellen Bleianämie. (CONTRIBUTIONS CONCERNING THE THERAPY OF EXPERIMENTAL LEAD ANEMIA.) *Acta Medica (Budapest)* 8:337-46, 1955.

Rabbits were injected with a daily dose of 6 mg/kg Pb acetate. At the same time, intravenous injections of the following materials were made: Pernaemon-forte, Neo-Perhepar, vitamin B<sub>12</sub> (2 and 5 mg/kg), Co citrate, and vitamin B<sub>6</sub>. Throughout the next 14 days, hematological studies were made and urinary porphyrins determined. Under these experimental conditions, the liver preparations and vitamin B<sub>12</sub> were favorable influences against the red-cell count and the hemoglobin content. The efficacy of the liver preparations of Co acetate used compensates for the anemia best. Vitamin B<sub>6</sub> is the best guard against anemia, being as good as a large dose of Pernaemon-forte and vitamin B<sub>12</sub>. (From *Chemical Abstracts* 50:3650, 1956)

- 618 Belli, R., Giuliani, V., and Zazo, S. (Univ. Siena, Italy): Processi immunitari nell'intossicazione sperimentale da piombo tetraetile. II. Comportamento delle globuline anticorpali in corso di immunizzazione attiva. (IMMUNOLOGIC PROCESSES IN EXPERIMENTAL POISONING WITH TETRAETHYLLEAD. II. ANTIBODY GLOBULINS DURING ACTIVE IMMUNIZATION.) *Folia Medica (Naples)* 38:1009-13, 1955.

Rabbits poisoned with TEL (administered as described in Part I, in doses of 1 and 10 mg/kg) and treated with streptococcus vaccine did not show an increase in antibody globulins in contrast to the controls. Animals poisoned with high doses showed a drop in globulins as compared with pretreatment levels. (See Abstract No. 630 for I)

- 619 Belli, R., Giuliani, V., and Zazo, S. (Univ. Siena, Italy): Processi immunitari nell'intossicazione sperimentale da piombo tetraetile. III. Comportamento elettroforetico delle proteine sieriche in corso di immunizzazione attiva. (IMMUNOLOGIC PROCESSES IN EXPERIMENTAL POISONING WITH TETRAETHYL LEAD. III. ELECTROPHORESIS OF THE SERUM PROTEINS DURING ACTIVE IMMUNIZATION.) *Folia Medica (Naples)* 38:1137-46, 1955.

Rabbits (groups of 3 each) were poisoned with 1 and 10 mg TEL/kg/day by sc injection for 33 days and then injected with progressively increasing

doses of streptococcic vaccine. In contrast to the controls, there was no increase in the antibody globulins in the poisoned animals. The latter showed also a slight decrease in total serum proteins, a decrease of albumin, and an increase in  $\alpha$ - and  $\beta$ -globulins.

- 620 Belli, R., and Giuliani, V. (Univ. Siena, Italy): Processi immunitari nell'intossicazione sperimentale da piombo tetraetile. IV. Comportamento degli anticorpi antitipici in corso di immunizzazione attiva. (IMMUNOLOGIC PROCESSES IN EXPERIMENTAL POISONING WITH TETRAETHYL LEAD. IV. BEHAVIOR OF ANTITYPHOID IMMUNE BODIES IN ACTIVE IMMUNIZATION.) *Folia Medica* (Naples) 38:1407-12, 1955.

Antityphoid agglutinins were determined in the serum of rabbits poisoned with TEL and treated with suspensions of *Salmonella typhi*. TEL was administered sc in doses of 1 and 10 mg/kg, for 24 days as described in the other articles in this series.

The antibody response to vaccine was definitely deficient with no trend towards an increase during the duration of the experiment. The impairment of immunity was noted even with doses which did not produce any toxic effects and were tolerated for long periods.

- 621 Belli, R., Giuliani, V., and Zazo, S. (Univ. Siena, Italy): Rapporto tra il tasso delle albumine e dell'acetilcolinesterasi nell'intossicazione sperimentale da piombo tetraetile. (RELATION BETWEEN LEVELS OF ALBUMIN AND ACETYLCHOLINESTERASE IN EXPERIMENTAL POISONING BY LEAD TETRAETHYL.) *Rassegna de Medicina Sperimentale* 2:220-4, 1955.

The serum of rabbits subjected in the earlier reported experiments to subacute and chronic poisoning by TEL and to simultaneous immunization with streptococcus vaccine was used in the tests here reported. Blood was withdrawn before the experiment and on days 4, 9, 16, 22, and 33 of treatment. While the control rabbits and those treated only with the solvent showed albumin and acetylcholinesterase (ChE) levels that were within normal limits, the TEL-poisoned rabbits exhibited a certain decrease of both albumin and ChE. A parallelism was found in the decrease of these 2 components.

The authors suggest that the changes observed point to liver damage by TEL. (17 references)

- 622 Belli, R., Maggio, M., and Arciello, G. (Univ. Siena, Italy): Comportamento della temperatura corporea in corso di intossicazione sperimentale con piombo tetraetile. (BODY TEMPERATURE DURING EXPERIMENTAL POISONING WITH TETRAETHYL LEAD.) *Folia Medica* (Naples) 38:790-7, 1955.

Two series of experiments were carried out with rabbits of both sexes (1.350-3.100 kg weight); in the 1st, a total of 17 received sc injections of TEL (dissolved in alcohol) at doses of 100, 50, 10, and 1 mg/kg daily; 2 controls received the solvent in the same manner. Body temperature taken rectally was followed for 10 days after start of administration. In the 2nd series, 15 rabbits

received TEL as above in doses of 50, 10 and 1 mg/kg/day and were followed for 35 days. Initial temperature ranging from 38.7-39.8 dropped abruptly in rabbits receiving the 100 and 50 mg doses, in some cases to the middle 30's. At these doses all but 1 animal died by the 8th day; 1 was sacrificed on the 9th day. Doses of 1-10 mg/kg did not produce a change in temperature except immediately preceding death.

- 623 Bianchi, C., Ambanelli, U., and Salvi, G. (Italy): Ricerche sperimentali e cliniche sull'azione della beta-mercaptoetilamina nella intossicazione da piombo-tetraetile. (EXPERIMENTAL AND CLINICAL RESEARCH ON THE ACTION OF  $\beta$ -MERCAPTOETHYLAMINE IN TETRAETHYL LEAD POISONING.) *Il Policlinico* (Rome) Sezione Pratica 62, No. 12: 397, 1955.

Rabbits were exposed to TEL vapor to give acute poisoning; 9 of 10 animals were not poisoned when 100-140 mg  $\beta$ -mercaptoethylamine had been injected intravenously daily. In other animals subacute poisoning was induced, and 100-180 mg/day of the amine caused more elimination of Pb in urine than occurred with intravenous urea (1-1.2 cc of 30% solution). The protective effect was considered to be due to chelation or to the effect of the SH group.

- 624 Biondi, S. (Univ. Naples, Italy): Le fosfatasi intraleucocitarie nel sangue periferico nel corso della intossicazione subacuta sperimentale da piombo. (INTRALEUCOCYTIC PHOSPHATASE IN THE PERIPHERAL BLOOD IN SUBACUTE EXPERIMENTAL LEAD POISONING.) Abstracts of Meeting of the Campana Society of Legal and Industrial Medicine. *Medicina del Lavoro* 46:60-1 (Jan.), 1955; *Folia Medica* (Naples) 38:133-47 (Feb.), 1955.

Three groups of rabbits were used: 2 consisted of 5 and 1 of 2; in each group 1 rabbit served as control and the others received 2 ml of 10% Pb acetate solution on alternate days over 3 wk, then observed until death (31-46 days). Before the experiment and every 7 days thereafter, complete hemochromocytometric examinations were performed. Intraleukocytic alkaline phosphatase was determined by Gomori's method on day 7 then every 4 days.

From the results observed, the author concludes that Pb intoxication causes a diminution in the phosphatase content of the leukocytes in circulating blood. This diminution is manifested in the noteworthy progressive diminution in intensity of the reaction, and not in the number of positive cells, which remain constant at 100%. The hypothesis is advanced that this decrease in phosphatase which parallels the known changes in the blood picture stems from the disturbances in the development of erythrocytes as a consequence of the effects of Pb on the hematopoietic organs.

- 625 Burnett, G.W., and Lobene, R.R. (Army Med. Serv. Grad. School, Washington, D.C.): THE COMPOSITION OF TEETH. II. SPECTRO-CHEMICAL ANALYSIS OF ENAMEL AND DENTINE, FROM SYRIAN HAMSTERS. *Journal of Dental Research* 38:814-9, 1955.

Quantitative spectrochemical analysis was made of

enamel and dentin from incisors and molars of adult hamsters. The enamel always contained: Ag, Al, B, Ba, Ca, Cr, Cu, Fe, K, Li, Mg, Mn, Na, P, Pb, Si, Sr; all these elements, except Cr and Pb, were always present in the dentin. The major constituents were Ca and P; the only other elements exceeding 0.1% were Mn, Na, and Fe. Other elements were present in some, but not all, samples.

- 626 Field, J.B., Costa, F., and Boryczka, A. (Univ. S. California School Med.; Los Angeles County Hosp.): INHIBITION OF SOME MOUSE TUMORS BY COMPOUNDS OF HEAVY METALS. Proceedings of the American Association for Cancer Research 2, No. 1:15 (Abstracts), 1955.

A consistent and reproducible inhibition of Sarcoma 180 in the mouse was observed with Cu, Pb, Cd, and rubeanate at doses of 300, 100, and 6 mg/kg/day, respectively, when the drugs were given ip. The average diameter of the tumors was 1/2-3/4 the size of the controls. While the Cu rubeanate was without effect on leukemia L 4946 in AKR mice, Pb rubeanate produced some prolongation of life in leukemia L 4946 and inhibition of the Harding-Passey melanoma in mice but had no effect on the RC carcinoma in DBA mice. Neither rubeanic acid (dithiooxamide) nor a number of analogs had any antitumor effect. A number of inorganic salts of univalent and divalent Pb and Cu and salts of Cd were studied for tumor-inhibitory activity. Pb chromate (200 mg/kg/day) and Pb nitrate (54 mg/kg/day) were mildly but consistently effective against Sarcoma 180 but not on the RC carcinoma. Pb chloride (75 mg/kg/day), Pb carbonate (50 mg/kg/day) and CuCN (25 mg/kg/day) gave borderline effects, while 3 additional Pb salts, 7 Cu salts, and 6 Cd salts had no detectable effect. Although metallic salts have received attention as anti-cancer agents in the past, they have not been a subject of interest in present chemotherapeutic programs. In part disinterest also stems from the high toxicity of most heavy metals to the animal host. Although the rubeanate derivatives of Cu, Pb, and Cd appear to be somewhat active against certain mouse tumors it is doubtful that they deserve any particular further study or interest.

- 627 Gajdos, A., Gajdos-Török, M., and Pecora, L. (Hôtel Dieu Clinic, Paris, France): Studio dell'azione del piombo sulla sintesi della protoporfirina libera nei globuli rossi periferici di coniglio. (ACTION OF LEAD ON FORMATION OF FREE PROTOPORPHYRIN IN THE PERIPHERAL RED CORPUSCLES OF THE RABBIT.) Folia Medica (Naples) 38:773-6 (Aug.), 1955.

The protoporphyrin synthesis by erythrocytes of an anemic rabbit, incubated with glycine was inhibited by Pb acetate even in minute doses in vitro (concentrations as low as 0.0001 mg), but no inhibition was observed in rabbits previously made anemic and poisoned with Pb in vivo.

- 628 Gibson, K.D., Neuberger, A., and Scott, J.J. (Natl. Inst. Med. Res., London, England): THE PURIFICATION AND PROPERTIES OF  $\delta$ -AMINOLAEVULIC ACID DEHYDRASE. Biochemical Journal 61:618-29, 1955.

In the presence of Pb, maximum activity of ALA dehydrase was 80%. (44 references)

- 629 Giuliani, V., and Belli, R. (Univ. Siena, Italy): Comportamento di alcuni tests di funzionalità epatica nell'intossicazione sperimentale da piombo tetraetile. (SOME LIVER FUNCTION TESTS IN EXPERIMENTAL TETRAETHYL LEAD POISONING.) Folia Medica (Naples) 36:1286-94, 1955.

Thirteen rabbits (1.800-2.400 kg weight) were divided into 5 groups, one of which served as controls. Group 2 received the TEL solvent (95% alcohol), and the other 3 groups (3 animals each) received sc 1, 10 or 50 mg TEL in alcohol solution/kg/day for 24 consecutive days. The study consisted of (1) determination of total amount of bilirubin, (2) the Hanger reaction, (3) the Takata-Dohmoto reaction, (4) the determination of the protein quotient, (5) the determination of the mobilized bilirubinuria. The results are presented in tables showing that rabbits poisoned by TEL incurred liver damage the severity of which was the more evident, the more sensitive the test, the higher the dose, and the longer the period of poisoning. The bilirubin test with Na dehydrocholate showed agreement with other tests and a high sensitivity at an early stage.

- 630 Giuliani, V., Belli, R., and Zazo, S. (Univ. Siena, Italy): Processi immunitari nell'intossicazione sperimentale da piombo tetraetile. Nota I. Comportamento del titolo antistreptolisinico del siero in corso di immunizzazione attiva. (IMMUNITY IN EXPERIMENTAL POISONING WITH TETRAETHYL LEAD. I. ANTISTREPTOLYSIN LEVEL IN THE SERUM DURING ACTIVE IMMUNIZATION.) Folia Medica (Naples) 38:1001-8 (Sept.), 1955.

Six rabbits poisoned with TEL (by sc injections of 1 or 10 mg/kg/day, as an alcohol solution) were treated with iv injections of streptococcus vaccine in increasing doses. The immunizing defense mechanism was found to be completely inhibited as far as streptococcic hemolysins are concerned. The phenomenon appears even at doses which are practically innocuous when administered over a long time.

- 631 Giuliani, V., and Maggio, M. (Univ. Siena, Italy): Reattività termica in corso di intossicazione sperimentale con piombo tetraetile. (THERMIC REACTIVITY IN EXPERIMENTAL TETRAETHYLLEAD POISONING.) Folia Medica (Naples) 38:798-806, 1955.

Rabbits in groups of 3 animals each (1.550-3.100 kg weight) were used. One group served as an untreated control; 1 group was injected sc with a 0.1 ml of 95% alcohol solution/kg/day. The test groups received 50, 10, or 1 mg TEL (alcohol solution)/kg/day to induce subacute or chronic poisoning. On the 6th, 12th, 14th, and 19th day, both controls and poisoned animals received iv a streptococci suspension, and the body temperature was followed. Bacterial suspensions which were practically apyrogenic to normal rabbits or to animals treated with solvents for TEL, were pyrogenic to rabbits poisoned with TEL, provided the bacterial material was not administered at a time just preceding death.

- 632 Graziani, G., Fusco, M., and Rossi, L. (Univ. Naples, Italy): Ferro serico e saturnismo. Nota IV. La frazione insatura della proteina plasmatica capace di legare il ferro nella intossicazione sperimentale. (SERUM IRON AND LEAD POISONING. IV. THE UNSATURATED FRACTION OF PLASMA PROTEIN CAPABLE OF BINDING IRON IN EXPERIMENTAL POISONING.) Folia Medica (Naples) 38:1-10 (Jan.), 1955.
- The transferrin-Fe complex was measured colorimetrically at 520 m $\mu$ . The unsaturated Fe-binding capacity (UIBC) was determined in 12 rabbits during prolonged Pb poisoning as in the authors' previous experiment. The UIBC values declined for 2 wk and then increased again to attain values higher than initially. The serum Fe increased as the intoxication progressed. Intravenous Fe administration caused the UIBC to drop to low values. When on prolonged treatment the Fe administration was repeated, the UIBC drop was far less marked. The effect after oral administration was slower. The authors conclude that the binding power between Fe and transferrin is profoundly disturbed by Pb and the transport from the deposits of Fe to the tissues is impaired.
- 633 Kubistova, J. (Inst. Occup. Hyg., Dis., Prague, Czechoslovakia): Vliv CaEDTA na experimentální akutní otravu olovem. (INFLUENCE OF CaEDTA ON EXPERIMENTAL LEAD POISONING.) Pracovní Lékarství 7:329-35, 1955.
- See Abstract No. 679.
- 634 Kuwaki, T. (Keio Univ., Japan): STUDIES ON DETOXICATING FACTORS IN LIVER CONCENTRATE AGAINST LEAD POISONING. I. CORRELATION BETWEEN SOME KNOWN SUBSTANCES (VITAMIN B<sub>12</sub>, GLUCURONIC ACID) AND LIVER CONCENTRATE. Journal of Science of Labour (Japan) 31: 450-60 (July), 1955.
- The author's associates had found earlier that there was some detoxicating substance in cattle liver extract against Pb poisoning and the substance was purified by K. Tsuchiya. However, whether or not the detoxicating factors in the liver concentrate are some already known substances (vitamin B<sub>12</sub>, glucuronic acid) is not yet decided. Experiments were done to examine the effect of vitamin B<sub>12</sub> and glucuronic acid on Pb poisoned animals in comparison with that of liver concentrate. The following results were obtained: Vitamin B<sub>12</sub> alone in about the same quantity as contained in the liver concentrate was not so effective on Pb poisoned animals as the liver concentrate. Glucuronic acid alone in about the same amount as that contained in the concentrate was also not so effective as the latter. But a far larger amount of glucuronic acid was very effective. Some of the detoxicating factors of the liver concentrate against Pb poisoning may be either vitamin B<sub>12</sub> or glucuronic acid contained in the concentrate, but these 2 factors do not represent the whole activity of the liver concentrate. Whether detoxication depends on some unknown factors in the concentrate or on the cooperative action of some known and unknown factors is not yet clear. (From author's English summary)
- 635 Kuwaki, T., and Tsuchiya, K. (School Med., Keio Univ., Japan): A STUDY ON TOLERANCE OF ANIMALS TO LEAD POISONING. Journal of Science of Labour (Japan) 31:291-7 (May), 1955.
- Pb poisoning, induced by sc injections, with appearance of stippled cells, was tolerated by 1 group of guinea pigs, whereas another group, receiving the same injections, died within the early stages of the poisoning. Resumption of the injections after a period when animals seemed to recover to almost normal conditions, produced signs of poisoning of lesser severity than in the earlier period of injections; ie, the anemia was less severe and the number of basophilic cells was lower. It was concluded that a resistance or tolerance developed in this group. The individual differences to Pb poisoning are classified as follows: (1) the group that is most sensitive to Pb, with lower adaptation, in which case animals die after a few injections; (2) the group showing good adaptation, with increased stippled cells (considered one of the adaptation processes); (3) the group that survives for a long period of time without manifest signs, and that is most resistant against Pb. (From authors' English summary)
- 636 Mishima, M. (Univ. Kyoto, Japan): HISTOCHEMICAL STUDIES ON LEAD POISONING. I. TISSUE PHOSPHATASE DURING ACUTE LEAD EXPOSURE. II. TISSUE PHOSPHATASE DURING CHRONIC LEAD EXPOSURE. III. TISSUE OXIDASE DURING ACUTE AND CHRONIC LEAD EXPOSURE. Japan J. Nation's Health 24:68-96, 1955.
- Pb(OAc)<sub>2</sub> (1.83 mg) was injected intravenously into a mouse and the effect on alkaline phosphatase activities was examined. Organs, time in hr to develop the maximum amount of alkaline phosphatase, and hr required to return to normal amount of alkaline phosphatase, respectively, are: duodenum, 2, 8-48; liver, large intestine, kidney and stomach, 2-4, 24-48; small intestine, spleen, adrenal gland, heart and urinary bladder, 2-8, 24-48; no change in alkaline phosphatase was observed in pancreas, esophagus, trachea, lung, cerebrum, and cerebellum. Similarly, the effect on acid phosphatase activities was examined: adrenal gland 1-4, 24-48; kidney, liver and pancreas, 2-4, 24-48; stomach and small intestine 2-4, 8-48; duodenum and large intestine, 4-8, 48; spleen, heart, cerebrum, cerebellum, and urinary bladder, 2-8, 24-48; no change was observed in the activities of acid phosphatase in esophagus, trachea, and lung.
- Tissues of mice exposed to air with Pb dust for 3 mo were examined after keeping 30, 40, 50, 60, 70, 80, 90, and 100 days in fresh air. Intensive activities of alkaline phosphatase were found in kidney, adrenal gland, and heart throughout the periods, while lowered activities of alkaline phosphatase were found in esophagus, large intestine, and cerebellum; the alkaline phosphatase in liver was increased at 1st, decreased at the middle stage then increased at the last period; stomach, duodenum, small intestine, trachea, lung, pancreas, urinary bladder, and cerebrum showed increased activities of alkaline phosphatase then decreased gradually, while spleen showed an in-

crease of alkaline phosphatase at the middle period with the decrease at the initial and last periods; activities of acid phosphatase were observed in kidney, liver, heart, stomach, small intestine, adrenal gland, spleen, trachea, urinary bladder, cerebrum, and cerebellum; pancreas showed a decrease of acid phosphatase of the middle period with the increase in initial and last periods. No initial increase of alkaline phosphatase was observed in esophagus and lung.

The change in oxidase content in various organs by the above treatment is given. (From Chemical Abstracts 50:6667, 1956)

- 637 Mizuno, M. (School Med., Keio Univ., Japan): ON THE CHANGES OF MUSCLE CHRONAXIE OF RABBITS POISONED BY CARBON DISULFIDE, BENZENE, MERCURY AND LEAD. *Journal of Science of Labour (Japan)* 31:59-73 (Feb.), 1955.

The correlation between periodic chronaxie measurements and blood findings was studied and the features of the change in the former in each rabbit were also observed in detail. In Pb poisoning, the chronaxie of posterior extremity muscles of rabbits is shortened temporarily in the initial stage, but then gradually it is prolonged. The grade of change, however, is not so apparent compared with that of decreased hemoglobin (Hb), appearance of basophilic stippled red cells or loss of body weight. When the 4 kinds of poisoning are compared, according to the change of chronaxie and the decreasing rate of Hb level, the former is more manifest than the latter in the order of C disulfide, benzene, Hg, and Pb. Accordingly, the chronaxie measurements would be worth applying for the diagnosis at least of the 1st 3. The extensor and flexor ratio of muscle chronaxie becomes nearly 1:1 in the early stage of each poisoning, and no difference among the 4 kinds of poisoning is recognized. This implies that the 4 poisons may have some effects upon the central nervous system in the early stage of poisoning. The shortening of chronaxie does not appear even in the initial stage of poisoning except for Pb. As to whether this is due to the time interval of estimation or due to other unknown factors, no comment can be made here. (From author's English summary)

- 638 Morelli, A., and Loscalzo, B. (Univ. Siena, Italy): Sulla terapia dell'intossicazione sperimentale da piombo tetraetile con ormoni corticosurrenali. (TREATMENT OF EXPERIMENTAL POISONING WITH TETRAETHYLLEAD WITH ADRENOCORTICAL HORMONE.) *Folia Medica (Naples)* 38:545-9, 1955.

No protective effect was noted when groups of 5 rabbits each subacutely poisoned with TEL (100 mg/kg/day in alcohol solution, im) were treated with desoxycorticosterone acetate, cortisone acetate or a combination of the 2 hormones. Survival times for the controls and treated animals were 91 and 70-77 hr, respectively. The authors pointed out that these results should not be considered conclusive with regard to human intoxication.

- 639 Morelli, A., and Loscalzo, B. (Univ. Siena, Italy): Il versenato disodico calcico nell'intossicazione da piombo tetra-

etile. (DISODIUM CALCIUM ETHYLENEDIAMINE-TETRAACETATE IN POISONING WITH TETRAETHYLLEAD.) *Folia Medica (Naples)* 38:550-6 (June), 1955.

Two groups of 5 rabbits each (average weight 1.800 kg) were poisoned with TEL (100 mg/kg/day in alcohol solution, im). Two other groups of 9 and 10 rabbits received TEL as above and  $\text{CaNa}_2\text{EDTA}$  at 500 and 110 mg/kg/day, respectively. Survival of the control groups was an average of 91 and 129 hr, and of the treated groups, 61 and 108 hr, respectively. EDTA therefore offered no protective action.

The results obtained are briefly discussed for the purpose of further studies on the distribution of Pb in the different organs and tissues and on histologic studies in intoxicated animals and protected by EDTA, compared to equally intoxicated but not protected animals.

- 640 Motouchi, M. (School Med., Keio Univ., Japan): A STUDY ON BLOOD FINDINGS, LIVER FUNCTION TESTS AND HISTOLOGICAL APPEARANCES IN EXPERIMENTAL LEAD POISONING AND RELATIONSHIP AMONG THEM. *Journal of Science of Labour (Japan)* 31:371-84 (June), 1955.

Pb acetate (30 mg Pb/kg 6 times/wk) was administered sc to rabbits. The progress of poisoning was judged by changes in the blood. Various liver function tests showed that the total quantity of serum protein began to decrease in the comparatively early stage. Serum albumin began to decrease very early. Total quantity of serum globulin did not show conspicuous changes in spite of the progress of poisoning. Albumin/globulin ratio in serum showed a remarkable decrease in the very early stage. This phenomenon appeared prior to the various other tests. Fibrinogen decreased gradually in parallel with the progress of poisoning. Hepatosulphalein test, Co reaction and thymol turbidity test showed a little change in the later stage. Histopathological changes of the liver were recognized as degeneration, chiefly in the form of cloudy swelling, fatty change and congestion. (From author's English summary and conclusion)

- 641 Preziosi, P., and Loscalzo, B. (Univ. Naples, Italy): L'Azione della  $\beta$ -mercaptoetilamina nelle intossicazione sperimentali da piombo acetato e da piombo tetraetile. (EFFECT OF  $\beta$ -MERCAPTOETHYLAMINE IN EXPERIMENTAL POISONING WITH LEAD ACETATE AND TETRAETHYL LEAD.) *Folia Medica (Naples)* 38:1147-53, 1955.

In the 1st experiment, 5 rabbits received 25 mg Pb acetate/kg iv daily, and 5 received Pb as above and 50 mg/kg  $\beta$ -mercaptoethylamine (MEA) iv daily in divided doses. In the 2nd experiment 100 mg TEL in alcohol/kg/day was given im alone to 1 group of rabbits and in combination with MEA as above, both im and iv, to another. In neither case did MEA exert a protective action on the course of subacute poisoning in spite of the fact that it was administered at relatively high dosage, taking into account the toxicity of the drug for the rabbit.

- 642 Remy, R., and Gerlich, N. (City Hosp.,

Bielefeld, Germany): Zur Prophylaxe und Therapie der Bleivergiftung. I. Leberextrakte, Vitamin B<sub>12</sub> und Folsäure. (PRO-PHYLAXIS AND TREATMENT OF LEAD POISONING. I. LIVER EXTRACTS, VITAMIN B<sub>12</sub> AND FOLIC ACID.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 5:37-40 (Jan.), 1955.

A brief review and discussion of the effects of Pb on the production of hemoglobin and on the erythrocytes introduces an account of some experimental work with rabbits. The effect on the blood picture of the iv injection of Pb acetate in doses ranging from 2.0-6.0 mg/kg was first determined. When vitamin B<sub>12</sub> in doses ranging between 2.5 and 5.0 µg/kg was injected at the same time as the Pb solution, the blood changes were delayed in their appearance and lessened in degree. It was also found that vitamin B<sub>12</sub>, when given to the animals 10-14 days after being poisoned by Pb, had a pronounced curative action. In some experiments which are not detailed, it was found that injections of Co in doses considerably more than 0.02 µg/kg, also had a good effect in neutralizing the toxic action of Pb. Liver extracts were also tested for their potency in preventing blood changes induced by Pb. It was found that these had a much more potent effect than could be explained by their vitamin B<sub>12</sub> content alone. Experiments with folic acid showed that this had but little good effect and that only when given in very large doses could any protective action be demonstrated and even this was only transitory. (37 references)

643 Rieders, F. (Jefferson Med. Coll., Philadelphia, Pa.): EFFECTS OF ORAL Na<sub>2</sub>Ca ETHYLENEDIAMINE TETRAACETATE (EDTA) ON DISTRIBUTION OF FE, CU, ZN, AND PB IN RATS. Journal of Pharmacology and Experimental Therapy 113:45 (Abstracts), 1955.

Five male and 5 female weanling Wistar rats were kept on a diet containing Na<sub>2</sub>CaEDTA, 0.2% in food and 0.1% in drinking water for 4 mo. The experimental animals developed no significant differences from controls during the 4 mo as to appearance, activity, weight gain, erythrocyte count or Hb values. No gross or histopathology (hematoxylin and eosin stain) was noted at autopsy. Use of Fe stain revealed slight hemosiderin deposits in lung and spleen in 2 of 5 control males and in 4 of 5 control females but none in any of the tissues of the experimental animals. Chemical analysis of exsanguinated organs showed the following mean Fe, Cu, Zn and Pb content in the experimental animals as compared to controls: (values are expressed in % of corresponding mean values of controls; they are given in the order Fe, Cu, Zn, Pb; if they are statistically not significantly different from the controls, they are marked (\*)) Liver, males: 67, 131, 215, 200; females: 71, 75, 106\*, 175. Kidney, males: 47, 72, 67, 81; females: 39, 76, 77, 131. Spleen, males: 42, 184, 217, 215; females: 83, 204, 139, 80. Heart, males: 39, 90\*, 82, 72; females: 59, 138, 132, 133. Lung, males: 60, 127, 131, 150; females: 73, 148, 164, 132. Gut, males: 133, 159, 146, 109\*; females: 95\*, 95\*, 455, 106\*. Skeletal muscle, males: 25, 17, 27, 13; females: 29, 36, 50, 67. Brain, males: 160, 152, 71, 125; females: 80, 191, 100\*, 90\*. Bone, males: 50, 106\*, 35, 75;

females: 33, 80, 31, 63.

644 Sakaguchi, T. (School Med., Keio-Gijuku Univ., Japan): CHANGE OF SERUM PROTEIN AND ITS FRACTIONS IN EXPERIMENTALLY INDUCED LEAD POISONING. Journal of Science of Labour (Japan) 31:385-96 (June), 1955.

Experimental studies were made on the blood findings, liver function tests, microscopic changes and Pb in organs of dogs with subacute and chronic Pb poisoning by Pb acetate (15 mg Pb/kg and 3 mg/kg 3 times/wk). The conclusions are as follows: Inhibition of albumin synthesis in the liver appeared particularly in the very early stage. Consequently albumin/globulin ratio decreased more than any other liver function. The decrease of total protein was parallel to the decrease of the albumin/globulin ratio in serum in the subchronic cases, but the former did not show itself in the early stage of chronic cases. Pigment excretion function of the liver was slightly hindered only in the later stage. As to the histopathologic appearances, the greatest changes were seen in the liver and the kidney; there were hardly any changes in the other organs. In 2 dogs killed in the early stage (on about the 20th day of experiment) the liver was histologically damaged, but either only mild changes were seen in the kidney or none at all. On the other hand, in the other 3 cases killed after injection of Pb over a long period of time, considerable changes both in the liver and in the kidney occurred. The liver and kidney contained more Pb than any other soft organ, and this result seemed to coincide with pathological changes. In 2 cases killed in the early stage, the liver tissue contained more Pb compared with that of the kidney which showed only little Pb. In the other cases, however, the Pb in the kidney increased tremendously in the later stage of poisoning.

From these facts, the following results are considered: the factor which caused the decrease in albumin/globulin ratio in serum in the early stage is to be found in the hypofunction of albumin synthesis in the liver, but, in the later stage, in addition to this, the release of albumin from the kidney and the decrease of albumin removed have also an influence. It is difficult to obtain a correlation between the function and the morphology of liver, but from the above facts it is considered that the central part of lobules of the liver participates mainly in metabolic functions while the peripheral does so in excretory functions. (From author's English summary)

645 Salvini, M., and Scudier, U. (Univ. Padua, Italy): Sul trattamento dell'intossicazione da piombo tetraetile mediante iniezioni endovenose di Ca-etilendiaminotetracetato Na<sub>2</sub>. (ON THE TREATMENT OF TETRAETHYL LEAD POISONING BY INTRAVENOUS INJECTIONS OF CaNa<sub>2</sub>EDTA.) Medicina del Lavoro 46: 526-32 (Oct.), 1955.

Rabbits (16) were exposed to the inhalation of TEL in a concentration of 5 mg/l air; 8 were treated with CaNa<sub>2</sub>EDTA iv 1 hr before exposure, and 8 were so treated immediately after exposure. The results showed no antidotal effect on TEL poisoning. In a 2nd series, 24 rabbits were exposed to TEL as above; 8 were pretreated with 20 mg EDTA/

kg for 20 days; 6 received a single injection before, and 6, an injection after exposure, and 4 received no treatment. The results showed that EDTA had an antidotal action when given for a number of days before exposure to TEL. The authors attribute the favorable therapeutic result to the gradual accumulation of effective doses of EDTA in those tissues that are rapidly reached by otherwise fatal quantities of TEL. From their personal experiences they believe that when the object of a clinical therapy is to act antidotally on the TEL by means of chelating agents, the diffusion characteristics of the agent used should not differ from those of the TEL; otherwise it will be necessary to follow a route other than the iv. Preliminary results of experiments carried out with EDTA administered intraspinally are also reported. (19 references)

- 646 Scarinci, V. (Univ. Urbino, Italy): PRELIMINARY STUDIES ON A LEAD TETRAETHYL ANTIDOTE. *Studi Urbinati, Facoltà di Farmacia* (C), 29, No. 4:102-4, 1955.

A solution, pH 6.8, sterilized at 100°, of Na tri-thiolactate (2.88%) and Na thiolactate (3.84%) was used as an antidote on rabbits that had developed toxic symptoms by dripping TEL (lethal dose 0.6 ml) on a large shaved portion of the abdominal area. The animals survived when the intramuscular or intravenous dose given after 2 hr was 2 ml/kg, or after 15 min, with 0.5 ml/kg with 3 additional injections at 30-min intervals. A survival of 50% was obtained after 2 hr with 1.5 ml dose or after 3 hr with 2 ml dose. Also, the antidote mixed in any proportion with TEL formed a unionized salt extremely soluble in water and insoluble in absolute alcohol and chloroform. (From Chemical Abstracts 51:10736, 1957)

- 647 Sinitsyn, S.N.: (EVALUATION OF THE TOXICITY OF SYNTHETIC GASOLINE AND ETHYL GASOLINE WITH A HIGH BENZENE CONTENT.) *Inform.-Metod. Materialy Gorsudarst. Nauch.-Issledovatel. Sanit. Inst.* 1955, No. 2:21-7; *Referat. Zhur.*, Khim. 1956, Abstr. No. 49681.

The absolute lethal concentration of the vapors of synthetic gasoline (SG) (product of synthesis of CO and H<sub>2</sub>, initial boiling temperature 42°, maximum boiling temperature 189°, octane no. 31) for white mice was 125 mg/l and that of the synthetic ethyl gasoline (ESG) (SG 30.3% C<sub>6</sub>H<sub>6</sub>+0.5 ml/l of ethyl fluid) was 100 mg/l; the minimum lethal concentration of SG=95 mg/l, ESG 60 mg/l. The tolerated concentration of SG=90 mg/l, ESG 55 mg/l. Aviation gasoline caused 100% mortality at a concentration of 110 mg/l, 14.8% at 70 mg/l, at 60 mg/l no mortality was observed. The speed of onset of rigor mortis was increased in concentration of ESG of 3 mg/l, SG at 5 mg/l. The index of work ability decreased, starting with ESG concentration of 10 mg/l and SG 50 mg/l. The cholinesterase of brain decreased when the concentration of ESG was 10 mg/l or SG at 15 mg/l. In daily 2-hr exposures of rabbits in the course of 5 mo and 4-hr exposures in 6 mo to ESG in concentration 0.4-0.6 mg/l there was a decrease of leukocytes, a slight increase of segmented granulocytes, an insignificant decrease of lymphocytes, and a decrease of blood-

serum cholinesterase. (From Chemical Abstracts 52:21016, 1958)

- 648 Sobel, A.E., and Burger, M. (Jewish Hosp., Brooklyn, N.Y.): CALCIFICATION. XIII. THE INFLUENCE OF CALCIUM, PHOSPHORUS, AND VITAMIN D ON THE REMOVAL OF LEAD FROM BLOOD AND BONE. *Journal of Biological Chemistry* 212:105-10, 1955.

In rats with experimental Pb poisoning a high Ca-low P diet produced the most rapid loss of Pb from the skeleton, accompanied by the highest blood Pb level. A high P-low Ca diet produced the slowest loss of Pb in the lowest blood Pb level. The addition of vitamin D to the diets produced (a) a decrease in blood Pb, (b) decreased loss of bone Pb, (c) a rise in the serum Ca x P product, (d) an increase in the per cent of ash in bone, and (e) an increase in weight of all the animals. Vitamin D during Pb administration enhances Pb absorption, causing a rise in blood Pb. After Pb administration has ceased, however, the antirachitic vitamin, to the degree that it causes a rise in serum phosphate, depresses blood Pb. The high Ca-low P diet, by decreasing serum phosphate, causes a concomitant rise in blood Pb at the expense of bone Pb. On the other hand, in the high P-low Ca diet the resulting rise in serum phosphate is paralleled by a low blood Pb level and decreased loss of bone Pb. High blood Pb is accompanied by low serum P and vice versa, but there is no simple reciprocal relationship. (From authors' summary)

- 649 Staples, E.L.J. (Wallaceville Animal Res. Station, Wellington, New Zealand): EXPERIMENTAL LEAD POISONING IN DOGS. *New Zealand Veterinary Journal* 3:39-46, 1955.

Nine young mature dogs were used in an experiment designed to reproduce the clinical picture seen in the field cases. In series 1, 3 dogs received basic Pb carbonate equivalent to 1000, 500, and 200 mg Pb/kg body weight 4, 2, and 3 times respectively. All vomited after the 1st dose, and the blood Pb level was allowed to return to pre-dosing figure before the next dose. A daily check was made on the blood Pb level. In series 2, 6 dogs received daily the carbonate in doses ranging from 50-3 mg Pb/kg body weight. The carbonate, containing 79.25% Pb was administered in gelatin capsules.

In series 1, results were not very conclusive; listlessness, anorexia, vomiting, and nervousness were the main signs. In view of the vomiting, it was concluded that Pb poisoning in dogs is more likely chronic rather than acute. The liver of the dogs contained 7.8, 22.1, and 10.5 ppm Pb.

In series 2, all animals, except those receiving the lowest doses showed a marked drop in weight and a distemper-like syndrome after 13-63 days, which preceded convulsions. Jaundice was seen in some dogs. A normal mean Pb level of 0.7 ppm in the liver was obtained on 12 control dogs. Two dogs of series 2 had very high liver Pb levels, 139.0 ppm and 120.0 ppm; this could be explained by the high total of Pb ingested. The author suggests that values of 5.0-10.0 ppm should be regarded with suspicion, and >10.00 ppm are of definite significance in diagnosis. The blood Pb levels did not drop below 1.0 ppm in any of them



after 1st symptoms were observed. One dog only showed basophilic stippling in each of the weekly examinations. From the histopathologic findings, the author concludes that in cases of Pb poisoning lesions of a significant nature cannot always be expected; however, examinations of the cerebellum, liver and kidney are recommended. Highly suggestive are the intranuclear acidophilic inclusion bodies in liver and kidneys and if these are absent, evidence of Purkinje cells degeneration in cerebellum plus centrilobular degeneration and renal tubular and vascular damage support Pb poisoning diagnosis.

- 650 Tolgskaya, M.S. (Inst. Ind. Hyg. Occup. Dis., Acad. Med. Sci., Moscow, USSR): *Izmeneniya v nervnoi sisteme pri eksperimental'noi intoksikatsii svintsom.* (CHANGES IN THE NERVOUS SYSTEM IN EXPERIMENTAL LEAD POISONING.) *Arkhir Patologii* 17, No. 4:20-7, 1955.

Pb acetate was given by gastric tube in gradually increasing doses from 0.008-0.3 g/kg to rats and from 0.006-0.077 g/kg to guinea pigs until Pb toxicity developed or up to 7.5 mo. The animals were sacrificed at different time intervals; 4 guinea pigs died while giving birth to young. After small doses of Pb early reversible changes appeared first in the cortex when clinically no symptoms of intoxication were noted. With the onset of chronic intoxication, in addition to the cortical, there appeared changes in the subcortical nodes, in the thalamohypothalamic region, in the trunk, in the spinal cord, and later in the peripheral nerves. In acute and subacute effects of Pb (studied in rabbits, given sc 1% Pb nitrate solution in a dose of 0.033 g or 0.12 g/kg orally daily) on the nervous system there is a predominance of diffuse vascular disturbances and diffuse but not clearly defined changes in the cells of different regions of the nervous system without specific localization. In chronic Pb intoxication in all sections of the nervous system there is evidence of predominant damage to the cells of the anterior horns of the spinal cord, of the peripheral nerves and in the conducting motor paths. The effects of these are reflected in the clinical syndrome. The destructive changes in the nerve cells and fibers are accompanied by considerable vascular disturbances and proliferative changes on the part of the glia and in the internal organs. After the changes in the nerve cells there appear changes in the walls of the smaller vessels, disturbances in the circulation, and changes and disturbances in the general blood picture. The author concludes that the findings refute the existing opinion reported in the literature that changes in the nervous system in Pb intoxication are secondary and arise in connection with anemia or vascular disturbances. (13 references)

- 651 Ursano, F. (Univ. Naples, Italy): *L'identificazione istochimica del piombo nelle intossicazioni acute e sub-acute.* (HISTOCHEMICAL IDENTIFICATION OF LEAD IN ACUTE AND SUBACUTE POISONING.) Abstracts of Meeting of the Campana Society of Legal and Industrial Medicine. *Medicina del Lavoro* 46:60 (Jan.), 1955; *Folia Medica*

(Naples) 38:807-12 (Aug.), 1955.

Rabbits were poisoned with 10% aqueous solution of basic Pb acetate, given by stomach tube. Animals receiving 2 ml/kg twice daily died after 2 days; the same dose given once daily caused death after 21 days. Pb in tissues was identified with  $\text{NH}_4\text{SH}$  and staining with hemalum-eosin or by treatment with  $\text{K}_2\text{Cr}_2\text{O}_7$  and staining with toluidine blue (Frankenberger). Pb was found in the liver cells, in the kidneys, and in the spleen. In the lungs, only the parenchyma showed occasional Pb deposits.

- 652 Wilson, R.H., Poley, G.W., and DeEds, F. (US Dept. Agric., Albany, Calif.): *TOXICITY STUDIES ON PEAR POMACE CONTAINING MIXTURE OF INSECTICIDE RESIDUES.* Federation Proceedings 14:Abstract No. 1275 (Mar), 1955.

Pear pomaces prepared from fruit of several experimental orchards, each with a known and controlled spray program, were analyzed separately for Pb, As, F and DDT and then mixed to obtain the highest possible level of each residue in a composite. For controls, pomaces from an unsprayed orchard and from orchards with uncontrolled spray programs were used. The control, composite, and run-of-the-mill pomaces were mixed with diet at 10, 20, and 30% levels and fed to rats for 315 days, when the supply was exhausted. Growth rate was not significantly affected, although food intake increased progressively with increased concentration of pomace. Presumably, since the fiber of pomace was not available to the rats, they ate more to achieve adequate nutritional intake. Hemoglobin, numbers of red and white cells, and differential counts were normal, and abnormal red and white cells were not observed. The incisor teeth did not bleach. No pathological findings were noted and organ weights were normal. Although the pomaces from sprayed fruit contained more than permissible amounts of residues, the concentration of each residual constituent was slightly below the toxic level after dilution with basal diet. Combination of slightly sub-toxic amounts of these dissimilar insecticides did not cause toxic symptoms in this study, even though Pb and As may both act on erythrocytes, and both Pb and DDT can produce neurological disturbances. On the other hand, it has been reported that combination of subtoxic amounts of similar insecticides (chlorinated hydrocarbons) can cause additive toxicity. (From authors' abstract)

- 653 Wittgens, H., and Niederstadt, D. (German Soc. Ind. Safety, Frankfurt, Germany): *Tierexperimentelle Untersuchungen zur Frage der prophylaktischen Wirksamkeit der Milch bei chronischer Bleivergiftung.* (ANIMAL EXPERIMENTS ON THE QUESTION OF THE PROPHYLACTIC EFFICIENCY OF MILK IN CHRONIC LEAD POISONING.) *Archiv fflr Gewerbepathologie und Gewerbehygiene* 13, No. 6:544-72, 1955.

Animal experiments were undertaken with the object of ascertaining whether there is justification for the widely held view that milk is a valuable prophylactic and remedial measure in Pb poisoning. White male rats were given Pb acetate, both orally and by intraperitoneal injection over a period of up to 8 mo. One series received milk as their

beverage, another only water. Comparison with a series of control animals established the fact that in white rats the chief diagnostic signs of chronic Pb poisoning are loss of weight, decrease of hemoglobin, poor condition of the fur and degenerative changes in the liver and kidneys. Decrease in erythrocytes, punctate basophilia and an increased content of Pb in the bones occurred in some animals but were not regarded of diagnostic significance. In assessing the effect of administration of milk, the symptoms appeared to be more severe in the milk-fed animals, and more of these died in the series receiving intraperitoneal injections of Pb. There was no essential difference in the blood findings, in the pathological appearances of the internal organs, or in the liver function tests, and though the levels of coproporphyrinuria were not conclusively distinctive, 2 milk-fed animals which were severely affected in health and in condition of the fur and which had a high urinary excretion of coproporphyrin recovered completely, with an increase of hemoglobin and a decrease of coproporphyrinuria when milk was replaced by water.

The data obtained are shown in 13 tables and 9 figures. On these grounds the authors conclude that milk has not only no protective action but also possibly increases the risk of Pb intoxication in white rats, and if these effects can be considered analogous to those in human beings the administration of milk to Pb workers is of no benefit. (20 references)

- 654 Zambrano, A., Mangieri, A., and Silvestroni, A. (Univ. Naples, Italy): Eliminazione urinaria e fecale del piombo e comportamento della coproporfirinuria nell'intossicazione cronica sperimentale da piombo trattata con calcio E.D.T.A. (URINARY AND FECAL ELIMINATION OF LEAD AND THE BEHAVIOR OF COPROPORPHYRINURIA IN CHRONIC EXPERIMENTAL LEAD POISONING TREATED WITH CALCIUM ETHYLENEDIAMINETETRAACETATE.) Bollettino della Società Italiana di Biologia Sperimentale 31:611, 1955.

Nine rabbits with chronic Pb poisoning induced by 1 ml of 10% solution/day were given iv 1 ml 20% solution of CaEDTA for 7 consecutive days; 3 rabbits served as controls. The urinary excretion was increased 10-20-fold and the fecal, 2-3-fold. The decrease was progressive. The authors note that Pb is eliminated in both feces and urine, but much more copiously in urine.

- 655 Zambrano, A., Mangieri, A., and Silvestroni, A. (Univ. Naples, Italy): Il calcio EDTA nell'intossicazione sperimentale da piombo. (Eliminazione fecale ed urinaria di piombo - Comportamento degli elettroliti e della fosfatasi alcalina del siero di sangue). (CALCIUM SALT OF VERSENE IN EXPERIMENTAL LEAD POISONING. (URINARY AND FECAL LEAD EXCRETION. ELECTROLYTES AND ALKALINE PHOSPHATASE IN THE BLOOD).) Folia Medica (Naples) 38:813-37 (Aug.), 1955.

CaEDTA given to rabbits poisoned with Pb acetate (25 cg Pb (as acetate) orally and continued for 7 days by which time the animals had absorbed

70 cg Pb) caused an increase of Pb in the urine and feces and progressively decreased porphyrinuria. No changes occurred in the Ca, P, Cl, Na, and K levels in the blood serum, which might be a consequence of chelation. The intoxication caused considerable reduction of the phosphatase activity in the blood. Treatment brought about recovery of this enzymic activity.

## 1956

- 656 Balmus, G., Marinescu, G., and Nastac, E.: Resultatele aplicării tetrathionatului de sodiu în intoxicația saturnină experimentală. (RESULTS OF THE APPLICATION OF SODIUM TETRATHIONATE IN THE EXPERIMENTAL SATURNINE INTOXICATION.) Acad. rep. populare Române, Bul. științ., Sect. științ. med. 3:937-42, 1956.

The action of Na tetrathionate was studied on rabbits at different stages of Pb intoxication. Pb was administered in aqueous solution by stomach tube, or pulverized Pb carbonate was mixed in the diet. Na tetrathionate was given at concentrations of 3, 5, 6, 8, and 10% sc or iv, and had no effect in advanced stages of intoxication, while in milder stages the survival was 3 times that of nontreated animals. The action was comparable to that of 2,3-dimercaptopropanol and was a function of the reserves in glutathione of the organism. Na tetrathionate is recommended for use in occupational Pb poisoning, where the degree of intoxication is lower than in experimental Pb intoxication. (From Chemical Abstracts 51:16881, 1957)

- 657 Biesiekierska, J., and Teuchmann, J.K. (Centralny Inst., Ochrony Pracy, Warsaw, Poland): (EFFECT OF EXPERIMENTAL LEAD POISONING ON THE ORGAN OF VISION.) Prace Centralnego Inst. Ochrony Pracy 6, No. 1 (17):7-10, 1956.

Guinea pigs were poisoned with  $Pb(NO_3)_2$ , 100 mg/kg body weight, given as 5% solution in 2 or 3 portions. Early changes in eye muscles were observed, particularly in the levator palpebrae superioris muscle. This may be useful in diagnosing a continued Pb poisoning. (From Chemical Abstracts 53:7434, 1959)

- 658 Blosser, T.H., Abbitt, W.H., Adams, M.F., and Ward, G.M. (State Coll. Washington, Pullman): TRACE MINERALS IN THE BLOOD AND EXCRETA OF DAIRY COWS AT PARTURITION. Proc. 37th Ann. Meeting Western Div. Am. Dairy Sci. Assoc. 1956, 9 pp.

Cu, Pb, Mn, and Zn levels in the blood, urine, and feces of dairy cows were determined in 10 dairy cows from ~30 days antepartum to 30 days postpartum. Most marked changes in levels of these minerals occurred between 5 days antepartum and 5 days postpartum. (From Chemical Abstracts 51:8237, 1957)

- 659 Buckup, H., Böhm, M., Zimmermann, H., Remy, R., Portheine, F., and Voss, C. (State Inst. Ind. Med., Bochum, Germany): Nahrungskomponenten und ihre Bedeutung für die Prophylaxe beruflicher Bleivergiftungen. (Teil 1) (Experimentelle

Untersuchungen am Kaninchen.) (DIETARY COMPONENTS AND THEIR SIGNIFICANCE IN THE PROPHYLAXIS OF OCCUPATIONAL LEAD POISONING. I. (EXPERIMENTS WITH RABBITS).) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 6:1-4, 29-34 (Jan.), 1956.

The influence of various dietary components on Pb poisoning was studied on 6 groups of 25 rabbits each. The animals were of about the same weight, and were used in the experiment from Aug. 1953-Jan. 1954. As far as possible the rabbits were kept in separate cages and received 50 g oats/day and fresh cabbage ad lib. The animals received intraperitoneal injections of Pb acetate twice/wk at 1 ml of a 0.05% Pb acetate solution (3.2 mg Pb/kg body weight) in the 15th and 16th wk Pb acetate was administered intravenously. The Pb acetate solution was adjusted to pH 5. In addition, Group I received by esophageal tube daily 2.5 ml of 2% methionine solution; Group II, 2.5 ml of 2.7% cysteine HCl solution; Group III, 1 ml of 5% ascorbic acid solution; Group IV, 8 ml whole milk; Group V, 1 µg vitamin B<sub>12</sub>/kg subcutaneously; Group VI served as control. Although considerable changes were seen in the blood pigment, the animals tolerated the Pb doses relatively well. The weight curves in the 11th-13th wk showed no significant variations. However, the groups receiving methionine and cysteine showed a tendency to increase in weight; ascorbic acid and B<sub>12</sub> had no effect one way or the other; animals on milk and the controls showed tendency to loss in weight. Ascorbic acid, as well as methionine in some cases, exerted a protective action on erythropoiesis. In animals treated with milk, a lower deposition of Pb in bone was observed.

A diet high in nutrients is recommended for Pb workers; excessive fat and protein should be avoided, as should misuse of alcohol. There is no basis for considering normal ingestion of milk as harmful for Pb workers. The authors, however, doubt that milk in itself is protective. Technical safety and preventive measures are believed to be the most important.

- 660 Calapso, P., and Majorca, G. (Inst. Sci. Information, Milan, Italy): Glomerulonephropatia saturnina; ricerche sperimentali. (GLOMERULONEPHROPATHIA CAUSED BY LEAD; EXPERIMENTAL STUDY.) Biologica Latina 9, No. 4:483-500, 1956.

Of 48 rats, 12 served as controls; 36 received sc 1 ml of a 1/1000 solution of Pb acetate daily for 3 mo. Histologic and histochemical examination of the initial damage induced in the kidneys showed that the first and most important damage appears in the glomerular capillaries while the tubules are only later involved in the degenerative process. Pb blocks the SH group thus inhibiting the enzymes possessing such groups; these enzymes together with other factors control the chemical and physical equilibrium of the glycoproteins of the glomerular wall, which are the main component of the ground substance around the loops. The tubular nephrosis is produced by the exudation of plasma following such damage and possibly by a direct action of the Pb on the epithelium.

According to modern views on the pathology of the kidney, the authors consider this kind of renal

damage among the glomerular nephroses of toxic ethiology. (63 references)

- 661 Candela, R.R., Candela, J.L.R., and Sanz, P.: INFLUENCE OF EXERCISE ON LEAD DEPOSIT IN EXPERIMENTAL INTOXICATION. Med. Seguridad 4:23-4 (Jan.-Mar.), 1956.

Rats of both sexes, weighing from 200-250 g, were intoxicated with 1 single dose of 0.5 mg Pb nitrate/kg weight. During the following 10 days they were submitted to physical exercise (running) 2 hr/day. After this, on measuring the Pb deposit in the muscles and bones of the legs, it was found that it was much greater in the rats that had been performing exercise than in those of the control group. (From Archives of Industrial Health 14: 573, 1956)

- 662 Desoille, H., Michon, R., and Truffert, L. (Inst. Ind. Hyg. Med., Paris, France): A propos de l'emploi d'une huile de coupe plombifère et soufrée. (THE USE OF LEAD AND SULFUR CUTTING OILS.) Proceedings of the Institute of Industrial Hygiene and Medicine. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 17:582-5 (Nov.), 1956.

The use in some countries of a cutting oil containing an organic Pb compound, such as Pb naphthenate, had aroused the fear that it would endanger the health of workers. Several years earlier one of the authors had shown that a hazard of Pb absorption did exist. Since that time it was considered that not all of these cutting oils would be accompanied by the same risks. For this reason, an oil containing a Pb and a S compound was used in animal experiments. Application of an oil emulsion at concentrations which would approach work conditions (5 drops (increasing to 15) of 10, 30, and 50% emulsion daily, Pb and S contents are not given) to the skin of guinea pigs for 2 mo, caused no changes in the blood. Application for 57 days of 10 drops of 30% emulsion led to blood changes (increased stippled cells). The Pb content of the liver and kidney was not increased significantly. Although the Pb content of fumes and aerosols released by using a 10% aqueous emulsion of the oil on a lathe was 0.22 mg and 0.35 mg/m<sup>3</sup> of air at a distance of 0.10-0.20 m from the head of the lathe, under actual working conditions these concentrations would not occur in the operator's breathing zone.

- 663 Dresel, E.I.B., and Faik, J.E. (Univ. Coll. Hosp. Med. School, London, England): STUDIES ON THE BIOSYNTHESIS OF BLOOD PIGMENTS. 2. HAEM AND PORPHYRIN FORMATION IN INTACT CHICKEN ERYTHROCYTES. 3. HAEM AND PORPHYRIN FORMATION FROM δ-AMINOLAEVULINIC ACID FROM PORPHOBILINOGEN IN HAEMOLYSED CHICKEN ERYTHROCYTES. Biochemical Journal 63:72-9; 80-7, 1956.

2. Among the inhibitors studied, Pb inhibited porphyrin formation from glycine, but did not apparently interfere specifically with the incorporation of Fe into porphyrin. (37 references)

3. Addition of 10<sup>-4</sup>M Pb acetate caused almost total inhibition of heme synthesis from glycine, scarcely any inhibition of heme and porphyrin for-

mation from PBG, and a considerable inhibition of porphyrin formation from ALA. The step most sensitive to Pb must be among the early steps leading to the synthesis of ALA. (16 references)

- 664 Esyutina, O.S. (Acad. Sci., Kazakh SSR): Vliyanie svintsovoi intoksikatsii na razvitie eksperimental'nogo raka. (THE EFFECT OF LEAD INTOXICATION ON THE DEVELOPMENT OF EXPERIMENTAL CANCER.) Trudy Instituta Kraevoi Patologii, Akademiya Nauk Kazakhskoi SSR 4, No. 11:55-63, 1956.

Since much work has been done on the effect of the functional state of the nervous system on the development and course of Pb poisoning, the author wished to determine the effect of Pb poisoning on the development and course of skin cancer produced in white mice by application of coal tar. In both series, mice (total, 194) received on the skin 1 drop of coal tar 3 times/wk for 30 wk, and were observed thereafter. Upon death, the animals were dissected and fixed in neutral formalin, and the area of the skin to which coal tar had been applied was cut out together with surrounding sound skin and followed microscopically. In the 1st series, control mice received daily by means of a metal stomach tube 0.5 ml physiologic solution. In the 2nd, mice received in the same manner daily 0.5 ml Pb acetate solution containing 0.4 mg Pb acetate. After 2 mo examination of blood showed basophilic stippling of erythrocytes and a large number of reticulocytes. The results showed that the coefficient of survival of control mice 2 mo and 10 days after start of experiment was 0.90 and in the experimental, 0.78; after 6 mo 10 days, it was 0.64 and 0.47 and at the end of experiment, 11 mo from start, it was 0.20 and 0.02, respectively. The time of the appearance of the 1st papillomas in the experimental mice was after 3 mo, and in the controls, after 4 mo. Progression into malignancies was obviously more frequent in the Pb group: after 6 mo 20 days from start, malignant tumors were found in 2 controls, and 6 of the Pb group; by the end of the experiment there were 10 in the controls, and 16 in the experimental.

The author considers that the acceleration and severity of the cancerous process was due to the lowering of the resistance of the organism by the effect of Pb on the central nervous system as well as by the direct action of the Pb circulating in blood.

- 665 Fried, J.F., Rosenthal, M.W., and Schubert, J. (Argonne Natl. Lab., Lemont, Ill.): INDUCED ACCUMULATION OF CITRATE IN THERAPY OF EXPERIMENTAL LEAD POISONING. Proceedings of the Society of Experimental Biology and Medicine 92:331-3, 1956.

The concept of interference in a metabolic cycle as a means of modifying metal toxicity was tested. The accumulation of citric acid in certain soft tissues of the rat was induced by administration of small, nonlethal doses of Na fluoroacetate. This was found to give partial protection to rats acutely poisoned with Pb nitrate by iv injection. Of rats given the LD<sub>90</sub> of Pb nitrate, 53% survived when treated with Na fluoroacetate. The LD<sub>50</sub> of Pb nitrate was increased from 58.2 mg/kg (as Pb) in saline controls to 67.7 mg/kg in fluoroacetate-

treated rats. (From authors' summary; 12 references)

- 666 Fuse, T. (Univ. Niigata School Med., Japan): STUDIES ON THE FLUORESCYTE IN LEAD-POISONING. PART II. PATTERNS OF FLUORESCYTES IN EXPERIMENTALLY LEAD-POISONED GUINEA-PIGS, (1). Journal of Science of Labour (Japan) 32:781-90 (Oct.), 1956.

In a previous paper the author has presented the demonstration of fluorescyte, the appearance of which is followed by the anemia of Pb poisoning. This communication deals with the change of fluorescyte counts in the circulating blood of experimentally Pb-poisoned guinea pigs. The findings are as follows: 1. The fluorescyte is found in almost all Pb-poisoned animals. 2. The level of fluorescytes in the circulating blood rose with increased severity of Pb poisoning. 3. The average number of fluorescytes increased hyperbolically against the decrease of red cell counts as well as of hemoglobin level, and also against the increase of reticulocyte counts. 4. The fluorescyte cannot be identified as the reticulocyte, and, therefore, it has to be considered as another indication of anemia. 5. The number of basophilic stippled red cells added to that of polychromatic ones and the number of reticulocytes respectively increased hyperbolically against the decrease of red cell counts. On this occasion, the rate of increase in reticulocyte counts grew earlier than that in basophilic stippled red cell counts added to polychromatic ones at least in the Pb-poisoned guinea pig. (From author's English summary)

- 667 Fuse, T. (Univ. Niigata School Med., Japan): STUDIES ON THE FLUORESCYTE IN LEAD-POISONING. PART II. PATTERNS OF FLUORESCYTES IN EXPERIMENTALLY LEAD-POISONED GUINEA-PIGS, (2). Journal of Science of Labour (Japan) 32:933-44 (Nov.), 1956.

In this paper, the implication of the finding, which has previously been reported is discussed as follows. An appearance of fluorescytes in the circulating blood is possibly considered to be in consequence of the occurrence of excessive free porphyrins in the red cell, which are the intermediates in hemoglobin synthesis. In Pb-poisoning, the increase of polychromatic red cells, basophilic stippled ones and reticulocytes may not be indicative of the regenerative phenomenon in hemopoiesis, while they may perhaps be a sign of suppression in the ripening process of the red cells. The polychromatic red cell would be intrinsically identified as the basophilic stippled one. It is supposed, however, that these 2 cells differ from each other not only in quantity but in the mode of their occurrence in the basophilic substances in the red cell. However, it may be reasonable to assume that the reticulocyte differs in its formation process from them. (From author's English summary)

- 668 Gerlich, N., and Remy, R. (City Hosp., Bielefeld, Germany): Zur Prophylaxe und Therapie der Bleivergiftung. II. Methionin, Cystein, Eiweisshydrolysate. (PROPHYLAXIS AND THERAPY OF LEAD POISONING. II. METHIONINE, CYSTEINE, PROTEIN HYDROLYSATES.)

Zentralblatt für Arbeitsmedizin und Arbeitsschutz 6:101-4 (May), 1956.

In continuation of research on the effects of liver extracts, vitamin B<sub>12</sub> and folic acid on Pb intoxication induced in experimental animals, the influence of S-containing amino acids was studied. Groups of rabbits (12 males in each group) were given iv injections of 6.0 mg of Pb acetate/kg on 3 successive days and on each of these days the amino acids under test were also injected. Hemoglobin determinations and red cell counts were carried out daily for a period of 7-10 days. The findings are recorded and discussed at some length. A protective effect as judged by a slower and ultimately a lesser fall in the number of red cells was demonstrated by the injection of methionine (12.08 mg), cysteine (15.28 mg and 7.64 mg) and liver hydrolysate (0.4 ml of preparation 1255 Boehringer, Mannheim). Oral administration of 100 mg of methionine was also effective and this influence was greatly enhanced when ascorbic acid, 100 mg daily, was given at the same time. Cysteine was only effective when given iv. No good protection was obtained with cystine. The author concludes that it is quite possible to have a favorable influence on Pb poisoning with vitamin B<sub>12</sub>, folic acid and liver extracts as well as with S-amino acids except for cystine. Favorable results were generally achieved with combinations, eg methionine and ascorbic acid.

- 669 Giuliani, V., and Belli, R. (Univ. Florence, Italy): Processi immunitari nell'intossicazione sperimentale da piombo tetraetile. Nota V. Sulla presenza di anticorpi bloccanti nel siero in corso di immunizzazione attiva antitifica. (IMMUNOLOGIC PROCESSES IN EXPERIMENTAL POISONING WITH TETRAETHYL LEAD. V. PRESENCE OF BLOCKING ANTIBODIES IN THE SERUM DURING ACTIVE TYPHOID IMMUNIZATION.) Folia Medica (Naples) 39:147-53 (Feb.), 1956.

Studies were carried out on the blood serum of rabbits intoxicated with TEL and subjected to active immunization by typhoid bacillus to discover whether blocking antibodies were present, and to obtain better information on the deficient immunization response previously reported by the authors.

Agglutination tests carried out on the serum portion precipitated in 35% saturated ammonium sulfate showed a higher antibody titration compared with that previously found in the total serum. Wiener's test confirmed the presence of blocking antibodies. The authors conclude by stating that the antibody concentration produced in an intoxicated animal under vaccine stimulation must always be considered as definitely deficient. (From authors' summary)

- 670 Giuliani, V., and Belli, R. (Univ. Florence, Italy): Processi immunitari nell'intossicazione sperimentale da piombo tetraetile. Nota VI. - Comportamento degli anticorpi antimelitense (completi ed incompleti) in corso di immunizzazione attiva. (IMMUNOLOGIC PROCESSES IN EXPERIMENTAL POISONING WITH TETRAETHYL LEAD. VI. BEHAVIOR OF ANTIBODIES AGAINST BRUCELLA MELITENSIS DURING ACTIVE IMMUNIZA-

TION.) Folia Medica (Naples) 39:154-61 (Feb.), 1956.

Ten rabbits (1.700-3.000 kg weight) were divided into 4 groups: Group 1 (2), controls; Group 2 (2) received sc 0.1 mg 95% alcohol/kg/day. Groups 3 and 4 (3 animals each) received sc 1 and 10 mg TEL in 95% alcohol/kg/day and on the 6th, 11th, 16th and 21st day an iv injection of 0.25, 0.50, 0.50 and 1 ml of antimelitensis vaccine, respectively. On days 9, 14, 19, and 24, 1 animal was sacrificed and the amount of agglutinin and the presence of incomplete antibodies was studied.

The antibody response to agglutination was found to be absent in the blood of the poisoned animals. Wiener's test showed the presence of blocking antibodies which partially explained the negative test for agglutinins.

- 671 Goldberg, A., Ashenbrucker, H., Cartwright, G.E., and Wintrobe, M.M. (Univ. Utah, Salt Lake City): STUDIES ON THE BIOSYNTHESIS OF HEME IN VITRO BY AVIAN ERYTHROCYTES. Blood 11:821-33, 1956.

The synthesis of heme was inhibited by malonate and Pb at several levels, particularly the formation of ALA and incorporation of Fe into protoporphyrin. (38 references)

- 672 Grant, W.M., and Kern, H.L. (Harvard Med. School; Massachusetts Eye Ear Infirmary, Boston): CATIONS AND THE CORNEA. TOXICITY OF METALS TO THE STROMA. American Journal of Ophthalmology 42, No. 4, Pt. 2: 167-81 (Oct.), 1956.

Toxicity of salts of the metallic elements to corneal stroma has been examined along with an analysis of certain chemical reactions of cations involved in corneal injury and attempts to reverse these reactions for therapeutic purposes. An approximately neutral 0.1M solution of a salt of each metal (Y, Be, La, Th, Ni, Cu, Ag, Cd, Hg, Pb) was dropped on the scraped cornea of 1 or more rabbits for 10 min. After exposure, the degree and type of injury was evaluated by periodic examination during several months. In control eyes removal of the epithelium and exposure to water or a neutral solution of ammonium chloride caused no permanent damage. In the case of Pb, solubility was insufficient to provide a 0.1M solution, but when tests were carried out employing a more dilute solution, this metal was so toxic it caused complete permanent opacity.

The results are summarized as follows: Toxicity to the corneal stroma as measured by corneal opacification in rabbits can in most instances be correlated with the tendency of the metal to bind to the tissue and with the denaturing influence of the metal on the cornea as measured by the decrease in capacity to absorb water and by loss of solubility of corneal mucoproteins in water. The cornea exhibits a wide range of selectivity in its reaction with different metals, quite analogous to the selectivity of a cation-exchange resin. The metals which compete most effectively for attachment to the tissue are in general the most toxic. The majority of toxic metals bind to the same reactive sites in the tissue as do innocuous metals such as Ca though with stronger affinity; certain toxic metals, however, react with the cornea at

other sites. Most effective reversals of the influence of toxic metals on corneal hydration and mucoprotein extractability have been obtained by using EDTA (Na, pH 8.0) following exposure of the denuded corneas to salts of Cu and Pb and by treatment with Na sulfosalicylate following exposure to Be sulfate.

- 673 Great Britain: THE WEST OF SCOTLAND AGRICULTURAL COLLEGE. REPORT ON THE WORK OF THE COLLEGE FOR THE YEAR ENDED 30th SEPTEMBER 1956. Stirling, Jamieson and Munroe, Ltd., 1956, 76 pp.

A case of Pb poisoning in cattle from chewing Pb-coated electric cable was reported. (From Veterinary Bulletin 28, No. 3:957, 1958)

- 674 Grishchenko, E.D., and Nikitenko, V.V. (Inst. Ind. Hyg. Occup. Dis., Acad. Med. Sci., Moscow, USSR): Vkluychenie metionina v aktomiosin i v myshechnuyu tkan pri khronicheskom svintsovom otravlenii. (INCLUSION OF METHIONINE INTO ACTOMYOSIN AND INTO MUSCLE TISSUE IN CHRONIC LEAD POISONING.) Voprosy Meditsinskoi Khimii 2, No. 5:328-37, 1956.

Experiments were performed with young male rats (115-260 g weight) to whom 100-200 mg Pb nitrate was administered daily orally over a 5-mo period. On days 10, 50, and 125 after start of experiment, groups of rats (5-11 rats/group) were injected into the stomach 1 ml of  $^{35}\text{S}$ -labeled methionine, and both experimental and control groups were sacrificed at each of the above periods designed to represent the various stages of poisoning. Body weight, ratio of organ (kidney, liver, thyroid, lungs, heart, brain) to body weight, basophilic stippling, hemoglobin content of blood, actomyosin content of heart and skeletal muscle, and viscosimetric activity of heart and muscle actomyosin, were followed, and results were tabulated.

The results showed that the process of chronic Pb intoxication could be divided into 3 distinct periods: During the 1st relatively short period (~2 wk), the rate of  $^{35}\text{S}$  incorporation had in all cases a tendency to decrease; the animals lost weight, the content and viscosimetric activity of muscle and heart decreased. During the 2nd period (within 3 mo) there was a temporary normalization of vital functions. The rate of protein resynthesis, the content and viscosimetric activity of actomyosin, the rate of weight increase, and other values returned to their normal level or exceeded it. During the last period (3 mo and more of intoxication) there was a change for the worse in nearly all values; this condition was irreversible.

- 675 Hammond, P.B., Wright, H.N., and Roepke, M.H. (Univ. Minnesota, Minn.): A METHOD FOR THE DETECTION OF LEAD IN BOVINE BLOOD AND LIVER. University of Minnesota, Agricultural Experiment Station Bulletin No. 221, Dec., 1956, 14 pp.

The principal aim of the investigations was to perfect a simple method of detecting Pb in blood and liver of cattle for diagnostic purposes. It is admitted not to be sufficiently accurate to be considered a quantitative analytical procedure, so

that for toxicologic investigations, accepted methods of analysis should be used. The method involves protein precipitation with trichloroacetic acid, development of a color reaction by treatment of the supernatant solutions with 2 reagents and estimation of Pb concentrations by visual comparison to a series of standard color blocks which are appended, showing color reactions for concentrations of 0-1.2  $\mu\text{g}$  Pb/ml blood and 0-32  $\mu\text{g}$ /g liver. Analyses of the blood of 16 apparently normal, healthy cows gave Pb values of 0.10  $\mu\text{g}$ /ml (SD  $\pm 0.06$   $\mu\text{g}$ /ml). From a comparison with a similar survey (Allcroft, 1950), showing similar results, the conclusion is drawn that Pb values of  $>0.24$   $\mu\text{g}$ /ml would be encountered in  $<5\%$  of normal cattle. The Pb content in the blood of 15 cattle visibly ill as a result of Pb ingestion ranged from 0.35-2.36  $\mu\text{g}$ /ml. Six of the animals died; their blood Pb was 1.09-2.36  $\mu\text{g}$ /ml. However, 2 animals survived with Pb values of 1.40 and 1.52  $\mu\text{g}$ /ml respectively. It is suggested that any color reaction for blood intermediate between 0.2 and 0.5  $\mu\text{g}$ /ml be considered strongly suggestive of Pb poisoning and that any color indicating higher concentration quite definitive evidence of Pb poisoning.

The livers of 14 normal calves and 5 normal cows were found to contain 0.2-1.9  $\mu\text{g}$ /g fresh substance (SD  $\pm 0.35$   $\mu\text{g}$ /g). Pb concentrations in the livers of 4 experimentally and 13 accidentally poisoned cattle ranged from 5.0-240  $\mu\text{g}$ /g. The authors conclude on the basis of their data that a clear color differentiation usually is possible between normal concentrations of blood and liver Pb and those found in cases of Pb poisoning.

- 676 Harada, A. (Univ. Kyoto, Japan): EFFECT OF VITAMIN B<sub>12</sub> AND FOLIC ACID UPON THE BLOOD PICTURE OF LEAD WORKERS. II. INFLUENCE OF VITAMIN B<sub>12</sub> AND FOLIC ACID UPON NUCLEIC ACID METABOLISM. Kokumin Eisei 25: 121-9, 1956.

The nucleic acid content in blood of rabbits, treated so as to give large reticulocyte counts by repeated bleeding, is reduced markedly by the addition of Pb in vitro, but when vitamin B<sub>12</sub> and folic acid are administered to the blood in addition to Pb, the decrease is almost prevented. The content of nucleic acid in guinea pig bone marrow of femur and tibia is also reduced markedly by the injection of Pb acetate, but the reduction is prevented when the guinea pigs are treated with vitamin B<sub>12</sub> and folic acid, and even the acceleration of its synthesis is apparently noticed. Thus, the favorable effects of vitamin B<sub>12</sub> and folic acid upon the blood pictures affected by the Pb are assumed to be caused by their favorable effects on the metabolism of nucleic acid in erythropoiesis. (From Chemical Abstracts 51:8992, 1957)

- 677 Japanese Association of Industrial Medicine: PROCEEDINGS OF THE 29TH GENERAL MEETING OF THE JAPANESE ASSOCIATION OF INDUSTRIAL MEDICINE. Journal of Science of Labour (Japan) 32:217-347 (Apr.), 1956. Among the 229 papers presented, the following concerned Pb (numbers refer to Proceedings): Tati, M: Determination of Lead in Air with EDTA. Abstract No. 50.

- Watanabe, H., Tomita, K., and Murayama, H.: A Survey on the Lead Poisoning among Workers in Newspaper Printing Factories. Abstract No. 64. See Abstract No. 3137.
- Osamura, K., and Nakanishi, Y.: Electrocardiographic Studies on the Worker at a Storage Battery Manufacturing Plant. Abstract No. 65.
- Nisino, S.: Treatment of the Lead Poisoned with Ca-EDTA by Oral Administration. Abstract No. 66.
- Horiuchi, K., Owada, K., Horiguchi, S., Nagao, Y., Iwataki, H., Ueda, T., Hirayama, A., Wada, N., and Yuge, M.: Prevention and Treatment of Industrial Lead Poisoning. (Report V): Effect of Oral Administration of Ca-EDTA. Abstract No. 67.
- Horiuchi, K., Tamori, E., Okada, A., and Yuge, M.: Reconsideration on the Distribution of Lead in the Body of Healthy Japanese. (Report I). Abstract No. 115.
- Horiuchi, K., Horiguchi, S., Nagao, Y., Okada, A., Yuge, M., and Wada, N.: Studies on the Fate of Lead Introduced into the Body. (Report III). Oral administration of RaD in guinea pigs. Abstract No. 116.
- Mori, A.: On Distribution of Lead in Erythrocyte Constituents and Form of Lead Combination. Abstract No. 117.
- Yokohashi, G.: Experimental Studies on the Distribution of Lead in Blood. Abstract No. 118.
- Sano, S., and Inoue, S.: Studies on the Disturbance of Hemoglobin Synthesis in Lead Poisoning. (Report I): Studies on the Porphyrin Metabolism. Abstract No. 119.
- Nishio, K.: Effects of Lead Ions upon the Activity of Muscle Phosphorylase and Phosphoglucumutase. Abstract No. 120.
- Orita, Z., and Harada, A.: Experimental Studies on the Effect of Ca-EDTA upon Lead Poisoning. (Report III). Abstract No. 121.
- Sano, S., and Harada, A.: Experimental Studies on the Effect of Vitamin B<sub>12</sub> upon Lead Poisoning. (Report III). Abstract No. 122.
- Fuji, T., Sakakibara, E., and Hisanari, M.: Studies on the Detoxicating Mechanism of Lead Poisoning. (Report IV). Abstract No. 123.
- Ichinose, O.: Studies on the Metabolism of Serum Iron and Copper in Chronic Lead Poisoning. Abstract No. 124.
- Horiuchi, K., Horiguchi, S., Nagao, Y., Okada, A., Yuge, M., Wada, N., and Iwataki, N.: Initial Symptoms of Workers Exposed to Lead for the First Time. (Report I). Abstract No. 125.
- Tsuchiya, K., and Nishimura, M.: Effects of Parathyroid Function on Lead Poisoning. Abstract No. 126.
- Wakizaka, I.: Lead Poisoning and Pituitary-Adrenocortical Function. (Report III): Chronic Lead Poisoning of Rats. Abstract No. 127.
- Wakizaka, I.: Lead Poisoning and Pituitary-Adrenocortical Function. (Report IV): Lead Poisoning of Adrenalectomized Rats. Abstract No. 128.
- Masukubo, M.: Experimental Studies on the Influence of Chronic Lead Poisoning on the Function of Genital Organs of Female Albino Rats. Abstract No. 129.
- Sudo, Y.: Electrophoretic Studies on the Serum Proteins of Workers Handling Lead, with Special Reference to  $\gamma$ -Globulin. Abstract No. 130.
- Watanabe, G., and Fuse, T.: Behaviour of Fluorescyte in the Lead Poisoned. (Report I): On the Fluorescyte Patterns in Experimentally Lead Poisoned Guinea Pigs. Abstract No. 131.
- Wakizaka, I., and Nukada, A.: Starvation and Lead Poisoning. Abstract No. 132.
- Nagai, T., and Huse, T.: On the Blood Glutathione Level in Experimentally Lead Poisoned Rabbits. Abstract No. 133.
- Nishiyama, K., Ishizawa, S., Oshima, M., and Miyazaki, M.: Experimental Studies on the Lead Content of Hair. Abstract No. 134.
- 678 Joardar, S.N.D., and Baetjer, A.M. (Johns Hopkins School Hyg. Pub. Health, Baltimore, Md.): EFFECTS OF ENVIRONMENTAL TEMPERATURE AND DEHYDRATION ON SUSCEPTIBILITY OF MICE TO LEAD POISONING. Federation Proceedings 15:Abstract No. 326 (Mar.), 1956.
- The majority of childhood Pb poisoning cases occur in summer. In order to determine if high environmental temperature and dehydration are responsible for this seasonal distribution, mice were exposed to 60°F, 72°F, and 95°F environmental temperatures for 3 days before and 2 wk after injection with Pb. The body temperature did not average more than  $\pm 1.5^\circ\text{C}$  from normal. Dehydration was produced by restricting water intake leading to a 12% loss of body weight over a 3-day period preceding injection and was maintained for 3 days after injection. High temperature increased the mortality significantly, hastened the onset of deaths and accelerated the rate of dying when a solution of Pb acetate, Na thiocyanate and Na citrate was injected ip and when Pb acetate was injected iv. Temperature exerted no effect on mortality when Pb acetate was administered ip, possibly because this substance formed a precipitate in the peritoneal cavity. Dehydration significantly increased mortality at all temperatures and decreased the latent period at high temperature when either of the Pb solutions was injected ip. Exposure to 60°F had no significant effect on mortality but deaths continued over a longer period. The effects of high temperature cannot be explained entirely on the basis of increased rate of absorption from the peritoneal cavity since similar results followed iv injection; nor do the results parallel body temperature and expected metabolic changes. The marked effect of dehydration indicates that rate of urinary excretion may be an important factor. (From authors' abstract)
- 679 Kubistová, J. (Dept. Ind. Hyg. Occupational Dis., Prague, Czechoslovakia): EFFECT OF EDATHAMIL CALCIUM-DISODIUM ON LEAD ACETATE INTOXICATION. OBSERVATIONS OF EFFECT ON EXPERIMENTAL ACUTE LETHAL INTOXICATION IN MICE. Archives of Industrial Health 13: 556-60 (June), 1956.
- Female white mice, 7-8 wk old, were used in all experiments. Acute Pb intoxication was induced by injection of an aqueous solution of Pb acetate (trihydrate) into the tail vein at a dose of 300 mg/kg. (The author notes that this dose, injected rapidly, will cause death within a few seconds. This can be prevented by decreasing the rate of injection of the total volume of  $\sim 0.3$  ml over  $\sim 5$  min.) The above dose caused an average mortality of 67% in control animals, the 1st after 12 hr, most on the 5th and 6th days, and the last after

2 wk. The mortality varied from 50-91% in various experiments performed from May 1954-Feb. 1955, and permitted statistically significant conclusions concerning the effect of  $\text{CaNa}_2\text{EDTA}$ .

The toxicity of EDTA was first determined:  $\text{LD}_{50}$  was  $>2375 \text{ mg/kg}$  iv and  $7125 \text{ mg/kg}$  ip. In Expt 1, EDTA was administered to the mice 5 min after Pb injection at a dose of  $350 \text{ mg/kg}$  iv, followed by 4 ip injections of  $200 \text{ mg/kg}$  at intervals of 3-5 hr. The total mortality rate in both the control and EDTA mice (17/30 vs 11/30) was not statistically significant. In Expt 2, EDTA was given at  $350 \text{ mg/kg}$  5 min after Pb; 7 injections of  $300 \text{ mg/kg}$  were given at intervals of 4-5 hr during the following night and day, and continued by daily injection of  $200 \text{ mg/kg}$  ip for 7 days. A highly significant improvement was observed: 13.4% mortality among 15 experimental mice, and 81.4% among 20 controls. Expt 3 was similar except that the 1st dose of EDTA ( $200 \text{ mg/kg}$  ip) was given 20 hr after Pb. The results were also highly significant: 5.8% mortality among 17 experimental mice, and 56% among 16 controls. Two other experiments were arranged similarly, but instead of ip injection, EDTA was administered sc; the results were highly significant. In an additional experiment according to the scheme recommended by Maison (1953),  $73 \text{ mg/kg}$  EDTA given iv daily, and not  $>360 \text{ mg/kg}$  weekly, were not effective.

The author concludes that it is clear that severe Pb intoxication in experimental animals may be dramatically improved by correct treatment with EDTA. Failures and successes of variations in the treatment showed that it is of greater importance to continue the administration of EDTA than to begin early with the treatment. It seems that the drug does not exert its beneficial effect by substantially increasing Pb elimination from those stores in the body that cause the symptoms and deaths in acute poisoning, but rather that it is effective predominantly by blocking the Pb that is continually released from these stores into the body fluids and by preventing it from reacting with some sensitive tissue structures. Some of the author's observations and those of others tending to substantiate this hypothesis are discussed. Other experiments showed that sc administration is as effective as ip and that the omission of the massive dose at the beginning of the medication or a considerable diminishing of the doses greatly decreases the effectiveness of the treatment. Experiments with chronic Pb poisoning are in progress.

- 680 Kubiřtová, J. (Ústav Hyg. prace, Prague, Czechoslovakia): (INFLUENCE OF CALCIUM VERSENATE ON EXPERIMENTAL CHRONIC LEAD POISONING IN ANIMALS.) *Pracovní lékařství* 8:173-5, 1956; Chemical Abstracts 50: 15961, 1956.

See preceding abstract.

- 681 Loscalzo, B., and Maggio, M. (Univ. Florence, Italy): Ripartizione del piombo nei surreni di conigli intossicati con piombo tetraetile e influenza su tale ripartizione di sostanze diverse (ormoni corticosurrenali,  $\text{CaEDTA}$ ,  $\beta$ -mercaptoetilamina). (DISTRIBUTION OF LEAD IN THE

SUPRARENALS OF RABBITS INTOXICATED WITH LEAD TETRAETHYL AND THE INFLUENCE OF SOME SUBSTANCES (CORTICO-SUPRARENAL HORMONES,  $\text{CaEDTA}$ ,  $\beta$ -MERCAPTOETHYLAMINE) ON THIS DISTRIBUTION.) *Lavoro Umano* 8:324-9, 1956.

The distribution of Pb in the adrenal glands was investigated both in rabbits poisoned with TEL ( $100 \text{ mg/kg/day}$  for 2-6 days) and in poisoned rabbits treated with the following (in groups of 2-4 rabbits each): (1) cortisone, (2) desoxycorticosterone, (3) cortisone + 2, (4)  $\text{CaEDTA}$  at  $500 \text{ mg/kg/day}$ , (5)  $\text{CaEDTA}$  at  $100 \text{ mg/kg/day}$ , (6)  $\beta$ -mercaptoethylamine iv and im. There was no relation between TEL dosage used and Pb content of the adrenals: 12.18-16.16  $\text{mg/100 g}$ . Both  $\beta$ -mercaptoethylamine and  $\text{CaEDTA}$  ( $110 \text{ mg/kg/day}$ ) were unable to diminish the Pb contents. In rabbits treated with adrenocortical hormones (especially cortisone) or with  $\text{CaEDTA}$  ( $500 \text{ mg/kg/day}$ ) however, the amount of Pb found in the adrenal glands was less than that found in the organs of the controls that died after the same periods of time: 3.86-10.16  $\text{mg/100 g}$ .

- 682 McIntosh, I.G. (Animal Res. Stat., Wallaceville, New Zealand): LEAD POISONING IN ANIMALS. *Veterinary Reviews and Annotations* 2, Pt. 1:57-60 (Apr.), 1956.

The author presents this review because Pb is a much greater factor in the ill health and death of a greater number of animals than has been previously realized. He also states that chemical examination for Pb in animals having access to this material or exhibiting cerebral symptoms is important for furthering knowledge of Pb poisoning. (17 references)

- 683 Merville, R., Tuchmann, H., and Dequidt, J. (Toxicol. Lab. Coll. Med. and Pharmacy, Lille, France): Action de l'éthylène diaminotétracétate de Ca et Na dans le saturnisme expérimental. (ACTION OF CALCIUM-SODIUM ETHYLENEDIAMINETETRAACETATE IN EXPERIMENTAL SATURNISM.) *Thérapie* 11, No. 6:1187-9, 1956.

Twenty rats were injected for 5 days with  $20 \text{ mg}$  Pb acetate/day; 10 of them were left alone, and 10 received daily for 5 further days  $150 \text{ mg}$  EDTA. In another experiment, to study the protective action of EDTA, 10 rats were injected daily for 4 days  $40 \text{ mg}$  Pb acetate, and 10 rats received daily for 4 days  $40 \text{ mg}$  Pb acetate plus 2 injections of  $150 \text{ mg}$  EDTA. The following organs were examined upon sacrifice: spleen, liver, adrenals, kidneys, lymph nodes, hypophysis, muscle, ovaries, blood, embryos, placenta. The results showed that in the 1st experiment, Pb content increased by 215 and 43% in the livers and spleen in spite of EDTA administration, and by 13 and 51% in the kidneys and liver in the 2nd. In all other organs the Pb content decreased by 6-84% after EDTA whether administered therapeutically or simultaneously with Pb.

- 684 Mori, A. (Keio Univ., Japan): DISTRIBUTION AND STATE OF COMBINATION OF LEAD IN BLOOD. *Journal of Science of Labour (Japan)* 32, No. 12:971-91, 1956.



A series of experiments was undertaken on the binding of Pb in blood, in view of conflicting reports by Behrens (1927), Teisinger (1935), and Koizumi (1926) concerning the reversibility of combination. Particular attention was given to the distribution and state of Pb in the internal fluid and in the stroma of red cells. Four normal dogs were sacrificed, and Pb determinations were made by the USPHS method. In order to distinguish the ionic and nonionic Pb, the Ross and Lucas coprecipitation method was applied. The chemical property of CaEDTA was utilized for the estimation of the affinity of Pb for red cells. The principal results obtained were as follows. Disparities in the binding capacity of Pb were evidenced in the blood of normal dogs, that of experimentally Pb-poisoned dogs, and in blood with Pb added in vitro. There was much more Pb in the red cells of normal dogs than in the plasma; also, the greater proportion of firmly bound Pb that was not released by hemolysis of the red cells, was detected in the internal fluid of the red cells. When Pb was added to the normal blood, it was recovered more easily from the red corpuscles than from the plasma. The added Pb may not penetrate into the internal fluid of the red cells, and even if a little of it did invade, the combination was very feeble and could be easily released by hemolysis. The combination, accordingly, must be a physical one which takes place on the surface of the red cells. In the experimentally poisoned dogs, Pb concentrations increased both in the red cells and in the plasma, although the former contained more Pb than the latter. The Pb found in the internal fluid of the red cells indicated stronger combination than shown in the normal blood. This implies that the combination of Pb in the fluid, including hemoglobin and to some extent in the stroma of red cells, is stronger in the case of Pb poisoning than when Pb is added to red cells for a short time in vitro. CaEDTA became PbEDTA only to a certain degree when the chemical was added to red cells from Pb poisoned animals. Of the Pb combined in vivo 40% was retained, but not chelated even 12 hr after adding CaEDTA. On the other hand, ~90% of the Pb combined in vitro was released as PbEDTA 12 hr after adding CaEDTA. Therefore, when a single injection of CaEDTA is administered to a patient with Pb poisoning, only a small proportion of Pb combining with the red corpuscles would be released and excreted in the urine. (From author's summary; 23 references)

- 685 Nagai, T., Huse, T., and Saikawa, S. (Univ. Niigata School Med., Japan): ON THE CHANGE OF BLOOD GLUTATHIONE LEVEL IN EXPERIMENTALLY LEAD-POISONED RABBITS. *Journal of Science of Labour* (Japan) 32:390-403 (May), 1956.

The authors investigated the change of blood glutathione (B-GSH) level in rabbits with experimental Pb poisoning caused by subcutaneous injections of Pb acetate. As a rule the concentration of B-GSH was found to be decreased in all poisoned animals. To describe in detail, some rabbits (the 1st group) died before B-GSH was thoroughly decreased in amount, the moderately long surviving ones (2nd group) showed appreciable decrease in amount of B-GSH, and the long surviving (3rd group) consider-

able decrease of it. The fall of B-GSH level was not only manifest, but also B-GSH level of corpuscles fell in the Pb anemia. Throughout every group of rabbits the change of reticulocytes counted simultaneously was just a mirror image of the change of B-GSH level, and the correlation between them was good,  $r$  being  $-0.557$  ( $P < 0.001$ ). Liver glutathione appeared to decrease, though different in grades according to the difference of observation times in each rabbit. Histopathological pattern of liver principally represented chronic cholangitis, and, moreover, atrophy and fatty degeneration of parenchymal cells. As to the mechanism proposed for the fall of B-GSH level, the following 4 circumstances would possibly be considered: (a) obstruction of GSH synthesis in liver, (b) infringement on SH group by Pb as a heavy metal, (c) as a phenomenon incidental to anemia, and (d) finally formation by the adrenal cortical hormone of unknown substance, which poisons SH group. (From authors' English summary)

- 686 Nakano, M: EXPERIMENTAL STUDIES ON THE PHOSPHORUS METABOLISM WITH RADIOISOTOPE  $P^{32}$ . 2. PHOSPHORUS METABOLISM IN LEAD POISONING. A. AN EXPERIMENT ON CHRONIC LEAD POISONING. B. AN EXPERIMENT ON ACUTE LEAD POISONING. *Journal of the Osaka City Medical Center* 5:605-11; 612-24 (Nov.), 1956. In *Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School*, Vol. 1, April 1949-March 1959, p. 35.

2A. When  $^{32}P$  was injected iv into normal or Pb-poisoned guinea pigs, urinary and fecal excretion of  $^{32}P$  decreased less in the Pb-poisoned animals than in the controls. It appears that the P metabolism in the guinea pigs was somewhat disturbed by the absorption of Pb.

2B. Na phosphate or physiological saline solution, containing labeled P, was administered iv to acutely Pb-poisoned guinea pigs or to Pb-workers. The affinity of  $^{32}P$  to the blood cells was lower in the Pb-poisoned guinea pigs than in controls. After administration of phosphate, the permeability of  $^{32}P$  increased. In man, the permeability into the blood cells of  $^{32}P$  administered as phosphate is higher than that of physiological saline solution. (From author's English summary)

- 687 National Academy of Sciences-National Research Council, Division of Biology and Agriculture: HANDBOOK OF TOXICOLOGY. VOLUME I. ACUTE TOXICITIES OF SOLIDS, LIQUIDS AND GASES TO LABORATORY ANIMALS. Prepared under the Direction of the Committee on the Handbook of Biological Data, edited by W.S. Spector. Philadelphia, Saunders, 1956, 408 pp.

Lethal doses of Pb and its compounds are tabulated on pp 174-9 under columns showing the species, route, dose (LD,  $LD_{50}$ , etc), dosage, vehicle, time of death, and references. The following compounds, aside from Pb ion, are included: Pb acetate, arsenate, carbonate, chloride, chromate, dioxide, lactate, monoxide, nitrate, oleate, orthoarsenate, orthophosphate, oxide, (red) oxide, silicate, stearate, sulfate, sulfide, tetraethyl.

- 688 O'Moore, L.B.: LEAD POISONING IN CATTLE. Irish Veterinary Journal 10:194-202, 1956.

The more sensitive and rapid methods of Pb estimation have now made possible routine analysis of postmortem and other specimens. Such analyses show that the concentration of Pb is very much greater in the kidney cortex than in other tissues. Experimentally it was found possible to produce Pb poisoning in 2 calves by administration of Pb acetate. One calf received 1600 g over a period of 35 mo when it died without showing typical symptoms of Pb poisoning. The second calf received a total of 396 g over a period of 10 mo when it died with typical symptoms of acute Pb poisoning. The intravenous injection of the chelating agent "Calcium versenate" ( $\text{CaNa}_2\text{EDTA}$ ) is recommended as being the best method of treatment. (From Veterinary Bulletin 27, No. 6:1877, 1957)

- 689 Orita, J. (Univ. Kyoto, Japan): EXPERIMENTAL STUDIES ON THE EFFECT OF MONOCALCIUM DISODIUM ETHYLENEDIAMINETETRAACETATE UPON LEAD POISONING. Kokumin Eisei 25:22-55, 1956.

Rats or rabbits with Pb poisoning were treated with  $\text{CaNa}_2$  ethylenediaminetetraacetate (EDTA). Oral administration of EDTA had a favorable effect on urinary excretion of Pb but sometimes caused diarrhea. No harmful effects were observed in continued and prolonged intraperitoneal treatment. EDTA caused a marked increase of urinary excretion of Pb but had no influence on fecal excretion. It had little influence on the mobilization of Pb stored in bones. EDTA accelerated the increase of the erythrocyte count and the hemoglobin level, and the decrease in basophilic, polychromic erythrocyte, and reticulocyte counts. These reversals are caused by a secondary action of EDTA. Administration of EDTA was followed by increased coproporphyrin excretion in urine. This increase did not coincide with the increase of the hemoglobin level which accompanied the increase of Pb excretion. The increase of coproporphyrin excretion was not accompanied by any clinical symptoms. (From Chemical Abstracts 51:13185, 1957)

- 690 Orita, J., Harada, A., and Hamami, T. (Univ. Kyoto, Japan): VARIATION OF LEAD LEVEL IN BLOOD AFTER INTRAVENOUS INJECTION OF MONOCALCIUM-DISODIUM ETHYLENEDIAMINETETRAACETATE. Kokumin Eisei 25:130-2, 1956.

Administration of  $\text{CaNa}_2\text{EDTA}$  to Pb-poisoned rabbits caused high Pb level in blood in 1-2 hr, lower in 3-4 hr, increased again in ~6 hr then decreased gradually. The mechanism of action of  $\text{CaNa}_2\text{EDTA}$  is explained in that  $\text{CaNa}_2\text{EDTA}$  affects first the Pb more easily liberated from the tissues, then it works on the Pb more firmly combined with the tissues. (From Chemical Abstracts 51:8992, 1957)

- 691 Orita, J., Harada, A., and Hamami, T. (Univ. Kyoto, Japan): EXPERIMENTAL STUDIES ON THE EFFECT OF DICALCIUM ETHYLENEDIAMINETETRAACETATE UPON LEAD POISONING. Kokumin Eisei 25:133-7, 1956.

Oral administration of  $\text{Ca}_2\text{EDTA}$  or its  $\text{CaNa}_2$  salt to Pb-poisoned rats caused an increased excretion of Pb in urine, although this caused the rat to

develop hypocalcemia. (From Chemical Abstracts 51:8992, 1957)

- 692 Remy, R. (Inst. Physiol., Vet. Coll., Hannover, Germany): Tierexperimentelle Untersuchungen zur Bleivergiftung. I. Toxikologie. II. Therapie und Prophylaxe. (EXPERIMENTAL STUDIES ON LEAD POISONING IN ANIMALS. I. TOXICOLOGY. II. THERAPY AND PROPHYLAXIS.) Deutsche Tierärztliche Wochenschrift 63:385-8; 405-8 (Oct. 1; 15), 1956.

Pb poisoning in man and animals is briefly reviewed with special emphasis on hematological findings in acute and chronic intoxication. In a study of acute Pb poisoning in 2-3 kg rabbits, Pb acetate was given iv on 3 successive days at levels of 2, 4, 6, 7, and 8 mg/kg, respectively. The 7 and 8 mg/kg dose levels of Pb acetate were uniformly lethal and death occurred before there was pronounced anemia. Anemia occurred at other dosage levels, but was followed by recovery. It was noted further that pure strain rabbits (Blue Vienna and Angora) died at a Pb dosage of 5 mg/kg. Very fat rabbits and growing rabbits also showed a low tolerance to Pb acetate. A series of experiments was also carried out on a large number of 150-g rats, employing ip injection of Pb acetate after it was found that such injections did not cause local inflammation. Rats receiving Pb acetate at 150 mg/kg in 1 injection died within 24 hr; of those receiving Pb acetate at 50 mg/kg, none died. In the last group a repeat dose after several days produced no deaths, but further injections to a total of 200 mg of Pb produced death regularly. In another group of rats given Pb acetate injections of 15 mg/kg at regular intervals for 2 mo, practically all animals were alive after reaching a total dosage of 360 mg. Further, these subacutely poisoned rats now uniformly withstood a 100 mg/kg dose of Pb acetate with no deaths, and 4 days later they again tolerated a further 100 mg/kg but 40% of them died within 10 days. The remainder outlived the research period and thus tolerated a total Pb acetate dosage of 560 mg/kg.

These findings are discussed with reference to hemoglobin and nucleoprotein synthesis and hemopoiesis, and the interference of Pb in these systems is postulated as being mediated through folic acid and vitamin  $\text{B}_{12}$ -containing enzymes.

II. Large doses of Vitamin  $\text{B}_{12}$ , folic acid, or liver extract helped retard or prevent the appearance of anemia in animals acutely poisoned with Pb, but had no beneficial effect in chronic Pb poisoning. Cysteine, given iv, was beneficial in acute Pb poisoning but not in subacute poisoning; cystine was ineffective in either case. Oral methionine (30-40 mg/kg) effectively retarded or prevented the onset of anemia, but was ineffective in reducing skeletal deposition of Pb. BAL was completely ineffective. For animals poisoned acutely with Pb, a complete protein hydrolyzate plus vitamin  $\text{B}_{12}$  injection gave better protection against anemia than either material alone. Oral or injected methionine alone was also inferior to the mixture in its protection against anemia. Ascorbic acid was an equally effective preventive of Pb-induced anemia of dogs but was ineffective in rats for acute and subacute poisoning. As to  $\text{CaNa}_2$ -

EDTA treatment, 33 rats were poisoned by ip injections of Pb acetate, 35 mg/kg, every 4 days to a total of 315 mg. At the same time, EDTA was given by esophageal tube to 17 of these animals 6 times/wk in doses of 294 mg/kg to a total of 7938 mg/kg. The remaining 16 rats served as controls: 80% died and the remainder showed severe poisoning symptoms. All the EDTA-treated rats lived, and seemed well. For the controls, the reticulocyte curves were from 2-3 times normal, but the treated rats had essentially normal curves. This may indicate prevention of bone-marrow damage. It is concluded that the EDTA is effective prophylactically against Pb poisoning as well as for acute, subacute, and chronic Pb poisoning. Oral EDTA and methionine are suggested for chronic Pb poisoning. (62 references)

- 693** Rieders, F., and Copeland, J.E. (Jefferson Med. Coll., Philadelphia, Pa.): INHIBITION OF ACCUMULATION OF CHRONICALLY INGESTED LEAD IN RATS BY SIMULTANEOUS FEEDING OF EDATHAMIL CALCIUM DISODIUM ( $\text{Na}_2\text{CaEDTA}$ ). Federation Proceedings 15:Abstfact No. 1541 (Mar.), 1956.

Two groups of weanling Sherman albino rats were used. Group 1 received a diet containing 2 ppm Pb, incorporated into food and drinking water as Pb acetate. The diet of group 2 contained 760 ppm  $\text{Na}_2\text{CaEDTA}$  and 3 ppm Pb, this additional ppm of Pb originating as an impurity from the  $\text{Na}_2\text{CaEDTA}$ . The animals were maintained on the respective diets for 38 wk with no gross or hematological ill effects. Then, 10 males and 10 females from each of the 2 groups were killed by chloroforming. Stomach, intestine, skin and tail were removed and discarded. The entire remainder of each animal was digested and analyzed for its Pb content by a dithizone method. The Pb contents of the animals were as follows: (values are given in mg/100 g; means and standard deviations are reported) Group 1, males,  $0.049 \pm 0.025$ ; females,  $0.054 \pm 0.028$ ; Group 2, males,  $0.020 \pm 0.008$ ; females,  $0.028 \pm 0.011$ . Accumulation of Pb in the course of its ingestion by rats is significantly diminished by the simultaneous ingestion of  $\text{Na}_2\text{CaEDTA}$ . (From author's abstract)

- 694** Skripnichenko, Z.M. (V.P. Filatov Ukrainian Inst. of Eye diseases, USSR): Eksperimental'nye dannye o vliyani tetraetilsvintsa na regulyatsiyu vnutriglaznogo davleniya. (EXPERIMENTAL INVESTIGATIONS ON THE EFFECT OF TETRAETHYL LEAD ON THE REGULATION OF THE INTRAOCULAR PRESSURE.) Oftal'mologicheskii Zhurnal 11: 143-48, 1956.

Rabbits, 6-8 mo old and weighing 2-2.5 kg, were injected sc daily or every 2 days with TEL, dissolved in oil, at the rate of 0.05 ml/kg body weight. The animals became agitated after the first few injections, some developed tremors and convulsions and 17 of 20 rabbits died within 10 days. The intraocular pressure was lowered in 2 and raised in 2 other rabbits. In another test 10 rabbits were injected every 3rd day for 30 times with 0.02 ml of ethyl fluid/kg body weight and 3 survivors of the 1st series received each 5 injections of 0.05 ml/kg weight and after a rest

period of 19 days 30 injections of 0.02 ml/kg each. Three of the 13 animals died after 9-18 injections, 4 after 30 injections and the remaining 6 were observed for 3.5 more mo. In 8 of the 13 rabbits the intraocular pressure rose from a preexperimental range of 15.5-22.3 mm to 33.0-36.3 mm. The average daily fluctuations of the intraocular pressure before the experiment was 3.7 mm for either eye. During the period of injections this fluctuation increased to 10.9 and 10.7 mm for the right and left eye, respectively, while after the test the average fluctuation for 5 surviving rabbits was 3.4 and 2.4 mm, respectively. (13 references)

- 695** Stevens, C.D., Feldhake, C.J., and Kehoe, R.A. (Univ. Cincinnati, O.): ISOLATION FROM LIVER OF TETRAETHYLLEAD AFTER ITS INHALATION. Journal of Pharmacology and Experimental Therapeutics 117:420-4 (Aug.), 1956.

A qualitative analytical method specific for TEL was developed and applied to analysis of liver tissues of rats exposed to TEL, to clarify the problems of certain potential defects in the analytical techniques of those who assumed to have obtained TEL as a volatile material from certain tissues of subjects intoxicated with TEL. The method, based on extraction of TEL by pentane, concentrated by low temperature vacuum distillation, and identified by infrared spectra and Pb analyses, is described and results are discussed in detail. The possibility that the tissues contained triethyl Pb and diethyl Pb was ruled out. TEL was shown to be present in liver tissues of rats which had inhaled TEL vapor. No homologs containing methyl groups were detected in the concentrates.

- 696** Stewart, W.L., and Allcroft, R.: LAMENESS AND POOR THRIVING IN LAMBS ON FARMS IN OLD LEAD MINING AREAS IN THE PENNINES. I. FIELD INVESTIGATIONS. Vet. Record 68:723-8, 1956.

The disorder, in young Swaledale lambs, is characterized by a specific locomotor disability and is confined to flocks grazing near old Pb mines. The history and symptoms are described. Pb values for blood, tissues and feces of affected lambs were abnormally high, as were those of herbage samples from affected areas, although symptoms typical of acute Pb poisoning were never observed and most affected lambs recovered spontaneously. Breeding ewes on affected farms remained clinically healthy. Blood Pb concentrations of ewes and their newborn lambs were similar, but within 3-5 wk those of the lambs were double those of the ewes. Clinical symptoms, however, were not always associated with high blood Pb levels. Growth and development were much poorer in lambs from an affected area than in lambs from a healthy farm. Although these results suggest that absorption of abnormal amounts of Pb is associated with the occurrence of the disorder, other possible factors cannot be ruled out. (From Veterinary Bulletin 27:Abstr. 236, 1957)

- 697** Stychinskaya, M.I.: THE THERAPY OF PATIENTS HAVING LEAD POISONING. Trudy Inst.

Kraevoy Patol., Akad. Nauk Kazakh. SSR  
4:128-39, 1956.

Experiments were performed with Pb-poisoned rabbits. After anemia developed, pentoxyl was administered per os in a 10% solution at doses of 0.01-0.015 g/kg for 20-30 days. The hemoglobin percent increased, as did the number of erythrocytes; basophilic stippling vanished from the peripheral blood, and the number of reticulocytes was reduced. The simultaneous administration of pentoxyl with the Pb for 20 days changed the blood picture to a lesser degree. It is suggested that pentoxyl stimulated and normalized the functioning of the bone marrow. (From Chemical Abstracts 51:18315, 1957)

- 698 Sümegi, I., Goreczky, L., and Róth, I. (3rd Dept. Internal Dis. Hungarian State Railway's Hosp., Budapest): MORPHOLOGICAL DATA ON QUANTITATIVE CHANGES IN THE NORMAL ANTIBODIES OF THE SERUM IN LEAD POISONING. Acta Morphologica Academiae Scientiarum Hungaricae 7:183-97, 1956.

In order to establish the possibility of demonstrating objective morphologic changes in the nervous system in addition to and parallel with the phenomena presenting themselves under the changed immunobiological conditions of Pb poisoning, 1 ml/kg body weight of 2% Pb acetate was injected intravenously into rabbits. This was repeated every 2nd day for 8-10 days. Up to 4000 µg of porphyrin appeared (largely coproporphyrin III). Animals also developed anemia and low erythrocyte counts and hemoglobin levels. Intense porphyrin fluorescence was observed in the kidneys, liver, and other organs. In the experiments with porphyrin, injection of 2.5 ml of 0.1% hematoporphyrin (2500 µg)/kg body weight produced similar immunobiologic changes. (51 references)

- 699 Sümegi, I., Goreczky, L., and Róth, I.: (MORPHOLOGICAL DATA ON THE QUANTITATIVE CHANGES IN PROTECTIVE SUBSTANCES OF THE SERUM IN LEAD POISONING.) Kiserletes Orvostudomány 8, No. 4:428-38, 1956.

- 700 Taddei, I., and Bianchini, M.: (PLASMA PROTEINS AS CARRIERS OF HEAVY METALS. ELECTROPHORETIC INVESTIGATIONS WITH LEAD AND MERCURY SALTS.) Atti accad. fisiocrit. Siena, Sez. med.-fis. 3:41-6, 1956.

The electrophoretic separation and microchemical analysis of serum of rabbits injected with Pb nitrate or Hg chloride showed that Pb circulates in vivo bound to albumin and  $\alpha_1$ - and  $\alpha_2$ -globulins and possibly to a lipoprotein fraction; Hg was bound only to albumins. (From Chemical Abstracts 51:14865, 1957)

- 701 Teuchmann, J.K. (Centralny Inst. Ochrony Pracy, Warsaw, Poland): (COMPARATIVE EXPERIMENTS ON LEAD POISONING OF ANIMALS PLACED IN A PRINTING SHOP.) Prace Centralnego Inst. Ochrony Pracy 6, No. 1(17):1-6, 1956.

Ninety guinea pigs were kept for a year in various places in a printing shop in which the air contained Pb (0.03-0.22 mg/m<sup>3</sup>). The weights, Pb contents in blood, roentgenograms of bones, and ana-

tomic histopathological tests were compared with 10 control animals. In general the animals were in good health. Some changes were found in the organs of vision. The accepted toxicity level of 0.03 mg% of Pb in blood was concluded to be too low. (From Chemical Abstracts 53:7434, 1959)

- 702 Ungher, J., Broşteanu, R., Neştianu, V., Lillis, M., Moscovici, B., and Pompilian, V. ("I.P. Pavlov" Inst. Neurol. R.P.R. Acad., Romania): Cercetări electroencefalografice pe animale intoxicate cu plumb. (ELECTROENCEPHALOGRAPHIC RESEARCH ON ANIMALS WITH LEAD POISONING.) Comunicările Academiei Republicii Populare Romine 6: 1033-43, 1956.

Dogs were administered 2 mg Pb acetate/kg/day to produce chronic poisoning; 0.5% solutions were used. The electroencephalograms (EEG) were registered once a week, prior to and after the administration of Pb. No linear progression was observed, rather a cycle, ie the animals became worse, then showed improvement, in spite of the fact that the administration of Pb continued in the same manner. Four phases could be distinguished. In the 1st, during the 1st 2 or 3 wk of poisoning, slow theta and delta waves were noted. The biocurrents showed reduced amplitude, intermittent light did not stimulate. The dogs were excited. In this phase the cerebral matter comes for the 1st time into contact with Pb. In the 2nd phase, during the 4th-8th wk, the EEG's improved but they showed spindles, ie, an inhibition had set in. After the Pb dose the light stimuli were much more effective than before. The dogs were quieter now, they became adapted to Pb. In the 3rd phase the compensation mechanisms were overstepped, the EEG's became worse again; epileptic tracings were noted. The dogs were obviously ill; they vomited a lot, and showed bloody scars on the skin. The 4th phase was coma preceding death, the tracings in the EEG were very flat.

- 703 Yamaguchi, S., and Katsuya, K.: (METABOLISM OF LEAD ETHYLENEDIAMINETETRAACETATE. I. METABOLISM OF LEAD ETHYLENEDIAMINETETRAACETATE GIVEN BY INTRAVENOUS INJECTION.) Igaky To Seibutsugaku 40:234-8, 1956.

Rabbits were treated with various amounts of Pb ethylenediaminetetraacetate by intravenous injection in a single dose or in multiple doses. Approximately 88% of Pb administered was excreted in the urine within 3 hr and 99% in 9 hr. Very little Pb was found in the feces. A small but distinct amount of Pb was deposited in the organs after repeated administration of PbEDTA, amounting as high as 1250 µg% in the liver and 146 µg% in the kidney. (From Chemical Abstracts 52:7530, 1958)

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- 704 Ambanelli, U., and Salvi, G. (Univ. Parma, Italy): Azione comparata della beta mercaptoetilamina e del sale disodico calcico dell'acido etilendiaminotetracetico sulla intossicazione sperimentale da piombo tetraetile. (COMPARISON OF  $\beta$ -MER-

CAPTOETHYLAMINE AND THE DISODIUM SALT OF CALCIUM ETHYLENEDIAMINETETRAACETATE IN TETRAETHYLLEAD POISONING.) *Folia Medica* (Naples) 40:350-73, 1957.

$\beta$ -Mercaptoethylamine showed in rabbits poisoned acutely with TEL (by inhalation exposure) a protective action manifested by prevention of death and increased urinary excretion of Pb. Although  $\text{CaNa}_2\text{EDTA}$  increased the urinary excretion it failed to protect against death and rather accelerated the onset of toxic signs. In subacute poisoning over a prolonged time the results were variable and did not permit a definite statement as to the value of either treatment.

In order to study certain obscurities surrounding TEL poisoning, the authors determined the Pb content of the kidneys, lungs, liver, brain, and heart of a number of rabbits both by the dithizone (Bambach and Winter) and the polarographic methods. Certain differences in results were found, which were attributed to analytical errors. They found also that the Pb contents varied as to the time death occurred. The sooner death occurred, the greater were Pb contents, regardless of duration and intensity of exposure. In the organs of a worker who died 6 days after onset of poisoning in spite of treatment with the chelating agent, the following amounts of Pb were found: brain 11.63 mg, liver 20.6, kidneys 1.26, lungs 4.05, stomach (in 26.2 g of fresh tissue) 248.12  $\mu\text{g}$ . (19 references)

- 705 Atchabarov, B.A., and Makashev, K.K.: (THE FATE OF LEAD IN THE ORGANISM.) *Trudy Inst. Kraevoi Patol., Akad. Nauk Kazakh SSR* 4:5-21, 1956.

The absorption and distribution of Pb by the organism was tested on 99 white rats using radioactive isotope of Pb ( $\text{ThB}$ ) which was administered intravenously, subcutaneously, and intragastrically in doses of  $50-200 \times 10^3$  impulses/min. The rate of Pb absorption by the organism and its distribution among the tissue organs varied greatly. If administered once/os, Pb was completely absorbed within 2-4 hr; if administered repeatedly to the point of appearance of chronic poisoning, Pb absorption became progressively slower. The same was true of Pb repeatedly administered subcutaneously. Two to 2.5% of the Pb was eliminated in 24 hr via the urine and 0.3-20% via the feces. (From *Referat. Zhur. Khim., Biol. Khim.* 1957, No. 14516; *Chemical Abstracts* 51:18315, 1957)

- 706 Bersin, T., Müller, A., and Schwarz, H. (St. Gallen, Switzerland): Zur pharmakologischen Wirkung einiger anorganisch-organischer Komplexverbindungen. (PHARMACOLOGICAL ACTION OF SOME INORGANIC-ORGANIC COMPLEX COMPOUNDS.) *Archives of Biochemistry and Biophysics* 69:507-13, 1957.

A number of EDTA salts were prepared.  $\text{CaNa}_2\text{EDTA}$ , orally administered to growing albino mice, was somewhat better tolerated than  $\text{Ca}_2\text{EDTA}$ . However, the author himself took 0.3 g  $\text{Ca}_2\text{EDTA}$ /24 hr for 3 mo and tolerated the drug well.  $\text{Ca}_2\text{EDTA}$  is used in the prophylaxis of Pb poisoning. The  $\text{LD}_{50}$ 's (g/kg) for albino mice iv were as follows:  $\text{CaMgEDTA}$  1.87;  $\text{MgNa}_2\text{EDTA}$  0.124,  $\text{BiNaEDTA}$  0.075. Albino mice injected iv with 1.616  $\text{CaMgEDTA}$  became

unconscious for some hours but recovered completely. Piperazine  $\text{CaEDTA}$  is used as vermicide. Authors conclude that the pharmacological effect is produced by the entire EDTA molecule.

- 707 Bessis, M., and Breton-Gorius, J. (Natl. Blood Transfusion Center, France): Granules ferrugineux dans les cellules macrophages et les érythrocytes au cours du saturnisme expérimental. Examen du microscope électronique. (FERRUGINOUS GRANULES IN THE MACROPHAGES AND ERYTHROCYTES IN EXPERIMENTAL SATURNISM; EXAMINATION WITH THE ELECTRON MICROSCOPE.) *Comptes Rendus des Séances de la Société de Biologie et de ses Filiales* 151, No. 2:275-6, 1957.

Adult rats received 3 intraperitoneal injections of 0.2 ml Pb acetate (8 g%) and were sacrificed 3 wk later. Blood and spleen were prepared for examination by electron microscope (Hoffman et al, 1956). The erythrocytes contained large numbers of granules of a nonhemoglobin Fe complex 40-100Å diameter. These granules were also present in very large amounts in the macrophages of the spleen.

- 708 Bessis, M., and Breton-Gorius, J.: (ELECTRON MICROSCOPE STUDY OF THE BLOOD AND HEMATOPOIETIC ORGANS IN EXPERIMENTAL LEAD POISONING. IRON CYCLE INTERPRETED.) *Pathol. et biol., Semaine hôp.* 5:411-28, 1957.

Electron microscopic studies were made on rats injected intraperitoneally with several 0.5-ml doses of 8% Pb subacetate and sacrificed thereafter at intervals. Granulations of 20-50 Fe atoms (50 Å diam.) surrounded by protein of high molecular weight were found in the erythrocytes.

The Fe is collected by pinocytosis during the erythroblast stage in the bone marrow. The Fe is also laid down in cytoplasmic structures without hemoglobin, producing the basophilic punctations characteristic of Pb poisoning. The spleen is overrun with macrophages containing much Fe from phagocytosis of red cells. The Fe-containing masses in the macrophages vary greatly in size, from small to very large. The results show that the mechanism of Pb poisoning is either an inhibition or a disruption of synthetic processes in the red cells. Although the red cells contain much Fe in an abnormal form, the amounts of hemoglobin (containing Fe) are much lower than in normal red cells. (22 references.) (From *Chemical Abstracts* 54:15717, 1960)

- 709 Bessis, M., and Breton-Gorius, J.: Etude au microscope électronique des granulations ferrugineuses des érythrocytes normaux et pathologiques. Anémies hémolytiques, hémoglobinopathies, saturnisme. (ELECTRON MICROSCOPE STUDY OF FERRUGINOUS GRANULATIONS OF NORMAL AND PATHOLOGICAL ERYTHROCYTES; HEMOLYTIC ANEMIAS; HEMOGLOBIN, DISORDERS; SATURNISM.) *Revue d'Hématologie* (Paris) 12, No. 1:43-63, 1957.

Erythroblasts and certain normal or pathologic erythrocytes contain ferruginous granules which form visible plaques upon staining with Prussian blue. In the course of cellular maturation the granules scatter and consolidate as though partic-

ipating in the genesis of the hemoglobin molecule. These ferruginous granules arise from the lysis of reticular cells which in turn have recovered them from phagocytized red cells, the Fe having been extracted from hemoglobin. They were seen in cases of thalassemia and in rats poisoned by Pb. (From Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 18, No. 6:812 (Abstracts), 1957)

- 710 Biondi, S. (Italy): USE OF SERUM-ALBUMINS IN KERATINIZED CAPSULES IN THE PREVENTION OF SATURNISM. In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. II, Summaries, pp. 79-80.  
See Abstract No. 829.

- 711 Caccuri, S., Pecora, L., Fati, S., and Vecchione, C. (Italy): RESEARCHES ON THE PORPHYRINOGENESIS IN THE LEAD-POISONING. In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. II, Summaries, p. 52.  
See Abstract No. 779.

- 712 Candela, R.R., Dehesa, G., and Candela, J.L.R.: (TREATMENT OF EXPERIMENTAL ACUTE INTOXICATION WITH LEAD. II. EFFECT OF CALCIUM ETHYLENEDIAMINETETRAACETATE.) Med. y seguridad trabajo 5, No. 20:24-8, 1957.  
Pb excretion in the urine of poisoned white rats increased three-fold after treatment with CaEDTA (From Chemical Abstracts 53:2472, 1959)

- 713 Cordy, D.R. (Univ. California, Davis): OSTEODYSTROPHIA FIBROSA ACCOMPANIED BY VISCERAL ACCUMULATION OF LEAD. Cornell Veterinarian 47:480-90 (Oct.), 1957.  
Three cases of osteodystrophia fibrosa in growing baboons were described and differentiated from other bone diseases. An abnormal Ca-to-P ratio in the diet, similar to that observed in horses with the condition, was found. Low renal levels of Pb with accompanying inclusion bodies were an incidental finding. It is thought that the accumulation of Pb was not significantly related to the bone disease since no heavy deposition appeared in bone radiography, anemia was not observed, and no disturbances specifically referable to Pb toxicosis were seen. The baboons may have obtained the Pb as paint or as spray on fruit. (19 references)

- 714 Dhar, D.C. (Central Drug Res. Inst., Lucknow, India): STUDIES ON ANAEMIA: PART V - CHANGES IN PROTEIN COMPOSITION OF BLOOD IN EXPERIMENTAL LEAD ANAEMIA. Journal of Scientific and Industrial Research (India) 16C:123-6, 1957.  
The results of studies of electrophoretic and chemical fractionation of the blood proteins of albino rabbits before and after anemia are reported. Albino rabbits weighing between 1.2 and 1.5 kg and maintained on a diet of water ad lib, carrots, green leaves, and bran were used in this investigation. After studying the normal protein distribution of these rabbits, anemia was produced in them by the administration of 3 iv injections of 2% Pb solution (6 mg/kg body weight) given on

successive days. In the Pb-anemic rabbit an increase in plasma protein concentration was observed. This result was explained on the basis that a drop in albumin and a corresponding rise in globulin concentration had occurred.

- 715 Di Maggio, G. (Inst. Pharmacol. Exptl. Therap., Univ. Catania, Italy): Il metilesculetolo quale fattore protettivo nell'avvelenamento da piombo. (METHYLESCULETOL AS A PROTECTIVE FACTOR IN LEAD POISONING.) Biochimica Applicata 4:149-56, 1957.

In groups of rats (1) controls, (2) given 50 mg Pb acetate/100 g orally, (3) given 2 mg methylesculetol/100 g daily, and (4) treated with both Pb and methylesculetol, the body weight (within 30 days) changed by +9.7, -6.6, -2.2, and +5.1%, respectively, and liver weight (fresh) to 5.420, 5.940, 4.980, and 5.110 g (water 63.92, 67.03, 72.55, and 68.13%), with the following contents: free cholesterol, 0.40, 0.84, 1.44, and 0.56% (dry basis); esterified cholesterol, 0.91, 1.16, 0.80, and 0.45%; cholesterol esters, 1.68, 2.14, 1.48, and 0.84%; cholesterol ester soaps, 0.77, 0.98, 0.68, and 0.39%; neutral fat soaps, 1.11, 1.26, 2.44, and 1.00%; free soaps, 0.92, 0.30, 3.22, and 1.72%; phosphatide soaps 3.34, 1.93, 1.71, and 1.67%; phosphatides (as distearinyllecithin), 5.31, 3.07, 2.72, and 2.66%; total lipides, 9.42, 7.61, 11.20, and 7.78 g % (dry basis); glycogen (as glucose), 2.040, 0.840, 0.530, and 1.560 g % (fresh basis). The author concludes that methylesculetol exerts a protective action in Pb poisoning.

- 716 Durbin, P.W., Scott, K.G., and Hamilton, J.C.: THE DISTRIBUTION OF RADIOISOTOPES OF SOME HEAVY METALS IN THE RAT. University of California Publications in Pharmacology 3, No. 1:1-34, 1957.

A summary is presented of data on the biological half times and the principal deposition sites of 18 heavy metals in mature rats (Sprague-Dawley, Curtis-Dunning, and Slonaker strains). Radioisotopes were administered orally, im, or iv in neutral isotonic saline or Na citrate. Data are included on the following elements: Cd, Hg, In, Tl, Sn, Pb, Nb, Ta, Mo, W, Tc, Re, Ru, Os, Rh, Ir, Pd, and Pt.

Pb was among the metals that were characterized by relatively slow absorption from an im site unless given with a complexing agent, transient retention in liver and kidney, and prolonged retention in the skeleton. In the U.C. studies, using <sup>203</sup>Pb iv, on the 1st day, liver, kidney, blood, and bone contained 55% of the administered dose; 28% had been excreted in the urine and feces. By the 6th day most of the Pb in the soft tissues had been eliminated (in the feces), whereas the skeletal Pb remained the same as the 1st day. Given orally, CaEDTA had no effect on the distribution of radio Pb in either soft tissue or skeleton, and failed to augment its excretion significantly. (103 references)

- 717 Dutkiewicz, T., Paluch, J., and Neuhorn, U.: Porównanie toksycznego działania ołowiu zawartego w szklach ceramicznych wysoko i niskoołowiowych. (COMPARISON OF TOXIC ACTION OF HIGH AND LOW LEAD LEVEL

CERAMICS.) *Medycyna Pracy* 8, No. 6:389-98, 1957.

In order to compare the toxicity of Pb compounds in high level glazes (57% PbO) and in low Pb level glazes (10% PbO), 2 groups of rabbits were given equal amounts of both sorts of glaze intratracheally, 15 and 16 mg Pb/kg of weight respectively. Lead excretion in urine and its deposition in the tissues, as well as histopathologic examination, showed that both the absorption and the toxic action of Pb compounds in these 2 kinds of glaze are identical. The solubility in acids of Pb compounds present in the glazes is no criterion for evaluation of their toxic action when absorbed by way of the respiratory tract. (From *Excerpta Medica Sect. XVII*, 5, No. 1:226, 1959)

718 Fabre, R., and Girault, M.: Contribution à l'étude de l'action des toxiques sur l'embryon de poulet. Application au cas du plomb. (EFFECTS OF TOXIC SUBSTANCES ON THE CHICK EMBRYO. EFFECTS OF LEAD.) *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences* 244:535-8, 1957. The vitellin sacs of chick embryos were injected with 0.1 ml of Pb acetate and the effect on the development studied. If injection was performed before the embryo was 3 days old it died; after 10 days no effects were noted. Injection on the 5th day caused 50% mortality. The survivors were stunted, had general atrophy of the encephalic block with necrotic zones occupied by macrophages, and an abnormal astrocyte density. The cranium was abnormally distended by a liquid consisting of protein (6-8 g/l), albumins and  $\alpha$ - and  $\beta$ -globulins.

719 Formijne, P., and Lehr, C.F.G., with the technical assistance of Linschoten, J. (Univ. Amsterdam, The Netherlands): EFFECTS OF COMBINED ADMINISTRATION OF LEAD CARBONATE AND ALLYLISOPROPYLACETYL CARBAMIDE ON PORPHYRIN EXCRETION IN THE RABBIT. *Koninklijke Nederlandse Akademie van Wetenschappen, Proceedings, Series C* 60, No. 4: 531-6, 1957.

Male and female rabbits, 2.5-5 kg weight, pre-experimentally excreted daily 0-50  $\mu$ g of coproporphyrin (CP); both uroporphyrin (UP) and porphobilinogen (PBG), were absent in all animals. Two out of 14 rabbits were given 200 mg of Pb carbonate/kg/day, mixed with food; 12 rabbits were given the same dose of "Sedormid" (allylisopropylacetylcarbamide). (Administration of "Sedormid" (allylisopropylacetylcarbamide) causes intense excretion of porphyrins in the rabbit.) After a period of 17-42 days, 5 of the sedormid rabbits received additionally Pb carbonate. Administration of Pb carbonate alone increased the excretion of CP (even though it was irregular and slow; the peak was reached on the 14th-17th day) and caused a slight excretion of PBG. Sedormid alone produced a marked excretion of porphyrins and PBG in 5 of 12 rabbits. Subsequent combined administration of sedormid and Pb carbonate in these 5 rabbits decreased the excretion of UP and PBG in all, though in different degrees. Excretion of CP was not changed significantly by addition of Pb carbonate in 4 animals while one showed a marked increase.

The results suggested to the authors that Pb can inhibit to some extent the formation of PBG and UP in the sedormid rabbit, which could be explained by an inhibitory effect of Pb on CP formation in the liver, while the effect of Pb on the bone marrow is responsible for the main CP excretion during the administration of Pb + sedormid.

720 Goreczky, L., Róth, I., Sümegi, I., and Vajda, G. (Hungarian State Highways, Budapest): IMMUNOLOGICAL CHANGES IN THE SERUM IN ACUTE LEAD POISONING. *Schweizerische Zeitschrift für Allgemeine Pathologie und Bakteriologie* 20:459-69, 1957.

Rabbits (2.5-3 kg) were injected intravenously with 20 mg Pb acetate/kg (2% aqueous solution). Tests with rat leukocytes, *Micrococcus pyogenes* var. aureus, and *Salmonella typhosa* showed that the opsonic activity of the serum was increased  $36.7 \pm 16.5$  and  $59.5 \pm 22.8\%$  at 6 and 24 hr, respectively, after the Pb injection. At the same times, the bactericidal activity against *Micrococcus pyogenes* var. aureus and *Salmonella typhosa* of the serum was decreased  $27.4 \pm 16.6$  and  $52.5 \pm 21.8\%$ , and the complement titer was 0.40 and 0.38 (normal 0.48). It was assumed that the porphyrin which formed was involved in the actions of *Micrococcus pyogenes* var. aureus, and 2.5 mg hemoporphyrin/kg was injected into another set of animals. The changes in the above tests were of the same order of magnitude but slightly less than with the Pb injections. (37 references.)

721 Gorsheleva, L.S.: THE ULTRAPARADOXICAL PHASE DURING RESEARCHES ON CONDITIONED MOTOR REFLEXES IN WHITE RATS UNDER THE INFLUENCE OF VARIOUS INTOXICATIONS. In *Works of the Institute of Higher Nervous Activity, Pathological Series, Volume III. Experimental Investigations Into Disorders of the Higher Nervous Activity of Animals Under Intoxications and Infections, and Search for a Pathogenetically Based Therapy*. Moscow Academy of Sciences of the USSR, 1957. Translated by M. Paenson, A. Peters, Z. Lothan, and Z.S. Cole. Washington, D.C., National Science Foundation. U.S. Department of Commerce, Office of Technical Services, OTS 60-21086, 1960, pp. 76-87.

Eleven white rats were tested for their conditioned alimentary motor reflexes; 6 were found to be of the strong balanced type of nervous system and 5 belonged to the weak type. The animals were injected sc with a 0.06 oil solution of TEL/kg body weight (sic). Responses of 3 individual rats are singled out and charted in 3 tables. One of them, after showing completely appropriate motor reactions before TEL injection, changed its behavior suddenly on the 4th day. The 2nd rat displayed the same ultraparadoxical phase as the 1st one on the 14th day and the 3rd rat disclosed on the 22nd day of intoxication phenomena of completely inhibitory and ultraparadoxical phases. Results of the experiment thus showed that the period of TEL intoxication is marked by several features: whereas the animals rushed to the food box and stubbornly looked for food in response to the inhibitory stimulus (differentiation), in response

to the positive stimulus they not only did not manifest any positive motor reaction nor run towards the food box but on the contrary turned away from it and hid. A similar behavior was observed in most animals of the weak type of nervous system. (16 references)

- 722 Granati, A., and Andreani, D. (Univ. Rome, Italy): Atteggiamenti del ricambio protidico nelle intossicazioni sperimentali. Nota I. Il "turnover" metabolico dell'albumina marcata nell'intossicazione da Pb. (PROTEIN TURNOVER IN EXPERIMENTAL POISONING. I. METABOLIC TURNOVER OF LABELED ALBUMIN IN LEAD POISONING.) Rassegna di Fisiopatologia Clinica e Terapeutica 29, No. 4:387-95, 1957.

Four rabbits (2 kg body weight) were used; 2 of them were poisoned by oral administration of 6 ml of a 20% Pb acetate solution every 4 days over a period of 2 mo. Electrophoretic examination of the serum at the end of the feeding period showed hyposerinemia and a hypergamma-globinemia; total proteins and especially albumin were lower than normal. No albuminuria was observed throughout this period. Both poisoned and control rabbits received then iv  $^{131}\text{I}$ -labeled human albumin, and 24 and 48 hr thereafter blood was collected; this was repeated every 48 hr over 8 days. Before and during the experiment, each rabbit received daily 3 drops of 10% K iodide so as to prevent the uptake of the  $^{131}\text{I}$  by the thyroid. The results of the experiments showed that in the poisoned animals a decrease of the albumin pool and a slowing of the metabolic turnover of the protein occur. This is interpreted by the authors as being due to a reduced breakdown, and that the intermediate metabolites resulting from the splitting of the albumin molecules are utilized to a lesser extent than in the controls.

- 723 Granati, A., Scavo, D., and Peruzy, A.D. (Univ. Siena, Italy): Il comportamento della protidemia serica nella intossicazione sperimentale da piombo. (SERUM PROTEINS IN EXPERIMENTAL LEAD POISONING.) Folia Medica (Naples) 40:53-61 (Jan.), 1957.

Eight days after determining the normal protein fractions in the serum of 14 rats (by paper electrophoresis), Pb poisoning was induced by administration of 0.15 g Pb acetate in aqueous solution by stomach tube on alternate days. The proteins were determined after 30 and 60 days. Between these periods, 9 rats died, so that only 5 were available for the last analysis. After 30 days, there was a slight increase in total blood proteins, low albumins, and an absolute and relative increase in globulins, especially  $\alpha$ - and  $\beta$ -globulins,  $\beta$ -lipoproteins, and  $\alpha_1$ - and  $\beta$ -glycoproteins. After 60 days, the total proteins were reduced with markedly low albumin, and also reduced globulin. A relative increase in  $\alpha_1$ -globulin,  $\beta$ -lipoproteins and  $\alpha_1$ - and  $\beta$ -glycoproteins was still present. The changes reflect protein deficiency in the tissues and reduced mesenchymal reactivity.

- 724 Grosser, G. (Univ. Padua, Italy): La terapia dell'avvelenamento da piombo

(ricerche sperimentali con Piro-Na). (THERAPY OF LEAD POISONING (EXPERIMENTAL STUDY WITH PIRO-Na).) Rivista degli Infermi e delle Malattie Professionali 44:1071-81 (Nov.-Dec.), 1957.

In the 1st experiment, rabbits (av 1900 g weight) were divided into 3 groups: 1 received for 7 days iv 1 ml of a 1% Pb nitrate solution/day; Group 2 received Na pyrocatechindisulfate (Piro-Na) at 5 ml of 10% solution iv from the 11th-20th day of the experiment; Group 3 received for 7 days Piro-Na followed by Pb nitrate; all rabbits were observed for 28 days. In the 2nd experiment, the subacute poisoning was obtained in 9 days; 1 day thereafter the 1st 2 lots were treated as above for 11 and 18 days and together with the controls were observed for 37 days. As evidenced by improvement of the blood picture, particularly the stippled cells and reticulocytes, Piro-Na acted similarly to  $\text{CaNa}_2\text{EDTA}$  in its antidotal effect on the Pb absorbed in the organism. (27 references)

- 725 Gusev, M.I. (Ryazan I.P. Pavlov Med. Inst.): EFFECT OF LOW LEAD CONCENTRATION ON PORPHYRIN METABOLISM. Gigiena i Sanitariya, 1957, No. 8:21-5. In Levine, B.S.: U.S.S.R. Literature on Air Pollution and Related Occupational Diseases. Washington, U.S. Department of Commerce, Office of Technical Services, 1960, Vol 1, pp. 105-10.

In order to help determine limits of allowable concentrations of Pb in the atmosphere, young male rabbits (1160-2140 g weight) were exposed to Pb oxide concentrations of 10  $\mu\text{g}/\text{m}^3$  and 3.9  $\mu\text{g}/\text{m}^3$  daily for 6 hr over a period of 6.5 mo. The higher concentration increased the urine-eliminated coproporphyrin to 5.5-10.59 g/day (twice that of the control group), but exposure to 3.9  $\mu\text{g}/\text{m}^3$  failed to effect any change in the coproporphyrins.

- 726 Hammond, P.B., Hoyt, H.H., and Nelson, B.J. (St. Paul, Minn.): RESULTS WITH NEWER THERAPEUTIC METHODS IN LARGE ANIMAL PRACTICE. II. THE ROLE OF FLUID AND ELECTROLYTE THERAPY IN LEAD ARSENATE POISONING. Journal of the American Veterinary Medical Association 131:91-2 (July 15), 1957.

Four cows died and 2 others became sick after being placed in a new pasture at a state hospital farm. A can of Pb arsenate found in the pasture showed evidence of having been disturbed by the cattle. Analyses of material from one animal that died revealed >10 ppm As in the rumen contents and 5-10 ppm in the liver. The Pb concentration in the blood was normal in 1 of the animals surviving and 0.3 ppm in the other one. Plasma bicarbonate levels in both animals were below normal, indicating metabolic acidosis. The signs observed were characteristic of As poisoning rather than Pb poisoning. Therapeutic measures for the 2 surviving cows were described.

- 727 Hammond, P.B., and Sorenson, D.K. (Univ. Minnesota, St. Paul): RECENT OBSERVATIONS ON THE COURSE AND TREATMENT OF BOVINE LEAD POISONING. Journal of the American Veterinary Medical Association 130, No. 1:23-5,



1957.

Approximately equal numbers of dairy and beef cattle from 2 mo to several years old were involved. Two showed marked excitement and convulsions and died shortly after onset of signs. The others were in variable states of depression and weakness, and the behavior of some suggested varying degrees of pharyngeal or buccal paralysis. The only diagnostically significant hematologic finding was the presence of basophilic stippling.

Twelve animals were subjected to treatment with  $\text{CaNa}_2\text{EDTA}$  at twice the dosage used for humans, twice daily on an intermittent basis, intraperitoneally, intravenously, or subcutaneously. The blood Pb values determined before and after treatment (American Public Health Association dithizone method) ranged from 0.25-0.5  $\mu\text{g/ml}$  to 1.0-1.5 and 1.5-2.5; the 4 animals showing the last 2 ranges died. The remaining 8 required 4-16 days of treatment before discharge. After 8 days of treatment the blood Pb had dropped to  $\sim 0.2-0.8 \mu\text{g/ml}$ . All signs, including blindness, were reversible. Only 1 showed residual ataxia.

The authors suggest that the levels of blood Pb at the time of illness may be of diagnostic significance.

- 728 Hartley, B. (General Hosp., Launceston, Tasmania): LEAD POISONING IN A DOG. (Letters to the Editor.) *Lancet* 2:1338 (Dec. 28), 1957.

An Alsatian pup developed Pb poisoning from chewing at the tinfoil lining of his make-shift kennel. Pieces of foil were found in his lower bowel. Radiographs showed thick white lines proximal to the epiphysis in his hips. He had a blue line around his gums and abdominal colics. He recovered after treatment with colloidal Ca.

- 729 Hsu, Y.-H., Yu, C.-T., and Lou, D.-A. (Chekiang Med. Coll., Hangchow, China): (ARTERIOLOSCLEROSIS IN EXPERIMENTAL LEAD POISONING.) *Chung Hua I Hsueh Tsa Chih* 43:886-74, 1957.

The authors suggested that Pb poisoning would cause hypertension before arteriolosclerosis. Thirty rabbits ( $\sim 2 \text{ kg}$  each) were given 5 ml of 0.1% Pb acetate iv weekly for 10 wk. Only the 17 survivors were observed for 11 mo. Hypertension was found in all 10 rabbits in which blood pressure was measured. Autopsies of 16 rabbits showed contracted kidneys in all. Arteriolosclerosis was most apparent in heart and brain, then spleen and adrenal glands. The most likely mechanism of arteriolosclerosis was given. (From *Chemical Abstracts* 53:4539, 1959)

- 730 Ichikawa, S., Ikeda, Y., Nanjo, M., Omori, Y., Hayashi, E., Isono, C., Kano, S., Yoshimoto, H., and Koyama, T.: (PERCUTANEOUS ABSORPTION OF HEAVY METALS.) *Eisei Shikenjo Hokoku* 1957, No. 75:373-80.

When rabbits were given 30% Pb nitrate solution (0.2 ml/day) on the back skin, the blood Pb level was increased markedly after a week's experimental period, but neither growth rate nor macroscopic change in organs was evidenced. (From *Chemical Abstracts* 52:17444, 1958)

- 731 Ivemark, B., and Seldinger, S.I. (Univ. Upsala; Karolinska Hosp., Stockholm, Sweden): RENAL DAMAGE IN RATS FROM THE LEAD SALT OF EDTA AND FROM UMBRADIL. *Acta Radiologica* 48:366-75 (Nov.), 1957.

The histological renal changes in rats (170-200 g weight) following iv and intra-arterial (ia) injections of PbEDTA are briefly described. For iv injections, 17 rats were given 1.0-3.0 g PbEDTA/kg body weight; 7 (controls) were injected with 1.0-214 g Umbradil (contrast medium)/kg body weight and 3 with 1.0-2.0 g/kg body weight hypertonic Na chloride solution. For ia injection, 0.3-4.0 g/kg body weight PbEDTA with 1% CaEDTA was used with 7 rats; for control, 3 rats were injected with 0.4-0.8 g/kg body weight Umbradil and 1 with hypertonic salt solution. After iv injections, tubular epithelial degeneration with the formation of hyaline casts and mineral deposits were found. Following ia injection of EDTA, interstitial and periglomerular hemorrhage occurred in addition to moderate epithelial changes of the tubules. The lesions were similar to, but more severe than those appearing after the injection of comparable doses of Umbradil.

- 732 Japanese Association of Industrial Medicine: PROCEEDINGS OF THE 30TH GENERAL MEETING OF JAPAN ASSOCIATION OF INDUSTRIAL HYGIENE. *Journal of Science of Labour* (Japan) 33:451-588 (July), 1957.

Among the 232 papers presented, the following concerned Pb (numbers refer to Proceedings):

- Tsuchiya, K., and Tanaka, D.: An Electrophoretic Study of Lead Worker's Sera. Abstract No. 158. See Abstract No. 1870.  
Sano, S., and Inoue, S.: Studies on the Disturbances of Hemoglobin Synthesis in Lead Poisoning. (Report II). Porphyrin Biosynthesis from Glycine, S-Amino-Levulinic Acid and Porphobilinogen in Lead Poisoning. Abstract No. 160.  
Horiuchi, K., Horiguchi, S., Nagao, Y., Hashimoto, K., and Yuge, M.: Prevention and Treatment of Lead Poisoning. (Report VI). Administration Methods of Ca-EDTA. Abstract No. 161.  
Horiuchi, K., Okada, A., Tamori, E., and Yuge, M.: Reconsideration on the Distribution of Lead in the Body of Healthy Japanese. (Report II). Abstract No. 162.  
Yokohashi, G.: Localization of Serum Protein-bound Radioactive Lead by Filter Paper Electrophoresis. Abstract No. 163.  
Yoshida, Y., Mukai, T., Ogata, A., and Matsui, K.: Experimental Studies on the Effect of Allithiamine on Lead Poisoning. Abstract No. 164.  
Saruta, N., and Yamaguchi, S.: On the Treatment of the Chronic Lead Poisoning - Especially the Administration of Parathyroid Hormone together with Ca-EDTA. Abstract No. 165.  
Saruta, N., Yamaguchi, S., Ishinishi, N., Tsutsumi, T., Asoo, M., Matsumoto, B., and Kotsubo, Y.: A New Diagnostic Method of Plumbism in Case of Group Inspection. Abstract No. 166. See Abstract No. 1855.  
Nishino, S.: Occupational Hazards of Lead Sulfide. (Report I). Experimental Study of the Toxicity of Lead Sulfide by Oral Administration. Abstract No. 167.  
Niinuma, K.: Experimental Studies on the Effect

- of the EDTA-salts on the Lead or Manganese Poisoning. Abstract No. 168.
- Suzuki, Y., and Matsuka, Y.: On the Strength and the Elongation of Hair of the Lead and Manganese Workers. Abstract No. 169. See Abstract No. 1861.
- Nishiyama, K., Ishizawa, M., and Ohshima, M.: On the Lead Content of Hair of Lead Workers. Abstract No. 188.
- 733 Kelentey, B., Százados, I., Takács, I., Halmai, Z., and Vályi-Nagy, T. (Med. Univ., Debrecen, Hungary): STUDIES ON EXPERIMENTAL LEAD POISONING. IV. METABOLISM OF RATS AT REST AND UNDER EXERCISE IN CHRONIC LEAD POISONING. *Acta Physiologica Academiae Scientiarum Hungaricae* 12:277-81, 1957.
- Male and female rats (240-400 g weight; 2 groups of 10 each) were poisoned by administration of 5 mg/kg of Pb nitrate through a gastric tube every other day for 1-1/2 yr (total Pb administered, 465.6-744.0 mg). One group was sacrificed at the end of the experiment and organs tested for Pb, either by dithizone or by polarography. The other group was subjected to metabolic study, 7 control rats being compared with the 10 poisoned animals. Poisoned animals did not lose much weight as compared to the controls. On completion of chronic Pb poisoning, the metabolic rate at rest in the poisoned rats was 24% less than that of controls (9.2 g cal/min/100 g weight and 12.1, respectively). The metabolic rate after exercise (5 min running) was 19% less in poisoned rats (16.7 g cal/min/100 g body weight vs 20.6). This is statistically significant.
- 734 Kirchgessner, M. (Inst. Animal Husbandry, Stuttgart-Johenheim, Germany): Der Mengen- und Spurenelementgehalt von Rinderblut. (THE CONTENT OF MAJOR AND TRACE ELEMENTS IN THE BLOOD OF CATTLE.) *Zeitschrift für Tierernährung und Futtermittelkunde* 12:156-69, 1957.
- The contents of major elements (Si, K, Na, Cl, S, Ca, P, and Mg) and trace elements (Fe, Mn, Al, Zn, Mo, Cu, Ni, Co, F, I, and Pb) and their interrelationships in blood, colostrum and milk of dairy cattle were investigated. Oelschläger's method (1956) was used to analyze the samples collected. In healthy cows, the amounts in blood fluctuated within certain physiologic limits. Abnormal values existed in well producing cows 1-2 days post partum (PP): P, Ca, Si, S, Fe, Al, Cu, Ni and Co in the blood decreased; the last 5 elements were increased ante partum (AP). Pb values were, in mg/kg total blood: 0.35 PP (1-2 days) and 0.42 AP and PP (10 days). The reason for the marked changes was the great need for these elements in colostrum formation. The contents of elements in the blood of 5 1-yr-old heifers showed in comparison with that of cows an increase especially in Mg, Ni, Zn and Co. As tabulated, the average Pb contents in colostrum (6 samples from 2 milkings) were 170 and 67 µg/kg milk; in the blood serum, 0.14 mg/kg whole blood, as compared with colostrum, 0.20 mg/kg milk. The total secretion of Pb in colostrum and in normal milk was: 1.4 mg/10.5 kg and 0.4 mg/10.0 kg. The average Pb contents in blood serum and in corpuscles were 0.27 and 0.22 mg/kg serum and cells, respectively. The shifts in some major and minor elements in various disease or deficiency states are also illustrated and discussed. (45 references)
- 735 Kiryachko, B.A. (Ukrainian Inst. Postgrad. Med.): Vliyanie khronicheskogo otravleniya svintsom na immunobiologicheskuyu reaktivnost organizma zhivotnogo. (EFFECT OF CHRONIC LEAD POISONING ON THE IMMUNOLOGICAL REACTION OF THE ORGANISM.) *Gigiena i Sanitariya* 22, No. 8: 30-4, 1957. In Levine, B.S.: U.S.S.R. Literature on Air Pollution and Related Occupational Diseases. Washington, U.S. Department of Commerce, Office of Technical Services, 1960, Vol. 1, pp. 137-42.
- After a 2-3 wk observation period, 30 rabbits were divided into 3 equal groups and treated as follows: (1) received typhoid vaccine alone; (2) typhoid vaccine together with Pb acetate orally at 10 mg/kg daily for 4.5 mo, followed by 20 mg for 1 mo, and 30 mg/kg thereafter; (3) Pb acetate as in 2, followed by vaccine. As summarized by the author, Pb poisoning was accompanied by a reduction in the production of agglutinins in the course of immunization with typhoid vaccine. This was most pronounced in group 3. Blood serum complement activity was lowered. However, immunization following Pb administration raised the complement titer to a considerably higher level than in the controls. During immunization, control rabbits developed a small amount of acetylcholine (ACh) and a simultaneous increase in serum cholinesterase (ChE) activity, assumed to be indicative of the presence of humoral compensation. Group 2, and particularly Group 3, accumulated a considerable amount of ACh with simultaneous reduction in ChE activity. Lowered capacity to generate agglutinins and disturbed interstitial metabolism appeared early in the poisoned rabbits, and were evident much earlier than the classical signs of Pb poisoning (blood changes).
- 736 Kosaki, T., Ikeda, T., Kotani, Y., Nakagawa, S., and Saka, T. (Mie Prefect. Univ. School Med., Tsu, Japan): (THE AFFINITIES OF CELLS AND THEIR FORMATIVE ELEMENTS FOR PORPHYRIN BODIES. XII. THE AFFINITY OF CELLS AND THEIR FORMATIVE ELEMENTS FOR COPROPORPHYRIN I AND III.) *Mie Medical Journal* 7:305-12, 1957.
- Procedures are given for the isolation of tetramethyl esters of coproporphyrin III and coproporphyrin I from urine of Pb-poisoned rabbits and normal cattle bile, respectively. (From Chemical Abstracts 52:13820, 1958)
- 737 Kramer, W.: Necrotische myelopathie t.g.v. loodintoxicatie bij een hond. (NECROTIC MYELOPATHY IN A DOG DUE TO LEAD POISONING.) *Tijdschrift voor Diergeneeskunde* 82:411-21, 1957.
- Acute gastrointestinal disturbances developed in a dog after ingestion of grass contaminated with red Pb. This was followed by paralysis of all 4 legs with spread from posterior to anterior. Examination of the nervous system revealed myelitis and increased number of cells in the cerebrospinal

fluid, characteristic of subacute necrotic myelopathy. There was an abnormal amount of Pb in the nervous system (390 µg/100 g of spinal cord, 90 µg/100 g brain). (From Veterinary Bulletin 28, No. 7 Abstract No. 2287, 1958)

- 738 McConnell, W.C.: OIL FIELD PROBLEMS CONFRONTING THE VETERINARIAN. Veterinary Medicine 52:159-63, 1957.

The legal aspects of pollution of streams and the tolerance of farm animals for minerals in drinking water are discussed. Symptoms of salt-water poisoning, postmortem findings and treatment are described. Poisoning by ingredients of crude oil and by heavy metals, principally Pb, from discarded containers, paint, pipe joint compound, and similar products, may also occur in oil fields. (From Veterinary Bulletin 28, No. 4:1210, 1958)

- 739 Majorca, G. (Italy): Altérations morphologiques initiales du rein dans le saturnisme expérimental. (INITIAL MORPHOLOGICAL ALTERATIONS OF THE KIDNEY IN EXPERIMENTAL LEAD POISONING.) In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, p. 295.

Listed by title only.

- 740 Mokranjac, M.S., and Radmić, S. (Coll. Pharmacy, Belgrade, Yugoslavia): (EFFECT OF PENICILLIN ON THE CONTENT OF LEAD IN BLOOD OF ANIMALS POISONED WITH LEAD.) Acta Pharm. Jugoslav. 7:143-8, 1957.

Results of the effect of penicillin on the content of Pb in the blood of sheep chronically poisoned with Pb are given. A considerable effect of penicillin on the increase of Pb in blood is found, the increase resulting from the mobilization of Pb in form of insoluble compounds. (From Chemical Abstracts 51:18288, 1957)

- 741 Morelli, A., Giuliani, V., and Serra, C. (Univ. Florence; Univ. Naples, Italy): Aspetti elettroencefalografici nell'intossicazione sperimentale da piombo tetraetile. I. Reperti nell'intossicazione acuta. (ELECTROENCEPHALOGRAPHIC ASPECTS IN EXPERIMENTAL POISONING BY TETRAETHYL LEAD. I. FINDINGS IN ACUTE INTOXICATION.) Lavoro Umano 9:433-40, 1957.

Rabbits (2.25 kg weight, in groups of not <2) were treated daily as follows: (1) control; (2) 100 mg TEL/kg sc; (3) same, iv; (4) 50 mg/kg iv; (5) 0.1 ml ethyl alcohol/kg iv; and (6) 40 mg Pb acetate/kg iv. TEL was injected without solvent. Groups 2, 4 and 6 were observed until death (Group 3 died between 20 min and 6 hr after injection). Electroencephalographs (EEG) were made before exposure and every 24 hr in the subacute poisonings and continuously after treatment for at least 30 min or other times in the iv groups. At high doses EEG changes occurred early (depression in amplitude, slowing of frequency, increase of the frequency with reduction of amplitude or slowing of frequency with rise of the amplitude). In spite of these discordant findings and others which do not make it possible to consider TEL as a synchronizing or unsynchronizing

agent, the authors conclude that TEL alters many neuron and polyneuron circuits and relays between cortex and reticular substance, thereby disorganizing the electric activity. The modification of the mode of synchronization is probably due to the action of TEL on the thermoregulatory centers.

In the rabbits given alcohol, only a slight slowing of the rhythm was observed which vanished 1 hr after administration. With a slight increase in frequency and a tendency to desynchronization was seen after doses subsequent to the 1st. (20 references)

- 742 Morelli, A., Giuliani, V., and Serra, C. (Univ. Florence; Univ. Naples, Italy): Aspetti elettroencefalografici nell'intossicazione sperimentale da piombo tetraetile. Nota II-Reperti nell'intossicazione cronica. (ELECTROENCEPHALOGRAPHIC ASPECTS IN THE EXPERIMENTAL POISONING WITH TEL. II. CHRONIC INTOXICATION.) Lavoro umano 9:545-52, 1957.

Two groups of at least 2 rabbits in each (1.850-2.850 kg) received sc TEL dissolved in 0.1 mg/kg ethyl alcohol in doses of 10 and 1 mg TEL/kg body weight/day until death and for 30 days, respectively. Another group was given only 0.1 ml/kg ethyl alcohol and 1 group served as control. EEG's were taken pre-experimentally and on the 10th, 20th, and 30th day of treatment; also for the 10 mg group on the 70th day (most animals died in 10-20 days, administration to survivors was ceased on the 20th day), and for the 1 mg group after 60 days. Alterations in the EEG increased with the dose of TEL and with the duration of administration. When the treatment was suspended, the EEG returned to normal in animals poisoned with the smaller dose; remission was not always obtained in the rabbits which had been given the larger dose.

- 743 Nishimura, M. (Tokyo Dental Coll., Japan): EFFECTS OF PARATHYROID FUNCTION ON LEAD POISONING. PART 1. THE IMPEDIMENT OF CALCIUM METABOLISM BY REMOVAL OF PARATHYROID AND ITS RELATION TO LEAD METABOLISM. Journal of the Science of Labour (Japan) 33:923-32 (Dec.), 1957.

Parathyroidectomized albino rats were experimentally poisoned with Pb and the relation between Ca and Pb metabolism was studied. Serum Ca tended to decrease in acute Pb poisoning and more so in the parathyroidectomized rats. After ~2 wk a slight recovery of serum Ca was noted. Urinary Ca excretion decreased after parathyroidectomy but was temporarily increased after administration of Pb. Normal rats given Pb showed no change in urinary Ca excretion. The pattern of serum and urinary inorganic P was completely reversed to that of Ca in both groups of animals. Total retained Ca decreased in both groups in acute Pb poisoning, the Ca balance became negative in the parathyroidectomized ones. The connection of the parathyroid function with the Ca and Pb metabolism in acute Pb poisoning was confirmed. (From author's English summary) (34 references)

- 744 Nishio, K. (Univ. Kagoshima, Japan):

(PHOSPHORYLATION IN SKELETAL MUSCLE OF THE ACUTE LEAD-INTOXICATED RABBIT.) Seikagaku 29:313-8, 1957.

Rabbits administered orally a total of 0.6-2.5 g powdered Pb at doses of 0.1 g/day were anesthetized, and the gastrocnemius was removed. The ATP content was 1.6 times, phosphocreatine 1.1 times, hexose monophosphate 1.4 times, and inorganic phosphate 1.6 times as high as normal. Special  $^{32}\text{P}$  activity decreased for phosphocreatine but increased for ATP, hexose monophosphate, and for inorganic P. In vitro, Pb increased muscle phosphorylase activity by 14, 26, 22 and 48% at  $4.5 \times 10^{-3}$ ,  $5.9 \times 10^{-4}$ ,  $5.9 \times 10^{-6}$ , and  $5.9 \times 10^{-7}\text{M}$  Pb, respectively. Total inhibition was caused by  $4.3 \times 10^{-4}\text{M}$  Hg combined with  $4.3 \times 10^{-4}\text{M}$  Pb. Acute Pb intoxication produced increase in phosphorylation by breakdown of glycogen to hexose monophosphate. (From Chemical Abstracts 55:4753, 1961)

- 745 Oliver, W.T., and MacGregor, K.L.: LEAD ARSENATE POISONING IN DAIRY CATTLE. Canadian Journal of Comparative Medicine and Veterinary Science 21:248-50, 1957.

An outbreak of poisoning in a dairy herd of 35 animals is described. Fourteen deaths occurred principally among young cattle. The feed was found to contain 37% Pb and 11% As in the form of Pb arsenate. Tissue analysis indicated that toxicity was due to the arsenical and not the Pb radical as has been reported. This is supported by clinical and pathological findings of acute gastroenteritis. The source of the poison was a bag of insecticide found buried in the granary. (From Veterinary Bulletin 28, No. 2:563, 1958)

- 746 Remy, R., and Buckup, H. (Bernward Hosp., Hildesheim, Germany): Zur kritischen Beurteilung der Symptome experimenteller Bleivergiftungen. (CRITICAL EVALUATION OF THE SIGNS OF EXPERIMENTAL LEAD POISONING.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 7:233-7 (Oct.), 1957.

About 170 male albino rats (150 g body weight) were injected intraperitoneally with a solution of Pb acetate (pH 5) in doses of 20-100 mg/kg body weight, every 2-4 days for up to 36 days so that a total of 300-500 mg Pb acetate/kg was administered. In some experiments single doses up to 400 mg Pb acetate/kg and a total of 700 mg/kg were given. Hemoglobin (Hb) and erythrocytes (RBC) decreased more rapidly and to a lower level as the Pb doses were increased. When 100 mg Pb acetate/kg was injected every 4 days for 16 days, the RBC decreased in a straight line and most of the rats died. At a dose of 35 mg/kg every 4 days RBC and Hb decreased in a straight line until the 16th day and irregularly from the 16th to 21st day after which time no further decrease was noted. When 20 mg/kg/dose was injected, the RBC after first decreasing in a straight line, distinctly rose after the 20th day reaching their initial count at the start of the 2nd mo of the experimental period, while the Hb values decreased along with the RBC and then remained constant. The reticulocytes strongly increased at the 35 mg dose during the 36-day experimental period whereas at the 20 mg dose the reticulocytes and stippled RBC increased for 20-22 days and then decreased. The authors concluded from the

experiment that in acute Pb poisoning death may occur before a distinct anemia is obvious. In chronic poisoning, however, the RBC and Hb curves during the 1st 2 wk are indicative of the degree of the poisoning. Analysis of the bones (shoulder) of the rats showed that up to a dose of 210 mg Pb acetate/kg the Pb levels increased in proportion to the doses. Higher doses resulted only in very small increases above the level reached at 210 mg/dose. Thus, the Pb concentration in the bones, within certain limits of the dose, also is an indication of the degree of intoxication. Histologic changes of liver, spleen and kidney increased as the doses increased. Rats, first poisoned and then given Pb therapy, showed hardly any changes in the blood or bones but their livers, spleens and kidneys were always histologically affected. Analysis of the bones of rats which had received 6 injections of 50 mg Pb acetate, revealed considerable Pb storage for several months while the RBC count returned to normal after 7 wk and the Hb value after 10 wk. Experiments to determine the lethal Pb doses showed that 500 mg Pb acetate/kg were fatal to all rats and survival after 200-400 mg/kg was only by very robust animals. Single doses of 100 mg/kg were generally tolerated; when this dose was repeated every 4 days, most rats died after the 3d injection and very few survived a 4th one. However, there appeared to be a certain adaptation to Pb. Rats which had recovered from a chronic poisoning by a total of 350 mg Pb acetate/kg over a period of weeks although still showing a distinct anemia, tolerated 2 additional doses of 100 mg Pb/kg each without fatalities and more animals survived 3 and 4 injections than in the case of unadapted rats.

- 747 Salvini, M. (Univ. Pavia, Italy): Efficacia dell'etilendiamino-tetraacetato-bisodico monocalcico sulla eliminazione urinaria del piombo nel trattamento della intossicazione con acetato di piombo. (EFFICACY OF DISODIUM MONOCALCIUM ETHYLENEDIAMINETETRAACETATE IN THE URINARY ELIMINATION OF LEAD IN THE TREATMENT OF POISONING WITH LEAD ACETATE.) Bollettino della Societa Italiana di Biologia Sperimentale 33, No. 4:409-10, 1957.

Six rabbits received iv injections of 3 mg/kg/day Pb (as acetate); half of the group received immediately after Pb, EDTA for 6 days, iv. In the rabbits that received no EDTA, of the total of 86.25 mg administered, 2.876 mg or 3.325% was eliminated in the 1st 5 days; 2.113% in the 2nd 5 days, and by the end of observation, 5.438% of the administered dose was eliminated. In the rabbits treated with EDTA, of 95.25 mg total Pb injected, 3.28% was eliminated in the 1st 5 days, and by the end of the experiment, 18.57% was eliminated. The author concludes that aside from increasing the elimination of Pb, EDTA furnished indication of the existence of prior absorption of Pb.

- 748 Salvini, M. (Univ. Pavia, Italy): Efficacia del calcio-etilen-diaminotetraacetato-disodico sulla eliminazione del piombo con le urine e con le feci nella intossicazione saturnina sperimentale del coniglio. (EFFICACY OF CALCIUM DISODIUM ETHYLENEDIAMINE

TETRAACETATE ON ELIMINATION OF LEAD BY URINE AND FECES IN EXPERIMENTAL LEAD POISONING IN RABBITS.) Bollettino della Società Italiana di Biologia Sperimentale 33, No. 5:590-3, 1957.

Of 6 rabbits poisoned with Pb acetate (3 mg/kg/24 hr iv), 3 received from the 6th day of poisoning 10 mg EDTA/kg/24 hr over a 6-day period. The results showed that treatment with EDTA increased the total excretion of Pb from 18.31-26.5% of the amount injected. EDTA alters the pattern of excretion of Pb so that almost all of the excretion takes place through the urine, and the fecal excretion is unchanged or decreases.

- 749 Salvini, M. (Univ. Pavia, Italy): Bilancio di distribuzione tissutale e di eliminazione globale del Pb iniettato in animali di controllo ed in animali trattati con etilendiamina-tetraacetato-disodico-monocalcico endovena. (TISSUE DISTRIBUTION AND TOTAL ELIMINATION OF Pb INJECTED INTO CONTROL ANIMALS AND ANIMALS TREATED INTRAVENOUSLY WITH DISODIUM-MONOCALCIUM ETHYLENEDIAMINE TETRAACETATE.) Bollettino della Società Italiana di Biologia Sperimentale 33, No. 6:711-6, 1957.

In rabbits treated daily with 5 mg Pb/kg for 5 days, ~80% of the Pb was retained as compared with 70% for rabbits which received the same dose of Pb plus EDTA. Pb was deposited in certain tissues and later transferred to others. This redistribution of Pb results from chelation between Pb and EDTA. (From author's summary)

- 750 Salvini, M., Vidali, U., and Scudier, U. (Univ. Pavia, Italy): Efficacia terapeutica ed effetto piomburico del Ca-EDTA-Na<sub>2</sub> nel saturnismo. Esperienze in conigli intossicati per via endovenosa, intramuscolare e sottocutanea. (Ca-EDTA-Na<sub>2</sub> IN SATURNISM: THERAPEUTIC EFFECT AND EFFECT ON THE URINARY LEAD EXCRETION: EXPERIENCE WITH RABBITS INTOXICATED INTRAVENOUSLY, INTRAMUSCULARLY, AND SUBCUTANEOUSLY.) Il Policlinico. (Rome) Sezione Medica 64:82-99 (Mar.-Apr.), 1957.

Eighteen rabbits, 9-13 mo-old, (av weight 2250 g) were subdivided into 3 groups of 6 each. Group 1 was given iv injections of 3 mg Pb acetate/kg body weight for 5 days and then iv injections of 10 mg EDTA/kg body weight for the next 5 days. Group 2 was given im injections of 4 mg Pb acetate/kg for 6 days; then 3 of these animals were given iv injections of EDTA for the next 6 days. When it was seen that the extra amount of Pb eliminated as a result of the treatment was very low, the daily EDTA dose was increased to 240 mg/kg for 6 days. Group 3 received sc injections of 24 mg Pb acetate/kg for 6 days; then 3 of the animals were given daily iv injections of 240 mg EDTA/kg for the next 6 days. Administration of EDTA caused increased urinary Pb excretion in all animals. But the increase represented only a minimal part of the total Pb excreted by the animals. The authors believe that EDTA causes decomposition of Pb in the tissues, a reduction of the toxic effect of Pb on certain tissues and increased transfer of chelate to the kidney. (37 references)

- 751 Selariu, C., and Mihăescu, S.: (ACTIVITY OF PHOSPHATASES AND CHOLINESTERASE OF THE SERUM OF DOGS CHRONICALLY POISONED WITH LEAD NITRATE.) Comun. acad. rep. populare Romîne 7:45-9, 1957.

The action of Pb nitrate given intravenously was studied. Dogs received 6-10 mg in intervals of 5-6 days during 2 mo. The blood samples were taken at the beginning, after 4 days, and later each 14 days. The alkaline phosphatase activity was measured after Bodansky and the acid phosphatase after Klemperer and Miller. Immediately after the first injection, modifications of the phosphatase activities were noticed. The activity was maximum after the 4th day. The results indicate the intervention of Pb in the Ca metabolism of the bones. The cholinesterase did not show significant variations. (From Chemical Abstracts 52:2260, 1958)

- 752 Sessa, T., Rossi, L., and Apollaro, A. (Univ. Naples, Italy): La riboflavina nel sangue e nei tessuti nella intossicazione sperimentale da piombo. (RIBOFLAVIN IN THE BLOOD AND TISSUES IN EXPERIMENTAL LEAD POISONING.) Bollettino della Società Italiana di Biologia Sperimentale 33:1249-51, 1957. Biochimica Applicata 4:338-52, 1957.

Rabbits were given orally 100 or 200 mg Pb acetate daily (6 rabbits/dose). The riboflavin content of the liver, kidney, and heart decreased; the values for muscle and brain showed little change. The decrease for the 200-mg dose (acute) was about twice that for the 100-mg dose. An additional 5 rabbits were also studied after receiving 100 mg Pb acetate for 30, 40, and 50 days. After administration of 1 mg riboflavin im, a reduction in blood riboflavin was seen which was more intense in the more severe poisoning.

The paper published in Biochimica Applicata is given in greater detail and includes a comparison of the urinary excretion of riboflavin before and after various days of poisoning. A progressively higher excretion was observed in poisoning. The authors conclude that the findings point to a deficient utilization of vitamin B<sub>2</sub> in its role of enzymic constituent need for oxidation-reductions processes in cells.

- 753 Shibata, S.: PHARMACOLOGICAL STUDIES ON THE ANTIDOTAL ACTION OF CHELATING AGENTS. II. Nippon Yakurigaku Zasshi 53:602-13, 1957. Breviaria 30.

When 1.8 mg Pb acetate/kg rabbit was injected iv, the urinary excretion was 1.83% in 0-1 hr, 2.75 in 2-4 hr, 0.96 in 4-8 hr, 0.8 in 8-12 hr, and 1.76 in 12-24 hr, and total 10.92% in 24 hr. Following the iv injection of equivalent amount of PbEDTA, the excretion of Pb was 17.4% in 0-1 hr, 10.06 in 1-2 hr, 14.2 in 2-4 hr, 3.8 in 4-8 hr, 3.1 in 8-12 hr, and 2.2 in 12-24 hr, and total 49.8% in 24 hr. When 1.8 mg/kg dose of Pb acetate and 50 mg/kg dose of CaEDTA were injected simultaneously, the total urinary excretion of Pb in 24 hr was 49.5%. An equimolecular dose of CaEDTA against Pb dose gave the total excretion of 47.6% and half an equimolecular dose of the former gave 25.0%. Simultaneous injection of 50 mg/kg dose of 2,3-dimercaptopropanol (BAL) gave the

total excretion of Pb of 20.8%. The equimolecular dose gave 8.4% excretion. Na citrate on simultaneous injection in the dose of 50 mg gave a total of 12.7% Pb excretion in 24 hr; the equimolecular dose gave 10.2%. The Pb contents in blood 1, 2, 4, 8, 12, and 24 hr, respectively, after the injection of 18 mg/kg Pb acetate alone were: 3.40, 1.80, 1.51, 0.88, 0.82, 0.75 mg%; equimolecular dose of PbEDTA alone, 1.04, 0.82, 0.54, 0.43, 0.28, 0.25; 50 mg/kg CaEDTA with the above dose of Pb acetate, 1.05, 0.94, 0.62, 0.46, 0.33, 0.30; equimolecular CaEDTA simultaneously, 1.03, 0.95, 0.45, 0.26, 0.22, 0.19; half an equimolecular dose CaEDTA simultaneously, 1.84, 1.45, 1.2, 0.89, 0.72, 0.54; 50 mg/kg BAL simultaneously, 2.80, 1.36, 0.95, 0.92, 0.85, 0.76; equimolecular BAL simultaneously, 3.46, 2.45, 1.65, 0.86, 0.81, 0.69; 50 mg/kg Na citrate simultaneously, 3.48, 1.76, 1.01, 0.61, 0.40, 0.34; equimolecular Na citrate simultaneously, 2.86, 1.80, 0.71, 0.63, 0.42, 0.31 mg%, respectively. (From Chemical Abstracts 52:15740, 1958)

- 754 Skripnichenko, Z.M.: (INFLUENCE OF TETRAETHYLLEAD (TEL) ON INTRAOCULAR PRESSURE IN THE EXPERIMENT (SECOND REPORT).) Oftal'mol. Zhur. 1957, No. 6:372-9.

The influence of parenteral introduction of TEL solution (in cod liver oil) on the elastotonometric curve (EC), ophthalmotonus (O) and the results of a compressive-tonometric test were studied in 62 rabbits. Acute experiments were conducted with doses which killed the animals (0.05 ml/kg every other day). Dynamic observations continued for 2 mo to 2 yr. With doses which induce chronic poisoning (up to 0.5 mg/kg after 2 days) only some animals perished. In acute intoxication, attacks of motor excitement of the rabbit occurred. After the attack, O decreased, and the EC character changed. Later O decreased day by day up to the death of the animal and EC shortened and decreased. In chronic poisoning, the amplitude of O oscillations increased with a tendency of rise. EC was characterized by breaks, shortening, high start and level. The data of the compressive-tonometric test pointed to the prevalence of neurovascular elements in a disorder of O. In a number of animals, the described disturbances of O and EC regulation were preserved for 3 to 4 mo after the termination of poisoning. (From Referat. Zhur. Biol. 97976, 1958, transl. OTS-JPRS; Biological Abstracts 35:Abstr. No. 41481, 1960)

- 755 Smusin, Ya.S. (1st Med. Inst., Leningrad, USSR): Deistvie nekotorykh veshchestv na aktivnost kholinesterazy mozga i myshts. Gistokhimicheskoe opredelenie istinnoi i lozhnoi kholinesteraz v thanyakh myshei pri otravlenii tetraetilsvintsom. (THE EFFECT OF SEVERAL SUBSTANCES ON CHOLINESTERASE ACTIVITY OF THE BRAIN AND MUSCLE. HISTOCHEMICAL DETERMINATION OF TRUE AND PSEUDO CHOLINESTERASE IN THE TISSUES OF MICE IN TETRAETHYLLEAD POISONING.) Trudy Pervogo Leningradskogo Meditsinskogo Instituta. Fiziologicheskaya Rol Atsetil-kholina i Izyskanie Novykh Lekarstvennykh Veshchestv 1957:143-8.

The experiments were performed with white mice poisoned sc with 1.07 g TEL/kg body weight; this dose produced death in 50% of the mice within 1 day. The mice (45) were sacrificed by decapitation at hours 1, 2, 4, 8, 12 and 24 after administration. Acetylthiocholine was used for localization of the true cholinesterase (ChE) and butyrylthiocholine for the pseudo. The results showed a sharp depression of the true ChE in the outer portion of the main brain, the elongated brain, and in the tissue of the calf muscle, with about the same degree of intensity. This effect appeared to a lesser extent in the case of the pseudo ChE. Depression of the true ChE appeared already after 1 hr and reached a maximum 4-8 hr after poisoning. A preliminary workup with acetone in the cold did not influence significantly the degree of detection. This indirectly indicated the ability of TEL to penetrate easily into all the tissue structures, including the lipids.

- 756 Teuchmann, J.K. (Central Inst. Ind. Hyg., Warsaw, Poland): Wplyw zatrucia ołowiem na odruchy rdzeniowe i nerw błędny. (EFFECT OF LEAD POISONING ON MEDULLARY REFLEXES AND ON THE VAGUS NERVE.) Acta Physiologica Polonica 8, 3-3a:545-8, 1957.

The spinal reflexes were investigated on decapitated cats. Pb in 0.62 mg/100 ml concentration gave a decrease of the limb reflexes and at 5 mg/100 ml lowering of the blood pressure. At 83 mg/100 ml disturbance of spinal reflexes was noted. Pb inhibited vagal conduction in a concentration of 24 mg/100 ml. (Excerpta Med. Sect. II, 11:4475, 1958).

- 757 Teuchmann, J.K.: (INFLUENCE OF LEAD POISONING ON THE REFLEX ACTIONS OF DECAPITATED CATS.) Prace Central Inst. Ochrony Pracy 7, No. 2(21):3-10, 1957.

Decapitated cats were given intravenously 1% aqueous Pb(NO<sub>3</sub>)<sub>2</sub> solution, and the reflexes excited by electric shocks were examined. Reflexes were inhibited at 0.62 mg% concentration of Pb, blood pressure began to drop at 5 mg%; large sublethal concentrations (up to 100 mg%) caused transient paradoxical stimulation, a functional dissociation of spinal nerves, and a complete paralysis of the whole neuron. (From Chemical Abstracts 52:20682, 1958)

- 758 Todd, J.R.: NOTES ON THE USE OF CALCIUM VERSENATE IN ACUTE LEAD POISONING. Veterinary Record 69:31-2, 1957.

"Calcium versenate" (NaCa edetate) was used in 2 calves, a bullock, a heifer and a donkey. Symptoms included blindness, nervousness, tongue paralysis, muscle twitching and depression. Diagnosis was confirmed chemically in all cases. Ca versenate diluted in saline was given intravenously in single total doses varying from 3-6 g depending on size of animal. Oral Mg sulfate was not given. All the animals recovered except 1 calf which died shortly after treatment. General recovery occurred in a matter of hours although some tongue paralysis persisted over 3 days and blindness up to 10 days. The author points out that the efficiency of this treatment is probably

related to the total amount of Pb absorbed and stored in the body, and that therefore a 2nd treatment may sometimes be necessary. (From Veterinary Bulletin 27, No. 6:1879, 1957)

- 759 Tönz, O. (Cantonal Hosp., St. Gallen, Switzerland): Nierenveränderungen bei experimenteller chronischer Bleivergiftung (Ratten). (KIDNEY CHANGES IN EXPERIMENTAL CHRONIC LEAD POISONING IN RATS.) Zeitschrift für die Gesamte Experimentelle Medizin 128, No. 4:361-77, 1957.

Rats (270) injected (route not stated) with 340-440 mg Pb as phosphate for 4-9 1/2 mo, survived up to 7 mo. The kidneys gained in size and weight, cysts formed and in 2 cases there was a light hydronephrosis. The glomeruli were unchanged while the tubular system showed significant alterations, such as enlarged epithelial cells, proliferations of the center sections with occasional adenoma and carcinoma and metastases (2 rats), slight lymphocytic infiltrations and mild fibrosis of the interstitium. The author found the picture to agree with that in Pb-poisoned children while in adults vascular changes prevail over those of the tubular system. The specific effect of Pb is based on a disturbance of the cellular and nuclear metabolism, leading first to enlargement of the cells and nuclei, cellular atypia and nuclear polymorphy, and later to pathologic mitoses, proliferations and tumor formation. The cancerogenic effect of Pb resembles that of X rays. (56 references)

- 760 Tolgskaja, M.S. (Inst. Ind. Hyg. Occup. Dis., Acad. Med. Sci., Moscow, USSR): Veränderungen in den interneuronalen Verbindungen der Grosshirnrinde unter der Einwirkung von einigen Industriegiften. (CHANGES PRODUCED IN THE INTERNEURONAL JUNCTIONS IN THE CEREBRAL CORTEX BY SOME INDUSTRIAL POISONS.) Archiv für Gewerbe-pathologie und Gewerbehygiene 16, No. 1: 34-44, 1957.

Eleven white rats were given oral doses of 0.008-0.04 g/kg Pb acetate or sc injections of 0.0004-0.0012 g/kg As or 0.3-0.5 g/kg aniline. The animals were observed for 60 days and then killed. Early changes of the cerebral cortex consisted of the formation of irregular spherical thickenings or swellings of the dendrites and a decrease in the number of the thorny projections which are seen in normal rats. The changes were reversible. When 11 other rats were given orally or sc increasing doses of Pb, As or aniline for 1-5 mo more severe alterations of the dendrites were noted. Subcutaneous administration of 0.03 g/kg Pb acetate, 6.0 g/kg aniline or 0.0012 g/kg Na arsenate caused death in 7-12 days. The damage to the cerebral cortex was still more intense than in chronic poisoning. Details are described and illustrated in 9 figures. (25 references)

- 761 Tolgskaya, M.S.: Morfologicheskie izmeneniya v mezhneironnykh svyazyakh kory bol'shikh polusharii golovnogo mozga pri nekotorykh professional'nykh neirotoksikatsiyakh. (MORPHOLOGIC CHANGES IN THE INTERNEURONAL JUNCTIONS OF THE CORTEX OF THE LARGE HEMISPHERES OF THE BRAIN IN SOME OC-

CUPATIONAL NEUROTOXICATIONS.) In Trudy Yubileinoi Nauchnoi Sessii Posvyashchennoi 30-Letnei Deyatel'nosti Instituta 1924-1954. Leningrad, Ministerstvo Zdravookhraneniya RSFSR, Institut Gigieny Truda i Profzabolevaniy, 1957, pp. 435-41.

Comparative experiments were carried out by the administration to white rats, of very small doses of Pb acetate, aniline or As and in acute intoxication by the same substances. It was observed that the morphologic changes in the interneuronal junctions are first reversible and disappear when intoxication is discontinued; therefore, they appear to be functional. With continued intoxication, these changes progress to the point that irreversible changes appear leading to destruction of all neurons.

- 762 Ungher, I., Lillis, M., Moscovici, B., and Pompilian, V.: Cercetari experimentale asupra unor reactii compensatoare in intoxicatia cu plumb. (EXPERIMENTS ON COMPENSATION REACTIONS IN LEAD POISONING.) Igiena 6:115, 1957.

After producing a dynamic stereotype in 2 dogs the animals were given repeated parenteral injections of 2 mg Pb acetate/kg body weight. One of the dogs was a strong type, the other one was a nervous animal. By testing the nervous activity the cyclic course of the manifestations was studied. The manifestations were characterized by a prolongation of the latent period after positive stimuli, elimination of the inhibitions of differentiation, followed by improvement until a normal state was reached. The results explain the compensatory role of the cerebral cortex in Pb poisoning. (From Zentralblatt für Arbeitsmedizin und Arbeitsschutz 7, No. 10:258 (Abstracts), 1957)

- 763 Ungher, J., Nestiano, and Lillis, M. (Neurol. Inst. "I.P. Pavlov," Acad. Rep. Pop. Romania): Recherche sperimentali sul saturnismo cronico. (EXPERIMENTAL STUDIES ON CHRONIC LEAD POISONING.) Minerva Medica 48, No. 31:1361-4, 1957.

To determine whether adaptation to Pb poisoning occurs, dogs were prepared by weekly iv injection of 2 mg Pb acetate and the effect on conditioned reflexes was followed by the method of Kupalov. After the 3rd injection, a dog with a strong nervous system by Pavlov's classification showed difficulty in distinguishing between different stimuli and an increased latent period in response to stimuli. This increased to the 7th injection, then decreased until the dog appeared normal after the 13th with respect to conditioned reflex, but agitation and dietary crisis forced suspension of treatment. A dog with a weak nervous system showed increasing latent period and difficulty in distinguishing between stimuli after the 1st injection, with convulsive crises after the 4th and did not survive beyond the 10th. EEG study showed between the 2nd and 3rd injections a 1st phase characterized by slow waves (theta and delta), regular with rapid rhythm, and diminution of the amplitude of the biocurrent of 25-75 µv. A 2nd was characterized by inhibitory processes and very regular, rapid waves (2-5 wk). The 3rd phase, lasting 3-4 wk, showed rapid regular rhythm with

slow waves and spikes. The 4th and final phase showed irregular delta waves, and no effect from stimulation by light. These experiments show that adaptation to Pb poisoning occurs, but on continued exposure, the various compensatory mechanisms are damaged, and more intense nervous activity results leading to death.

- 764 Vallejo-Freire, A., and Brunner, A., Jr. (Butantan Inst., São Paulo, Brazil): Eritrocitos na reticulocitose do saturnismo experimental. Estrutura mitocondrial. (ERYTHROCYTES IN RETICULOCYTOSIS OF EXPERIMENTAL SATURNISM. MITOCHONDRIAL STRUCTURE.) Memórias do Instituto Butantan (São Paulo) 28:245-65, 1957-58.

Erythrocytes of guinea pigs, poisoned with sc injections of 1 ml of a 1% aqueous solution of Pb acetate/day for 3-9 days, were examined by electron microscope. The identity of the so-called "substantia granulo-filamentosa" with mitochondria in the reticulocytes was confirmed. The increase of volume or tumefaction of mitochondria was found to be on an average 3 times greater than that observed in reticulocytes in hemorrhagic anemia. Similar changes were obtained by means of osmotic variations in vitro in reticulocytes from guinea pigs with reticulocytosis provoked by successive bleedings. In some reticulocytes the progressive disintegration of the mitochondrial structure could be observed beginning with the loss of the external membrane followed by successive dissolution of the other constituents of the mitochondria. The authors interpret this to represent the natural mechanism of the disintegration of mitochondria in erythrocytes from the stage of the erythroblast to the adult red cell. (16 references)

- 765 Velling, E.I., and Piskunova, V.V.: (THE DISTRIBUTION OF TETRAETHYL LEAD IN THE ORGANS OF ANIMALS.) Materialy po Voprosam Prom. Toksikol. i Klin. Professional. Boleznei (Gorky) 1957:27-35.

Rabbits were injected subcutaneously with 0.1 ml/kg of TEL. TEL became deposited in the organs as organic Pb, most of it having become deposited in the brain tissue: the Pb content in the cerebral hemispheres was 2.9 mg% and in the medulla oblongata 2.8 mg%. The liver contained 0.91 mg%, the heart muscles 0.87 mg%, and the lungs 0.61 mg%. Most of the blood Pb was deposited in the formed elements. (From Referat. Zhur. Khim., Biol. Khim. 1959, Abstr. No. 12052; Chemical Abstracts 53:20543, 1959)

- 766 Velling, E.I., and Preobrazhenskaya, A.A.: (THE EFFECT OF TETRAETHYL LEAD ON THE ACTIVITY OF ENZYME SYSTEMS.) Materialy po Voprosam Prom. Toksikol. i Klin. Professional. Boleznei (Gorky) 1957:36-44.

Rabbits were injected subcutaneously with 0.05-0.1 mg/kg of TEL. The activity of blood carboxylase and cholinesterase was depressed. One-3 hr later the concentration of blood acetylcholine (ACh) increased to a maximum of 0.13-0.15 mg% on the 3rd-5th day of intoxication; it then abated some, but on the 20-40th day rose again; however, at the end of the 3rd mo only traces of ACh could be found.

All organs of the TEL injected animals showed the presence of increased ACh. It reached 29.9 mg% in the tissue of the medulla oblongata as against 8.4 mg% in the control and 5.5 mg% in the cerebral tissue as against 1.33 mg% in the control. The content of ACh showed no detectable change in the spinal cord. ACh accumulated to 8 times its normal amount in the liver and heart muscles; it appeared to be reduced in the tissue of the adrenals. (From Referat. Zhur. Khim., Biol. Khim. 1959, Abstr. No. 12053; Chemical Abstracts 53:20543, 1959)

- 767 Vincent, J. with the assistance of Nguete, M. (Leopoldville, Belgian Congo): Les remaniements de l'os compact marqué à l'aide de plomb. (CHANGES OF COMPACT BONE LABELED WITH LEAD.) Revue Belge de Pathologie et de Médecine Expérimentale 26, No. 3:161-8, 1957.

In order to determine whether Pb introduced into the organism is distributed according to the same plan as radio-Ca 7 adult dogs and a 3-mo-old cat were given, for 1 wk, a 4% solution of basic Pb acetate mixed into their ration so that each animal received 50 mg acetate/day/kg body weight. After 1 wk intermission 3 of the dogs were given the same dose again for another week. A 2nd cat of the same age was intoxicated with the same daily dose for 7 consecutive weeks. An additional dog and cat served as controls. The long bones of the animals were studied histochemically and micro-radiographically from 1 day to 3 mo after the end of the experiment. Pb seemed to behave exactly like radio-Ca. It was deposited mainly in the recently formed osseous lamellae and to a lesser degree in the older bone tissue which was not yet saturated with Ca.

It is suggested that Pb may be used in determining the rate of osteogenesis: a deposit occurs in ~6 wk and calcification is complete after 3.5 mo. The thickness of a pre-osseous layer is ~10  $\mu$ /wk. The use of Pb for the study of the Haversian change is compared with that of radio-Ca and radio-S. Pb is in fact a convenient instrument for the study of changes in bone tissue and it confirms the results obtained from autoradiography. (25 references)

- 768 Von Backström, U.: SOME UNUSUAL CASES. ATYPICAL LEAD POISONING--BULL. SPECIFIC THERAPY WITH CALCIUM DISODIUM VERSEDATE. Journal of the South African Veterinary Medical Association 28:213-5, 1957.

A bull stopped eating and developed lacrimation, salivation, severe colic, bronchitis, paralysis of the bladder and weakness of the hindquarters. Rapid recovery followed single intravenous injection of a solution containing 24 g calcium disodium edetate. Pb was identified in the feces. It was believed to have been ingested from a pool of rainwater in the exercise pen which had drained off painted roofs. (From Veterinary Bulletin 28, No. 9:3000, 1958)

- 769 Wada, N.: STUDIES ON THE INDUSTRIAL LEAD POISONING. I. ABSORPTION, TRANSPORTATION, DEPOSITION AND EXCRETION OF LEAD. 4. AN EXPERIMENTAL STUDY OF LEAD INTAKE IN DOGS.



Osaka City Medical Journal 4:113-33 (June), 1957. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 1, April 1949-March 1959, pp. 159-79.

Two female dogs were fed 2.73 mg Pb/kg (as solution of Pb acetate) for 61 and 99 days respectively; a 3rd dog served as control. The experimental dogs lost 20% of their weight. Variations in the count of reticulocytes and punctate basophils indicated that the degree of Pb poisoning could not be assessed by the counting of abnormal erythrocytes; the increase of coproporphyrin constituted a more reliable test of Pb absorption. Fecal and urinary Pb excretion, accounting for some 90% of Pb ingested, rose sharply within 24 hr and then remained fairly steady. The remaining 10% Pb was stored mainly in the teeth and bones, other organs contained small quantities, liver, kidney, spleen, and lungs had the highest content. Other organs examined for the Pb content were: pancreas, stomach, intestine, trachea, brain, heart, bile, blood. (63 references)

- 770 Wassermann, M., Mihail, G.B., and Cojocaru, V. (Romania): Recherches hématologiques dans l'intoxication saturnine expérimentale des animaux homéothermes, à l'aide du microscope à contraste de phases. (HEMATOLOGIC STUDIES IN EXPERIMENTAL LEAD POISONING OF HOMOTHERMIC ANIMALS USING THE PHASE-CONTRAST MICROSCOPE.) In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 185-9.

See Abstract No. 824

- 771 Westermarck, H.: Lyijymyrkytysten hoito kalsiumi-EDTA eli kalsiumiverzenaattilla ja BAL eli dimerkaptopropanolilla. (CALCIUM-EDTA AND BAL (DIMERCAPROL) IN THE TREATMENT OF LEAD POISONING.) Finska Vet. Tidsskr. 63:417-22, 1957.

Pb poisoning in cattle has occurred when the drinking water contained 0.15 ppm Pb; in the blood 0.128 mg/1000 ml is found in cases of Pb poisoning. Pb oxide is the main cause of this poisoning in Finland. BAL has been given, 4-6 mg/kg; but EDTA is preferred, in doses of 1-2 g/100 kg, repeated 2-3 times with 2-3 day intervals. The intravenous injection must be given slowly, otherwise shock occurs. Sheep were killed with 0.4-0.5 g/kg of Na edetate. (From Veterinary Bulletin 28, No. 5: 1562, 1958)

1958

- 772 Afonova, V.N. (Pavlov Med. Inst., Ryazan, USSR): Izmenenie nekotorykh reaktivnykh grupp syvorotochnykh belkov pri khronicheskoi svintsovoi intoksikatsii. (CHANGES IN SOME REACTIVE GROUPS OF SERUM PROTEINS IN CHRONIC LEAD POISONING.) Farmakologiya i Toksikologiya 21:64-9 (Nov.-Dec.), 1958. In tests lasting 53-189 days, 14 rabbits were given orally Pb acetate (aqueous solution) in doses starting at 10 mg/kg and increasing every 2 wk by 10 mg/kg to a maximum of 80 mg/kg; 8 rabbits

served as controls. The animals were killed after manifest poisoning had been established. The serum proteins were examined every week. Sulfhydryl groups (SH) were determined by Anson's iodometric method; the amine groups, colorimetrically; the carboxyl, by formol titration (Zerensen).

Analysis showed active amine groups to decrease by 16.3-42.6%, av 30%; active SH groups by 14.3-42.9%, av 27.7%; active carboxyl groups by 11.6-43.8%, av 29.3%. The author concludes that in chronic Pb poisoning, one of the causes for the decrease in the above protein groups is a blocking action by Pb. She does not, however, exclude the possibility that certain biochemical and physiologic processes occurring in prolonged poisoning depress the synthesis of proteins containing the free reactive groups.

- 773 Agresti, A., Biondi, S., and Catellani, G.: Di un raro caso di saturnismo del cane sovrapponibile a quello professionale dell'uomo. (LEAD POISONING IN A DOG.) Acta Med. Vet., Napoli 4:169-92, 1958. An account of chronic Pb poisoning in a dog which had been a watch dog in a printer's workshop for 7 yr is given. The findings were in general similar to those of the condition in man. (From Veterinary Bulletin 29:1548 (May), 1959)

- 774 Baier, H. (Med. Clin. Inst. Ferdinand-Sauerbruch, Wuppertal-Elberfeld, Germany): Über die Wirkung von Blei auf die Fermentsynthese in vivo. (EFFECTS OF LEAD ON ENZYME SYNTHESIS IN VIVO.) Klinische Wochenschrift 36:970-2, 1958.

Rats were given  $Pb(NO_3)_2$  in their drinking water at an approximate level of 50 mg/day. When toxic symptoms were noted, the livers were analyzed for arginase activity. Values were 50% less than those in untreated animals. In vitro,  $10^{-3}M$  Pb resulted in 60-70% inhibition of the arginase activity of human red cell hemolyzates.

- 775 Baikie, A.G., and Pirrie, R. (Roy. Infirmary, Glasgow, Scotland): THE EFFECTS OF ACTH AND CORTISONE IN EXPERIMENTAL HAEMOLYTIC ANAEMIAS IN GUINEA PIGS; STUDIES ON ANAEMIAS DUE TO HETEROLOGOUS ANTIRED-CELL-SERUM AND ON THE ANAEMIS OF CHRONIC LEAD POISONING. Scottish Medical Journal 3, No. 6:264-73, 1958.

Anemia of chronic Pb poisoning was induced in 18 adult male guinea pigs by pipetting into the mouth of each animal a daily dose of 50-300 mg Pb nitrate in solution. On the 48th day when hypochromic anemia had developed, they were paired and 1 of each pair was given a daily intramuscular (im) dose of 20 mg corticotrophin (ACTH) for 15 days. The reticulocyte and stipple-cell count in the treated animals rose to about twice that of the controls by the 10th day of treatment with ACTH and declined slowly when ACTH was stopped, reaching normal values about 16 days after its discontinuance. No concomitant rise in hemoglobin (Hb) or red cell levels was noted. Fecal excretion of urobilinogen between the 54th and 65th day of poisoning was 0.46 mg/day in treated animals and 0.53 mg/day in controls. When 3 Pb-poisoned guinea pigs were given 12 mg cortisone ace-

tate im twice/day for 28 days, mean Hb value and red cell values in test and control animals did not differ whereas the mean reticulocyte count from the 4th-20th day of cortisone treatment was twice as high in experimental as in control animals. Three guinea pigs injected each with 0.2 ml of a potent liver extract between the 70th and 85th day of Pb poisoning showed no alteration in reticulocyte counts. Administration of a gelatin and propylene-glycol vehicle with or without 20 mg ACTH/day to 12 Pb-poisoned animals for 16 days, while Pb doses were stopped from the 2nd-9th day, produced a reticulocytosis similar in trend and magnitude in both groups. The discontinuance of Pb doses caused a striking fall in reticulocyte levels within 3 days which was followed by an equally striking rise 4 days after Pb was recommenced. In splenectomized Pb poisoned guinea pigs ACTH administration was not associated with any consistent change in reticulocyte and stipple cell counts. In normal (not Pb poisoned) guinea pigs ACTH produced a 2-3-fold increase of reticulocytes compared with non-ACTH-treated animals, without marked difference in fecal urobilinogen excretion. This led to the conclusion that this increase in reticulocyte count does not indicate a proportionate increase in erythropoiesis. Similar results were obtained after administration of gelatin and propylene-glycol vehicle with or without ACTH. The direct Coombs action was not applied in any of the experiments. It was concluded that ACTH and cortisone had no beneficial effect on anemias of chronic Pb poisoning. (30 references)

- 776 Bénard, H., Gajdos, A., and Gajdos-Török, M. (Natl. Inst. Health, France): Biogénèse de l'hémoglobine par le sang périphérique du lapin; action du plomb, du fluorure de sodium et de l'oxyde de carbone. (SYNTHESIS OF HEMOGLOBIN BY THE PERIPHERAL BLOOD OF RABBITS; EFFECT OF LEAD, SODIUM FLUORIDE AND CARBON MONOXIDE.) *Exposés Annuels de Biochimie Médicale* 1958, No. 20:41-54.  
See Gajdos, A., and Gajdos-Török, M.

- 777 Borbély, F. (Univ. Zurich, Switzerland): (TOXIC PROPERTIES OF LEAD ARSENATE.) *Schweiz. Z. Obst- u. Weinbau* 67:333-5, 1958.  
Toxicity of Pb arsenates to warm-blooded animals is discussed. (From Chemical Abstracts 54:14455, 1960)

- 778 Bunyan, J., Edwin, E.E., and Green, J., (Walton Oaks Exptl. Sta., Tadworth, Surrey, England): PROTECTIVE EFFECT OF TRACE ELEMENTS OTHER THAN SELENIUM AGAINST DIETARY NECROTIC LIVER DEGENERATION. *Nature* 181: 1801 (June 28), 1958.

Rats were fed necrogenic diets containing trace elements at levels below their toxicity (where they were known); Pb (alone, fed as Pb acetate at 0.5 ppm to 10 rats) and Ce, Hg, Ti, and V (together) were inactive. Mo, Os, and Co (together and separately) delayed deaths by necrosis beyond 130 days in 3 out of 7. Se, cystine, and  $\alpha$ -tocopherol prevented necrosis. Of the Pb rats, only 1 survived 88 days, and died on the 89th day.

- 779 Caccuri, S., Pecora, L., Fati, S., and

Vecchione, C. (Inst. Ind. Med. Univ. Naples, Italy): Recherches sur la porphyrinogénèse dans le saturnisme. (STUDIES CONCERNING PORPHYRINOGENESIS IN LEAD POISONING.) *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 19:341-6 (July-Aug.), 1958.

Young rabbits were made anemic by bleeding them for 3 days. On the 4th day, a suspension of red blood corpuscles from blood taken from their ear vein was prepared and reacted at 37° for 6 hr with a homogenate obtained from fresh tissue of different organs of these animals, in the presence of glycocoll. Synthesis of protoporphyrin (PP) in this system was slightly inhibited compared with a control system of red blood corpuscles and glycocoll. In another test, rabbits were fed daily 4 ml of a 20% solution of Pb acetate for 5 days and sacrificed on the 6th day. Addition of a homogenate of tissues from these Pb-poisoned rabbits markedly stimulated the synthesis of free PP in the system of red cells-glycocoll. The greatest activation was observed with lung tissue where the synthesized amount of free PP was more than double of that in the control tests. Liver, bone marrow and spleen, in this order, were the next active stimulants. Homogenates of tissues from Pb-poisoned rabbits also promoted the synthesis of erythrocytic coproporphyrin in the above system. The stimulating action of Pb on the synthesis of porphyrin in the organism was thus directly proved. (28 references)

- 780 Calapso, P., and Maiorca, G. (Inst. Sci. Information, Milan, Italy): Glomerulojalinosi da piombo; ricerche sperimentali. (GLOMERULAR HYALINOSIS OF LEAD; EXPERIMENTAL STUDIES.) *Biologica Latina* 11, No. 3:445-56, 1958.

A group of 30 albino rats of both sexes (180 g weight) were injected sc 10 mg Pb acetate/day for 9 mo. Mortality was 20% in the 1st 3 mo and 30% from 4th-7th mo. The histochemical studies were made only on those that survived from 7-9 mo. The findings indicated that prolonged treatment with Pb causes glomerular hyalinosis. A primary alteration of the glycoproteins in the glomerular mesangium followed by mucosclerosis was assumed. This change of the mesangium limits the activity of the glomerular endothelium which favors the accumulation of plasma proteins in the capillary loops. The absence of vascular lesions which in man are characteristic for Pb-induced atrophy of the kidney, may be due to too short an experimental period or to peculiarities of the test animals towards Pb. (36 references)

- 781 Di Maggio, G. (Univ. Catania, Italy): Fattori vitaminici P ed attività epatica. (VITAMIN P FACTORS AND HEPATIC ACTIVITY.) *Minerva Medica* 1958:1701-14.

In this discussion and review of the effect of 4-methylesculetin (ME) and quercetin in protein, lipid and carbohydrate metabolism, graphs are shown of the efficacy of ME in lowering free, esterified and total cholesterol in the liver of rats subjected to subchronic Pb poisoning. Neutral fats and total lipids were also reduced (Di Maggio, in press). (107 references)

Fabre, R., Truhaut, R., Girault, M. (Pharmacy Coll. Paris, France): Utilisation de l'embryon de poulet en toxicologie expérimentale. Application à l'étude des effets toxiques du plomb. (CHICKEN EMBRYO IN EXPERIMENTAL TOXICOLOGY. APPLICATION TO THE STUDY OF LEAD.) Annales Pharmaceutiques Françaises 16:545-57 (Sept.-Oct.), 1958.

The technique of injecting substances to be tested in the fertilized egg and incubation precautions are described. Neutral Pb acetate was injected in doses of 200-4000 µg/egg at various periods of incubation. At a dose of 1000 µg injected on the 5th day, development of the embryo was rather good, but there was 50% mortality and brain injury which could be observed macroscopically and microscopically. The severity of lesions was not in proportion to the dose employed. Injections on the 10th day had the same effect as injection made on the 5th day. Large doses (4000 µg Pb/egg) given on the 10th day occasionally caused only a minimum inhibition of growth. In 2 eggs that received 2000 µg each, 1015 and 990 µg Pb were found in the embryo, 860 and 900 in the vitellin sac, and 90 and 110 in the shell.

Fusco, M., Fati, S., and Vecchione, C. (Univ. Naples, Italy): Il comportamento del ferro nei tessuti nell'intossicazione sperimentale da piombo. (BEHAVIOR OF TISSUE IRON IN EXPERIMENTAL LEAD POISONING.) Bolletino della Società Italiana di Biologia Sperimentale 34, No. 8:382-5, 1958.

Eight rabbits were intoxicated by a daily oral dose of 0.20 g Pb acetate and sacrificed after ~20 days. The Pb and Fe contents were determined in the lungs, liver, brachial and sciatic plexus and bone marrow and compared with those in 8 control animals. In a group of 4 Pb-intoxicated rabbits the Pb and Fe content in blood, urinary Pb, protoporphyrin and coproporphyrin were determined besides the Pb and Fe contents in the above mentioned tissues. Two rabbits were intoxicated with daily doses of 0.10 g Pb acetate for ~1 mo and lungs, liver, brachial and sciatic plexus and bone marrow were analyzed for Pb and Fe. All experimental results pointed to the fact that Pb poisoning causes a decrease of Fe in the tissues. The reaction of catalase, peroxidase, myoglobin was not studied.

Gajdos, A. and Gajdos-Török, M. (Hotel Dieu, Paris, France): Modifications du taux de la protoporphyrine libre et de l'activité catalasique dans les globules rouges du lapin intoxiqué par le plomb ou par la phénylhydrazine. (CHANGES IN FREE PROTOPORPHYRIN LEVELS AND CATALASE ACTIVITY IN ERYTHROCYTES OF RABBITS POISONED WITH LEAD OR PHENYLHYDRAZINE.) Sang, Biologie et Pathologie 29, No. 1:27-33, 1958.

Six adult rabbits were injected im with 250 mg Pb acetate/kg body weight every 3 days for 6 wk. The catalase activity of the red blood cells was determined at regular intervals in the above rabbits and in 17 controls. Activity in the controls varied from 2500-4150 units/ml red blood cells, but

was practically constant for each individual animal. The Pb-poisoned rabbits exhibited a significant progressive increase of catalase activity, red-cell protoporphyrin (PP) and urinary CP. In order to compare the rate of globular PP and erythrocyte catalase activity, 6 rabbits were injected sc with 50 mg phenylhydrazine chlorhydrate/kg every 5 days. Determinations made every 2 wk showed a development of excessive amounts of globular hyper-PP parallel to the degree of phenylhydrazinic catalase activity. The mechanism of the increased catalase activity is discussed. (13 references)

Gajdos, A., and Gajdos-Török, M. (Natl. Inst. Hyg., France): Anémie hypochrome, hypersidérémique expérimentale par intoxication saturnine, fluorée ou oxycarbonée du lapin. Mécanisme pathogénique. (EXPERIMENTAL HYPOCHROMIC HYPERSIDEREMIC ANEMIA IN THE RABBIT IN LEAD, FLUORIDE, OR CARBON MONOXIDE POISONING. PATHOGENETIC MECHANISM.) Sang, Biologie et Pathologie 29, No. 6:444-60, 1958.

Two experimental methods were used as follows: Rabbit blood was incubated, in the presence and absence of the toxic substances (Pb acetate, NaF and CO), with glycoll marked with <sup>14</sup>C or with <sup>59</sup>Fe. The rabbits had been intoxicated by phenylhydrazine prior to the experiment. In vitro, the addition of Pb (30 mg) to the blood of these rabbits, incubated with <sup>59</sup>Fe, caused almost complete inhibition of heme synthesis. In the 2nd experiment, rabbits were rendered anemic by giving the toxic test substances. In the case of Pb, the anemia was produced by giving 100 mg of Pb (as subacetate)/kg by gastric tube several times every 5 days. NaF was given by the same route every 2 days at a dose of 60 mg/kg. For CO anemia, the animals were kept for 2-3 hr/day in a metal cage which was hermetically sealed but conveyed O and CO by 2 rubber tubes. When a distinct hypersideremic anemia was achieved with 20% reticulocytosis, the rabbits were bled and the blood (25 ml) was incubated with labeled glycoll and in 1 sample with 150 mg NaF (known to cause large increases in free erythrocyte protoporphyrin). After incubation for 4 hr at 37°, free erythrocyte protoporphyrin (PP), Hb-PP or heme were isolated and radioactivity was measured. The results showed that the blood was practically incapable of synthesizing heme; Hb-PP was practically nil. In the experiment where NaF was used alone, there was no accumulation of PP; in the phenylhydrazine-anemic blood, after addition of NaF, the content of PP rose from 1400 µg/100 ml red cells to an av 6300 µg. In the Pb-poisoned blood, PP content remained practically the same in the presence or absence of NaF (430 and 500 µg). When the blood of the Pb rabbits was incubated with <sup>59</sup>Fe, it was evident that the absence of heme synthesis was due to a lack of Fe incorporation. Both in this case and in the phenylhydrazine-poisoned rabbits the percentage of reticulocytes was about the same.

The authors summarize their experiments as follows: In rabbits poisoned with Pb, NaF and CO, a hypochromic and hypersideremic anemia was observed. These characteristics of the anemia can be explained by the inhibition of the combination of Fe with

PP. Hb synthesis thus inhibited causes a decrease in the globular level and Fe accumulates causing hypersideremia. There is also an increase in the free PP level in the red cells. PP, the synthesis of which is maintained, accumulates due to the small utilization in the hematopoiesis. The inhibition of heme synthesis seems to be the factor responsible for the coexistence of hypochromia and hypersideremia. (24 references)

- 786** Gentile, G. (Univ. Messina, Italy): *Ricerche sperimentali sull'intossicazione saturnina: Risultati finora ottenuti e piano di nuove ricerche.* (EXPERIMENTAL STUDIES ON LEAD POISONING: RESULTS OBTAINED AND PLANS FOR NEW RESEARCH.) *Folia Medica* (Naples) 41:902-10 (Sept.), 1958.

After a brief review of the occupations in which workers are most exposed to the hazards of Pb poisoning, the author reviews the various efforts made since 1910 (by Simon) to obtain a compound which, when administered to a Pb poisoned person, is capable of forming an insoluble Pb compound by binding the Pb cation. Although at present various antidotes are available, including the most modern Na pyrocatecholdisulfonate, BAL, and EDTA, the search is far from finished and many points need resolution. The author has been engaged in such research, which he intends to publish in the future. (19 references)

- 787** Grezaffi, A.J. (Texas A. and M. Coll., College Station): *AN ACUTE CASE OF LEAD POISONING IN A COW.* *Southwestern Vet.* 11:140, 1958.

Poisoning in a cow by accidental ingestion of Pb arsenate powder could not be counteracted with CaEDTA, Na thiosulfate, DCM (composition not given), or Havidote (composition not given). (From Chemical Abstracts 52:18867, 1958)

- 788** Grishchenko, E.D., and Nikitenko, V.V. (Inst. Hyg Occup. Dis., USSR): *A STUDY OF CERTAIN INDICES, BIOCHEMICAL AND OTHERWISE, IN ACUTE EXPERIMENTAL LEAD POISONING.* *Pharmacology and Toxicology* 21, No. 1:88, 1958. Translation of *Farmakologiya i Toksikologiya* 21, No. 1:81, 1958.

Acute Pb poisoning was induced by injecting 1.4 ml of a 1% Pb acetate solution (9 mg Pb) ip into rats weighing 192-291 g (av 224 g). One-1.5 hr after the Pb was injected, the animals were given by mouth 1 ml of a solution of <sup>35</sup>S methionine, in a dose of 10 µCi/rat. The control and experimental rats were killed after 1, 2, 3, 4, and 8 days. The poisoning did not greatly change the distribution of the <sup>35</sup>S methionine in the organs. It was significantly absent only in the muscle tissue and the myosin B of the muscles and heart. However, there was no noticeable change in the myosin B content during the 8-day period after the poisoning. After the 1st day, the viscosimetric activity decreased noticeably. The heart action was accelerated, but returned to normal on the 2nd day, while in the muscles, the process of neutralizing the harmful effect of Pb was much retarded, and the viscosimetric activity was just as low on the 8th day as on the 1st day. A weight loss was observed on the 2nd day, reaching 10% on the 4th

day. In acute poisoning, the weight loss seems to primarily occur in the muscle and fat tissues, since the other organs were found to be their normal size or even larger during the period of maximal weight loss. Some tendency of the dry matter content of the organs to decrease was observed in the poisoned rats.

Some of the symptoms of acute poisoning are similar to those appearing in the 1st stage of chronic poisoning. Some of these symptoms are more pronounced in acute poisoning (eg, the decrease in the viscosimetric activity of actomyosin), while others are not as pronounced. (From authors' abstract)

- 789** Harashima, S., Tsuchiya, K., Kondo, H., Motouchi, M., Sakaguchi, T., and Mori, A. (Keio Univ., Tokyo, Japan): *THERAPY AND PREVENTION OF LEAD POISONING WITH CALCIUM VERSENATE.* *Keio Journal of Medicine* 7:93-105 (Nov.), 1958.

The study was divided into 3 parts. (1) Dogs were injected sc with 3 mg Pb/kg body weight (as Pb acetate) 3 times/wk for 3 wk; on the days when Pb was not administered, 2.5 ml of 20% CaEDTA in glucose solution was given by iv drip for 1 hr; controls were given glucose only. Hemoglobin, red and white cells, basophilic stippled cells and reticulocytes were determined in experimental and control dogs. In these dogs, CaEDTA was very useful in preventing the onset of poisoning as well as in recovery from poisoning symptoms. Liver function as determined by A/G ratio of serum and total protein showed both criteria to be decreased in the control, but returned to nearly normal in the treated dog. No significant difference was seen in protein fractions, although γ-globulin was raised gradually in both dogs. In the experimental dogs, Pb distribution differed from that of the control, ie, on 36th day of experiment, in poisoned animals Pb content of plasma increased to 60 and in red cells to 100 µg/100 ml; controls: Pb in plasma 25 and red cells 40 µg/100 ml. Pb in urine was: experimental dog: 0.01 and 0.48 mg, throughout the experiment; control dog: 2.0 mg (22nd experimental day). Content of Pb in liver of the treated dog was 1/2 that in liver of control animal; Pb in kidney of treated dog was 1/3 that in kidney of control dog. (2) Pb workers suffering from chronic Pb poisoning were treated iv with EDTA. This therapy did not increase the Pb level in the blood while the urinary Pb level was highest after 3 hr administration. (3) Oral therapy with EDTA in workers with chronic Pb poisoning increased urinary Pb excretion in only a few patients. When oral therapy was extended over more than 6 mo, both blood and urinary Pb decreased and anemia was improved. (14 references)

- 790** Heggen, G.E., Olsen, K.B., Edwards, C.F., Clark, L.B., and Maisel, M. (Saratoga Springs Comm. Res. Lab.; Albany Med. Coll.; Union Coll., Schenectady, N.Y.): *EFFECTS OF X-IRRADIATION ON TRACE ELEMENT LEVELS IN RAT TISSUES.* *Radiation Research* 9:285-90 (Aug.), 1958.

Fourteen trace elements, including Pb, were studied in the pooled samples of liver, spleen, kidney, and lungs of male Sherman rats (140-200 g weight) after they had received 600 r total-body irradiation.

tion (200 kv, 20 ma) at a target distance of 53 cm at a rate of 81.5 r/min. In experiment 1 (46 rats), the animals were killed at 4, 8, and 12 days after irradiation; in experiment 2 (54 rats) at 2, 4, 6, and 8 days after exposure. Fe, Zn, Cu, Mo, and Mn were found consistently in all organs analyzed; Cr in most samples; and Al in all lung samples. Ni and Pb were found sporadically.

- 791** Horiuchi, K., and Horiguchi, S.: STUDIES ON THE INDUSTRIAL LEAD POISONING. I. ABSORPTION, TRANSPORTATION, DEPOSITION AND EXCRETION OF LEAD. 5. AN EXPERIMENTAL STUDY WITH RADIOACTIVE LEAD (RADIUM D). Osaka City Medical Journal 4:159-70 (Jan.), 1958. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 1, April 1949-March 1959, pp. 194-205.

Guinea pigs (400-500 g) given Pb acetate (in solution of 16.38 mg Pb/ml) at a dose of 1.0 mg/kg subcutaneously or orally for about 1 mo until Pb-poisoned, were subsequently given a solution containing some Pb acetate and a radioactive Pb tracer (RaD) either sc or orally or intratracheally. Serial RaD measurements were made for 20 days. Blood RaD levels reached maximum quickly (lowest in oral group, highest in sc group) and fell rapidly after the 2nd day. Red cells contained most, plasma and serum very little. RaD concentrations in tissues were as follows: sc group, bones highest in early and late specimens; liver, spleen, kidney high early, low by 10th day; lungs low, increasing later. Oral group, bones and teeth highest; next liver and spleen; kidney low, gradually increasing. Intratracheal group, kidney highest; bones and teeth next; liver and spleen high, decreasing gradually; cecum relatively high and remaining so. Fecal excretion was greater than the urinary except in the sc group. Figures are given for excreted and absorbed RaD. (21 references)

- 792** Hosaka, Y. (Sewaga Children's Hosp., Tokyo, Japan): IRON METABOLISM IN ANEMIAS IN THE GROWING STAGE. II. THE NONHEMIN IRON CONTENTS OF THE ORGANS OF RATS IN RÖNTGEN-IRRADIATION ANEMIA, LEAD-POISONING ANEMIA, AND MALARIAL ANEMIA. Nippon Shonika Gakukai Zasshi 62:334-9, 1958.

In the cases of Röntgen-irradiation anemia, Fe compounds in the liver, spleen, kidney, and pancreas increased. However, in the bone marrow, ferritin decreased and all other fractions increased. This suggested that the reserve Fe was not utilized due to the obstruction in the hematopoietic functions. In Pb-poisoning anemia, a similar imperfect utilization of the reserve Fe was noted as due to the obstruction in the hematopoietic function and to the increases in the hemosiderin content of the liver, spleen, kidney, and small intestine. (From Chemical Abstracts 52:14831, 1958)

- 793** Ising, U., and Voigt, G.E. (Univ. Lund, Sweden): Histochemische Untersuchungen über die Verteilung des Bleies bei experimentellen Bleivergiftungen. (HISTOCHEMICAL STUDIES ON THE DISTRIBUTION OF LEAD IN EXPERIMENTAL LEAD POISONING.) Acta Histo-

chemica 6:44-54, 1958.

Several methods for demonstrating Pb were tested; the most satisfactory were the Ag sulfide and the dithizone methods. Although the sulfide method was considered preferable because the smallest Pb deposits which could not be demonstrated by the dithizone method could be made visible by it, the dithizone method was considerably easier to execute. Acute Pb intoxication was produced in 2 hamsters given Pb acetate in water solution at a dose of ~500 mg/100 g of body weight either orally or subcutaneously, and killed. To produce chronic poisoning, 8 hamsters were given 20 mg Pb phosphate/100 g each, intramuscularly twice a week for 4-12 wk. Survival ranged from 2-105 days. Necropsy showed no macroscopic changes. At the injection site and in the mesenteric fatty tissue, peculiar grayish white formations, Pb granulomas, were found. Histochemical examination showed in acute poisoning in the kidneys the presence of Pb in the interstitial tubules, in ascending branches of Henle's loop, and in epithelial cells of the glomeruli as well as in the basal membrane; in chronic poisoning, it occurred chiefly in the parts of the proximal epithelia and in the fuchsinophile nuclear inclusions in tubular epithelia in a streak-like region of the cortex along the boundary of cortex and medulla. The nuclei of these cells were substantially enlarged and swollen. In the liver, Pb was found in the Kupffer cells; in chronic poisoning it appeared to be replaced by deposits of Fe.

- 794** Jötten, K.W., and Klosterkötter, W. (Westphalia Wilhelms Univ., Münster, Germany): Untersuchungen mit dem Rostschutzgrundanstrichpräparat "Graubleimennige-Arcanol." (INVESTIGATIONS ON THE RUST PREVENTIVE PAINT "GRAY MINIMUM ARCANOL.") Zentralblatt für Arbeitsmedizin und Arbeitsschutz 8:140-2 (June), 1958.

Experiments were carried out to determine whether occupational hazards in the use of "Gray minimum" are less severe than in the use of common red minimum. Gray minimum contains ~50% metallic Pb, red minimum 77-80% Pb<sub>3</sub>O<sub>4</sub>; 0.1N-HCl, within 30-120 min, dissolves 6-7 times as much Pb from red minimum as from gray minimum. When rabbits were exposed to the inhalation of sprayed fumes of gray and red minimum, respectively, the latter proved to be more toxic, causing a greater number of stippled cells in 1 test and a higher mortality in a 2nd. However, the Pb content in the organs was often higher with gray than with red minimum which led to the conclusion that Pb in this case was stored in the organism in a less reactive form. The authors point out that although gray minimum seems to be less toxic than red minimum, unprotected rabbits exposed to its fumes develop distinct symptoms of Pb poisoning. Thus, gray minimum should be used only with careful protective measures.

- 795** Klein, J.R. (Brookhaven Natl. Lab., Upton, N.Y.): DEPRESSION OF HEME FORMATION AND PRODUCTION OF FREE PORPHYRIN IN DUCK ERYTHROCYTES. American Journal of Physiology 203:971-4, 1958.

Incorporation of labeled glycine and acetate into heme and free porphyrin formation in the presence

of added glycine were depressed by Pb. All stages of heme formation by broken cells were inhibited, but early stages were most sensitive. (18 references)

- 796 Klimova, L.K. (Ukrainian Scientific-Res. Chem.-Sanit. Inst., USSR): PHARMACOLOGY OF THE NEW ANTIDOTE UNITHIOL. Pharmacology and Toxicology 21, No. 3:264-9, 1958. Translation of Farmakologiya i Toksikologiya 21, No. 3:53-8, 1958.

As determined in animals, unithiol (sodium 2,3-dimercaptopropanesulfonate) is a substance of low toxicity. Toxic manifestations become apparent in animals only after administration of unithiol in amounts >10 times the therapeutic dose. It has a wide range of therapeutic action and lower toxicity than BAL. The ratio of therapeutic dose to toxic (LD<sub>50</sub>) is 1:20 on average. When <sup>35</sup>S-labeled unithiol was given in a single sc injection to animals, it was rapidly absorbed to give the maximal concentration in the blood possible with the given dose within 30 min; the blood was free of <sup>35</sup>S after 24 hr. <sup>35</sup>S disappeared from the peripheral blood after repeated sc injection, at the same intervals of time as those following single injections. Unithiol (or metabolic products) was eliminated from the body chiefly by the kidneys (within the range of 70-80% of the administered amount) within the first 5-6 hr. It possesses no cumulative properties. Intravenous injection unithiol to rabbits or dogs in therapeutic doses or 10 times greater exert no marked effect on the circulatory system. Hypotensive action became manifest only when it is administered in doses considerably >10 times the therapeutic dose (500 mg/kg to rabbits or 150-200 mg/kg to dogs.)

- 797 Lang, H., and Fingerhut, M. (Univ. Mainz, Germany): Verteilung von i.v. injiziertem Pb 210 in Kaninchenorganen. (INTRACELLULAR DISTRIBUTION OF INTRAVENOUSLY INJECTED LEAD-210 IN THE ORGANS OF THE RABBIT.) Archiv für Experimentelle Pathologie und Pharmakologie 235:41-50, 1958.

<sup>210</sup>Pb as Pb acetate was used in equilibrium with the products formed from the <sup>210</sup>Pb, and the insoluble part was rendered soluble by treatment with HNO<sub>3</sub> and neutralization. Doses of 0.14 to 0.19 mg Pb were injected iv into rabbits. In the liver there was a marked and lasting accumulation of Pb in the mitochondria and a dilution of the activity in the microsomes and cytoplasm. Between 2 and 5 wk after the injection the specific activity in the mitochondria was about 8 times higher than that of the cytoplasm. Other organs did not show a special trend to accumulate Pb.

- 798 Matthews, J.J., and Walpole, A.L. (Imperial Chem. Ind. Ltd., Pharmaceuticals Div., Cheshire, England): TUMOURS OF THE LIVER AND KIDNEY INDUCED IN WISTAR RATS WITH 4'-FLUORO-4-AMINODIPHENYL. British Journal of Cancer 12:234-41 (June), 1958.

Mention is made of tumors found by Zollinger in rats following repeated subcutaneous injection of Pb phosphate. These were similar to spontaneous renal adenomas described by Ecker. Walpole con-

firmed Zollinger's findings (unpublished). The appearance of the tumors in his rats, however, was preceded by severe pathological changes in the kidney cortex, occurrence of numerous cysts involving mainly the proximal convoluted tubules, and of bizarre nuclear abnormalities in the tubular epithelium.

- 799 Miani, N., and Viterbo, B. (Univ. Padua, Italy): Studio istioautoradiografico sulla localizzazione del piombo (RaD) in vari organi di cane. (HISTO AUTORADIOGRAPHIC STUDY OF THE LOCALIZATION OF LEAD (RaD) IN VARIOUS ORGANS OF THE DOG.) Zeitschrift für Zellforschung und Mikroskopische Anatomie 49, No. 2:188-208, 1958.

The histological localization of Pb (RaD) in various organs of dogs that were killed 10 hr, 3 or 10 days, after intravenous administration of the RaD, was examined autoradiographically. In the kidneys RaD accumulated mainly in the rod epithelium. In the central nervous system (cerebellum, telencephalon, hypophyseal process, and neurohypophysis) it was found in the structures forming the capillaries and pyrenophores of the nerve cells and their dendrites while the nerve fibers of the white brain substance did not store the metal. In the spleen RaD was present mainly in the sinoendothelial and reticular cells. In the lungs it was bound to the histiocytic elements and in the liver to the liver cells and to Kupffer's cells. On the basis of the histautoradiograms the conclusion was drawn that Pb accumulates principally in the following structures which are common to all organs: mitochondria, cells of histiocytic macrophagic nature and structural elements of the capillaries.

- 800 Miki, M.: STUDIES ON THE LEAD CONTENT IN THE BODIES OF TEST ANIMALS. 1. LEAD IN BLOOD, URINE AND FECES OF THE RABBITS. Osaka City Medical Journal 4:135-48 (Jan.), 1958. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School. Vol. 1, April 1949-March 1959, pp. 180-93.

The Pb content in blood, urine, and feces of ~300-400 healthy, male adult rabbits was measured by spectrochemical analysis (Horiuchi et al, 1952). Statistical evaluation showed distribution of Pb to follow a log-normal relationship with a mean of 34.6 µg/100 g, and an upper limit of 104.4 in whole blood; in urine, the mean value was 21.13 µg/100 g, and upper limit, 66.3; in the feces, the mean was 163.66 µg/10 g, and upper limit, 268.5. The author suggests that these representative values and their upper limits may be applicable to a larger population, since each measured value follows statistical laws of distribution. (From author's summary)

- 801 Mokranjac, M.S., Radmić, S., and Soldatović, D. (Fac. Pharm., Belgrade, Yugoslavia): (ACTION OF CERTAIN DRUGS ON GUINEA PIGS INTOXICATED WITH LETHAL DOSES OF LEAD.) Acta Pharm. Jugoslav. 8:197-204, 1958.

The action of penicillin, p-aminosalicylic acid, BAL, Ca ethylenediaminetetraacetate and of Na

citrate on guinea pigs intoxicated with lethal doses of Pb was studied. Of all substances tested, only Na citrate acted as a real antidote; all other substances increased the mortality of intoxicated animals. (From Chemical Abstracts 53: 15330, 1959)

- 802 Mokranjac, M., and Soldatović, D. (Toxicol. Lab., Pharmacy Coll., Belgrade, Yugoslavia): Effet de certains antibiotiques sur la mobilisation du plomb chez l'animal soumis aux conditions d'intoxication par de petites quantités de plomb. (EFFECT OF VARIOUS ANTIBIOTICS ON THE MOBILIZATION OF LEAD IN ANIMALS SUBJECTED TO POISONING WITH SMALL QUANTITIES OF LEAD.) Comptes Rendus des Séances de l'Académie des Sciences 246, No. 24:3386-7, 1958.

The experiments were carried out with sheep which had first been treated with penicillin, then subjected to chronic poisoning. When, after some months their Pb level in blood and urine had returned to normal (15-18 µg/100 ml blood and 22-27 µg/1 urine), they were again poisoned by daily oral administration of 25 mg Pb as nitrate until the Pb concentration in the blood reached 200 µg/100 ml. Then streptomycin in a daily dose of 4 g was injected for 6 days, or 5 g/day terramycin or 20 g/day aminosalicylic acid (PAS) were given orally for 6 days. Blood and urine analyses showed a marked increase of Pb in both fluids, starting on the 2nd day of treatment; a maximum was reached some days after cessation of the treatment and the values returned to normal within 10-15 days. The greatest increase in blood Pb was observed after terramycin, and the greatest increase in urine following PAS. Streptomycin produced the smallest changes. With all 3 antibiotics the relative increase of Pb concentration was greater in the blood than in the urine. It is concluded that treatment of Pb poisoned patients with antibiotics for any disease will produce a mobilization of Pb with all possible undesirable consequences.

- 803 Nakade, R. (Kanazawa Univ. Med. School, Japan): (THE CONTENT OF THE FLUOROGENIC CORTICOIDS IN PLASMA AND ADRENAL GLAND OF THE RATS INTOXICATED WITH VARIOUS METALS.) Nippon Naibumpi Gakkai Shi 34:131-47, 1958.

For the determination of fluorescent corticosteroids the specimens are extracted with  $\text{CHCl}_3$ , then with 70% alcohol, followed by silica gel column chromatography according to Takeda's modification of Swent's method. The compound B fraction (mainly corticosterone), eluted with alcohol- $\text{CHCl}_3$  mixture (1:99), in plasma and adrenal gland of the rats is markedly lowered after injection of Hg, Fe, Ag, Pt, Zn, Bi, Mn, Mg, Sb, Ca, salt solutions, and greatly increased by the Au salt injection, while the compound F-like substance, eluted with alcohol- $\text{CHCl}_3$  mixture (5:95), is increased in all cases of the metal intoxication. Pb salt causes no definite tendency as to the amounts of both fractions. (From Chemical Abstracts 52:18832, 1958)

- 804 Nishimura, M. (Tokyo Dental Coll., Japan): EFFECTS OF PARATHYROID FUNCTION ON LEAD

POISONING. PART 2. OBSERVATIONS ON LEAD METABOLISM AND SYMPTOMS OF THE INTOXICATION WHEN PARATHYROID GLANDS ARE REMOVED. Journal of Science of Labour (Japan) 34:8-16 (Jan.), 1958.

Pb poisoning was induced in normal and parathyroidectomized albino rats. The following observations were made: (1) Pb anemia was more apparent in the normal group than in the parathyroidectomized one. (2) The amount of Pb in blood and urine was smaller in the parathyroidectomized rats than in the normals, but Pb retained in the body (mostly in the bones) was higher in the parathyroidectomized animals. (3) It was concluded that Pb poisoning becomes more chronic in the hypo-functional state of the parathyroid. (4) Both serum Ca and Pb in the bones do not merely depend on the Ca intake but on the hormonal function of the parathyroid. (5) The importance of parathyroid function in acute and chronic Pb poisoning is pointed out. (From author's English summary; 35 references)

- 805 Noda, E. (Kyushu Univ., Japan): (AN EXPERIMENTAL STUDY OF TETRAETHYL-LEAD POISONING.) Fukuoka Igaku Zasshi 49:2779-89, 1958.

The toxic action of TEL was studied in dd mice by giving them sc TEL in solution in olive oil. Also the action of certain drugs to prevent and cure TEL poisoning were also examined in dd mice by giving them the drugs by injection repeatedly at regular intervals before and after sc administration of TEL. Results showed that the sc  $\text{LD}_{50}$  of TEL was 13.02 mg/kg body weight.  $\text{CaNa}_2\text{EDTA}$  was most effective in acute and subacute TEL poisoning, followed by Na citrate. BAL was effective when the poisoning was acute but not statistically, in subacute. Glutathione, glucuronic acid, Na thio-sulfate, mercaptan and "yakriton" had no observable effect on the poisoning. (From author's summary; 61 references)

- 806 Odeschalchi, C.P. (Univ. Pavia, Italy): Ricerche sull'attività spontanea e sulla reattività dell'intestino isolate di ratto e di coniglio nell'intossicazione sperimentale de piombo. (THE SPONTANEOUS ACTIVITY AND THE REACTIVITY OF THE ISOLATED INTESTINE IN EXPERIMENTALLY POISONED RATS AND RABBITS.) Lavoro umano 10:351, 1958.

As compared to controls, no changes in reactions to certain substances were observed in the isolated intestine of rats and rabbits poisoned with Pb at various modes of administration when compared with controls. The author suggests that the intestinal structure possesses a complete anatomic integrity, and concludes that colics appearing in Pb poisoning are a local manifestation of the general morbid condition of the patient. (From Zentralblatt für Arbeitsmedizin und Arbeitsschutz 10:289 (Abstracts), 1960.)

- 807 Okada, M., and Asoda, A. (Tokyo Med. & Dental Univ., Japan): STUDIES ON DEPOSITION MECHANISM OF HEAVY METAL SALTS IN HARD TISSUES. I. ON THE OCCURRENCE OF ACTIVE INTERMEDIATE COMPOUNDS IN THE BLOOD WHICH LEAD TO DEPOSIT METAL IN HARD TISSUES. Proceedings of the Japanese Academy

34, No. 10:730-5, 1958.

Vital staining of hard tissues by Pb acetate, devised by Okada and Mimura (1938) is accomplished by injecting a microquantity into an animal, and the deposited Pb is demonstrated histochemically as a distinct fine line. This enables marking passage of time in hard tissue and thus examining growth and various responses of hard tissues under experimental conditions. In this study, a solution of Pb acetate was injected into an ear vein of a rabbit; the animal was sacrificed a few days later and the teeth fixed in formaldehyde solution. After decalcification in 0.2N HCl saturated with H<sub>2</sub>S, frozen sections of the tooth were prepared to determine Pb lines on dentin. With a series of metal acetates, Pb, with the minimum solubility product was superior to other metals. The degree of deposition was Ag>Cu>Zn. Ni, Cr, and Al were not detected. Thus, the deposition of the metal was parallel to the solubility product of the phosphate. A mixed solution of Ca and Pb salts produced a lighter Pb line in dentin than that from Pb salt alone. The data further indicated that Pb added to the serum is bound by serum protein, but in the presence of excess Ca salt Pb is not bound. The Pb present in the blood after intravenous injection is apparently a labile type that easily dissociates into Pb ion, while that in the blood after intraarterial injection is a stable type such as Pb phosphate.

The authors conclude that Pb and other metals entering the blood stream take transiently a form that combines with some substance (receptor) in competition with Ca, and then deposit in hard tissues.

808 Reva, A.D., Tsikora, I.L., and Gribnikova, A.M. (Dnepropetrovsk State Univ., Ukraine, USSR): DISTRIBUTION OF TRACE ELEMENTS IN THE LUMBAR ENLARGEMENT OF THE SPINAL CORD FROM THE RESULTS OF SPECTRAL ANALYSIS. Bulletin of Experimental Biology and Medicine (English translation) 46:824-6, 1958.

Spinal cords were obtained from cows 7-12 min after killing by severing carotid arteries and analyzed for their content of Pb, Cr, Ni, Al, Mn, Si, Ti, Cu, and Ag, in various areas of the lumbar part. While generally, the trace elements were found to be distributed unevenly, by examination of the numerical results Pb was among those uniformly distributed in all areas tested in an amount of 10<sup>-4</sup>% except for the white matter and the posterior roots where it reached a 10<sup>-3</sup>% concentration as ash. The concentrations of Pb in the individual areas were in %: whole area, 0.003; white matter, 0.0019; gray matter, 0.0004; some of anterior horn, 0.0002; some of posterior horn, 0.0006; anterior root, 0.0009; posterior root, 0.001.

809 Saccà, A., Aragona, F., and Ceruso, D. (Univ. Messina, Italy): L'acido tioctico nell'intossicazione sperimentale acuta da acetato di piombo. (THIOCTIC ACID IN EXPERIMENTAL ACUTE LEAD ACETATE POISONING.) Gazzetta Internazionale di Medicina e Chirurgia 63:1284-91, 1958.

One of 2 groups of 10 rats (150 g mean weight) each was treated intraperitoneally with 10 mg Pb acetate dissolved in 1 ml distilled water/day.

Group 2 received in addition to Pb 2 mg/day of thioctic acid in 2 daily doses of 1 mg. Treatment was over a period of 10 days, whereafter the animals were sacrificed by exsanguination. Histo-logic changes in the various organs (lungs, liver, spleen, kidney and endocrine glands) are described, and illustrated in microphotographs.

Thioctic acid was able to counteract the carbohydrate disturbances (liver glycogen) caused by Pb. However, the pathologic changes in the various organs examined were not modified. The authors conclude that on the basis of the failure by the drug to protect against Pb poisoning, Pb acts not only on enzymes with thiol function but also on other enzyme systems.

810 Saccà, A., Aragona, F., and Ceruso, D. (Univ. Messina, Sicily): (THE SODIUM CALCIUM SALT OF ETHYLENEDIAMINETETRAACETIC ACID (Na<sub>2</sub>Ca-EDTA) IN EXPERIMENTAL SATURNISM.) Gazz. intern. med. e chir. 63:1427-38, 1958.

Na<sub>2</sub>CaEDTA was shown to be able to repair the visceral lesions of Pb acetate (rats) but had effects on the kidney ascribed chiefly to its Na content. (From Chemical Abstracts 53:9486, 1959)

811 Salisbury, R.M., Staples, E.L.J., and Sutton, M. (Animal Res. Div., Dept. Agr., Wellington, New Zealand): LEAD POISONING OF CHICKENS. New Zealand Veterinary Journal 6:2-7, 1958.

Attempts to induce Pb poisoning in adult fowl failed to produce any evidence of Pb poisoning by giving single massive doses of Pb as red Pb and white Pb in capsules (maximum doses, 1000 and 200 mg/kg body weight, respectively). The highest liver Pb content was 15.1 ppm with 1000 mg Pb/kg, the lowest, 0.3 ppm at 200 mg/kg red Pb. The birds remained normal. In several episodes of Pb poisoning in fowl spent Pb shot was found in chicken gizzards and grit containing a high Pb content fed to chickens had produced a severe mortality in chickens, with the finding of necrosis of the gizzard lining and elevated liver Pb levels of 15-18 ppm. This led to experiments with 45 1-day-old white Leghorn chickens which were fed the same grit ad lib experimentally for 66 days. After killing all surviving chickens (20), identical gizzard lesions were found on post-mortem examination. Liver Pb levels ranged from 0.4 (body condition, good) to 34.6 ppm wet tissue (in 15 not surviving to the 66th day). There appeared to be a high correlation between the gizzard lesions and the liver Pb levels.

Adult birds were tested with the same grit fed ad lib to 14 2-yr white Leghorns and 1 white Leghorn cockerel. The experiment lasted 116 days when the remaining birds (6) were visibly affected and expected to succumb eventually. Liver Pb levels ranged from 2.9 ppm (in a bird surviving to the 116th day) to 53.6 ppm (in the 1st to die on the 56th day). There was a marked loss in weight in all birds, and in the hens that were in lay, eventual cessation of egg production. Other signs were: severe anemia (no stippling), necrosis of gizzard lining, greenish discoloration of the liver and greenish scour. The grit, shown to be toxic, was examined by a porcelain enamelling firm and found to be "frit," an ingredient used in the man-



ufacture of enamelware. Ingredients were: Pb oxide 32%, Si dioxide 30%, the rest, Si, B, Na, Fe, Al, Zn, and Ca compounds.

The authors conclude that the susceptibility to Pb intoxication in poultry decreases with age. If massive, high doses of basic Pb carbonate and red Pb are given, the compounds are not toxic to poultry if given in a state in which they will not be retained in the gizzard.

- 812 Sano, S.: STUDIES ON THE NATURE OF THE BASOPHILIC STIPPLED CELLS IN LEAD POISONING. 1. STUDIES ON THE CYTOLOGICAL INVESTIGATION OF BASOPHILIC STIPPLED CELLS. 2. STUDIES ON THE MECHANISM OF GRANULE-FORMATION OF BASOPHILIC STIPPLED CELLS IN LEAD POISONING. Acta Scholae Med., Univ. in Kyoto 35, No. 2:149-57; 158-63, 1958.

1. The following results were found: (1) The basophilic granule contains ribonucleic acid, suggesting it to be the residue of a cytoplasmic component of the erythroblast. (2) As the granule is devoid of desoxyribonucleic acid it is probably not derived from the nucleus of the erythroblast. (3) The basophilic stippled cell, polychromatophilic cell and the reticulocytes all contain ribonucleic acid, and in this respect the substances which characterize these cells may be considered to be identical. 2. Using the phase constant microscope, observations were made on the basophilic granule of the bone marrow and the peripheral blood cells in Pb-poisoned mice. It was found that: (1) The mitochondria were seen in the red blood cell of both the bone marrow and the peripheral blood in Pb poisoning. (2) The number of red blood cells containing mitochondria nearly approximated that of basophilic stippled cells. (3) The vacuoles were observed in the cytoplasm of the erythroblast and red blood cell with basophilic stippling. (4) The stippling is due to a vital aggregation of ribonucleic acid around mitochondria in the cytoplasm of red blood cell. (From Bulletin of Hygiene 34:1138, 1959)

- 813 Schöberl, A. (Veterinary College, Hannover, Germany): Moderne Methoden für den Nachweis von Bleivergiftungen. (MODERN METHODS FOR THE DETECTION OF LEAD POISONING.) Deutsche Tierärztliche Wochenschrift 65: 235-9, 1958.

Two modern micromethods for the determination of Pb in biological material, ie, the photometric method using dithizone and a polarographic method, are described and recommended to take the place of the classical method based on precipitation of Pb as sulfide. Pb determinations were made on some cattle and deer. The Pb content in the liver (mg/100 g) of a normal animal was found to be 0.05, in an animal acutely poisoned with  $Pb_3O_4$  0.36-0.39; for 4 cows and 2 deer chronically poisoned near a Pb smelter the following figures were found: 0.72, 0.63, 0.27, 0.23, 0.60, 0.71. The bones of 2 older deer in the neighborhood of a Pb smelter contained 4.34 and 7.9 mg Pb/100 g, respectively, a marrow-containing shank 5.6. These animals showed paralysis of the legs.

- 814 Shibuya, T.: (NUCLEIC ACID CHANGES IN

LEAD POISONING.) Fukuoka-Iagku-Zasshi 49: 972-90, 1958.

Subcutaneous injection of Pb acetate (20 mg/kg body weight, every other day, 5 times) to rabbits decreased the content of deoxyribonucleic acid in the brain and of deoxyribonucleic acid and ribonucleic acid in the spleen. Ribonucleic acid in the brain and both deoxyribonucleic acid and ribonucleic acid in the liver, kidney, and bone marrow showed little or no change. (From Chemical Abstracts 52:16617, 1958)

- 815 Shimooku, M. (Kobe Med. Coll., Japan): THE AMOUNT OF VITAMIN A IN THE LIVER OF MICE FED A VITAMIN A AND  $B_1$  DEFICIENT DIET. I. THE AMOUNT OF VITAMIN A IN THE LIVER OF NORMAL MICE SUBJECTED TO VITAMIN A AND  $B_1$  DEFICIENCY. II. THE AMOUNT OF VITAMIN A AND THE PATHOHISTOLOGICAL FINDINGS IN MOUSE LIVER IN VITAMIN A AND  $B_1$  DEFICIENCY WITH ACETIC LEAD POISONING. Acta Soc. Ophthal. Jap. 62, No. 3:67-73; 74-82, 1958.

I. The amounts of vitamin A in the liver of mice fed a normal, vitamin A-deficient and vitamin  $B_1$ -deficient diet were calculated by the glycerol dichlorohydrin method. The liver showed 2833 IU vitamin A/g in the normal mice fed a control diet containing 464 IU of vitamin A for 40 days. Animals maintained on a vitamin A-deficient diet or  $B_1$ -deficient diet showed a vitamin A content in the liver of 216 and 1179 IU/g, respectively. II. The relationship was discussed between the amount of vitamin A and the pathologic findings in the liver of mice subjected to experimental Pb intoxication and maintained on a normal vitamin A- and  $B_1$ -deficient diet. It is concluded that Pb intoxication may easily promote liver degeneration in the vitamin  $B_1$ -deficient mice as well as in the vitamin A-deficient animals. (From Excerpta Medica Section XII, 12:Abstr. No. 1563, 1958)

- 816 Stover, C.N., ed.: SEMI-ANNUAL PROGRESS REPORT. US Atomic Energy Comm. Doc. No. COO-217, 1958, 184 pp.

Progress is reported in long-term studies on the toxic effects of radioactive heavy metals in dogs. Data are included on the pathological effects and clinical symptoms in dogs receiving  $^{239}\text{Pu}$ ,  $^{226}\text{Ra}$ ,  $^{228}\text{Ra}$ , and  $^{90}\text{Sr}$ . Metabolism of  $^{212}\text{Pb}$  was studied in dogs following intravenous injection and after transfusion of  $^{212}\text{Pb}$  labeled blood cells. (From Nuclear Science Abstracts 13:4392, 1959)

- 817 Tarabaeva, G.I. (Acad. Sci. Kasakh SSR): Gonadotropnaya aktivnost gipofiza pri svintsovom otravlenii. (GONADOTROPIC ACTIVITY OF THE HYPOPHYSIS IN LEAD POISONING.) Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Meditsiny i Fiziologii 1958, No. 2:108-13.

Groups of 7 rats each were treated as follows: (1) was subjected to chronic Pb poisoning by the intragastric administration of 0.2-0.3 ml 1% solution of Pb acetate daily for 4 mo; (2) treatment as above with a 5% solution to induce acute poisoning; (3) served as controls. Upon sacrifice or death, the hypophysis was removed, and an emulsion in physiologic saline was prepared to be injected sc to infant female mice twice daily for 3 days.

The mice were sacrificed 100 hr after the 1st injection. The results showed that the gonadotropic activity of the hypophysis of mice that received the hypophyseal emulsion from rats poisoned with the 5% solution was disturbed, while mice that received the rat hormone from the 1% Pb acetate group and mice injected the experimental hormone from rats that received no Pb exhibited normal gonadotropic function of the hypophysis and in all cases the ovaries and other parts of the genital organs showed typical reactions of sexual development.

- 818 Teisinger, J., Lustinec, K., and Srbová, J. (Inst. Ind. Hyg. Occup. Dis., Prague, Czechoslovakia): EFFECT OF EDATHAMIL CALCIUM-DISODIUM ON RETENTION OF LEAD IN THE LIVER. A.M.A. Archives of Industrial Health 17:302-6 (Apr.), 1958.

In the first experiments livers of normal cats were removed, perfused with defibrinated ox blood with Tyrode's solution and Pb nitrate solution at different concentrations. During perfusion, blood was withdrawn at hourly intervals, and analyzed for Pb. In the 2nd series, 24 hr before perfusion in vitro, 2 cats received intravenously (iv) 10 ml 0.5% solution of Pb nitrate solution, and 1 received 6 ml. In the 3rd series, 24 and 48 hr before perfusion, 8 cats received iv 10 ml 0.5% Pb nitrate. After 1 hr of perfusion, a solution of EDTA was added to the blood.

Within 1-2 hr the livers of normal cats had absorbed about 50% of the circulating Pb from the blood. After this period an equilibrium between liver and blood was reached and the Pb content in the liver did not increase further. Experiments with cats poisoned with Pb showed that the mechanism of binding Pb to liver cells is reversible but the process of release of Pb into blood is very slow. When a solution of EDTA was added to the blood after perfusion this release action was accelerated 2-4-fold. It is assumed that EDTA rapidly forms complexes with the Pb ions which are released from the liver cells, thereby speeding up this reaction. Probably, neither EDTA nor PbEDTA penetrate into liver cells as these cells are practically unable to bind PbEDTA. (3 references)

- 819 Teramoto, K. (Kyoto Prefectural Med. Univ., Japan): (LEAD POISONING. THE CONTENT OF LEAD IN ORGANS OF RABBITS ADMINISTERED LEAD, DETERMINED BY THE MOBILIZING PROCEDURE.) Kyoto Furitsu Ikadaigaku Zasshi 64:221-37, 1958.

Polarographic determinations of the Pb content in various organs of rabbits administered Pb acetate showed that BAL, EDTA, and KI did not mobilize Pb but merely changed the Pb distribution between the organs. (From Chemical Abstracts 54:25314, 1960)

- 820 Timm, F., and Arnold, M. (Max-Planck-Inst. Exptl. Med., Göttingen, Germany): Histochemische Studien zur Ausscheidung des Bleisalzes der Äthylendiamintetraessigsäure durch die Rattenniere. (HISTOCHEMICAL STUDIES OF THE EXCRETION OF LEAD SALT OF ETHYLENEDIAMINETETRAACETIC ACID BY THE

RAT KIDNEY.) Archiv für Experimentelle Pathologie und Pharmakologie 233:422-30, 1958.

The preparation of the Pb, Cd, Cu, Hg and Zn salts of Na<sub>2</sub>EDTA is described. Albino rats were injected intraperitoneally or subcutaneously with aqueous solutions of these salts. PbNa<sub>2</sub>EDTA was tolerated without untoward effects in a single dose of 450 mg/kg body weight or in daily doses of 140 mg/kg over a period of weeks. About 68% Pb of the injected dose was excreted in the urine during 24 hr. Histochemical examination showed that Pb was stored in the bones and teeth. A rat which had received 140 mg/kg/day for 17 days showed rings around the incisors corresponding to the number of injections; the rings were spaced corresponding to the time intervals between administrations. Pb was also stored in the kidneys: in the glomeruli; their lumina, and basal membranes of capillary loops; in the lumina of the convoluted tubules and brush border; particularly in the canaliculi. The Cd and Zn salts were tolerated equally well as the Pb-salts while the Cu and Hg salt was much more toxic. The authors conclude that with an EDTA administration a reduction of Pb concentration may be achieved but not a complete removal of Pb because the ratio Ca:Pb is always more in favor of the Ca. (32 references)

- 821 Tokovoi, N.A., Zolotoukhin, G.E., and Voloshina, V.V.: (DISTRIBUTION OF MINERAL ELEMENTS IN TISSUES OF FARM ANIMALS.) Trudy Krasnoyarsk. Sel'skokhoz. Inst. 2: 156-61, 1958.

Determinations of numerous trace elements in various animal species showed no Pb in cattle, sheep, hogs, and no Mn in hogs and horses. (From Chemical Abstracts 55:7590, 1961)

- 822 Ungher, J., and Voinescu, S. (Inst. Neurology "I.P. Pavlov," Academy RPR, Romania): Contributii histopatologice la studiul encefalopatiei saturnine experimentale. (HISTOPATHOLOGICAL CONTRIBUTIONS TO THE STUDY OF EXPERIMENTAL LEAD ENCEPHALOPATHY.) Neurologia Psihiatria Neurochirurgia 3:425-33 (Sept.-Oct.), 1958.

Four dogs were injected iv 2 mg Pb acetate/kg body weight every 2-3 days up to a total amount of 180-600 mg over a period of 20 days to 2 mo. Histological examination revealed serious degenerative changes of the ganglionic cells, particularly in the 3d and 4th cortical layer of the cerebrum and the 2d and 5th layer of the cerebellum, and also of the subcortical formations, the neurofibrils, the myelin sheath and the glia. In the vascular system only hemodynamic changes (edema, hemorrhages, dilations) were noted. The authors maintain (in contrast to other authors) that Pb does not react through the vascular system but that it directly damages the parenchyma of the brain and other organs (liver, kidney). (13 references)

- 823 Washburn, R.G., Gilmore, L.O., and Fecheimer, N.S. (Ohio Agric. Expt. Station, Wooster): THE CHEMICAL COMPOSITION OF

CATTLE HAIR. I. FAT, ASH, AND NITROGEN CONTENT. Ohio Journal of Science 58:150-2, 1958.

Analysis of hair from 177 different cattle showed the average fat, ash, and N content to be 1.49, 2.04 and 13.46%, respectively. The following elements were identified from ash: B, Ba, Ca, Cu, Fe, Pb, K, Mg, Mn, P, Si, Ag, Na and Zn. K was not found in the ash from some of the samples of white hair. (From authors' summary)

- 824 Wassermann, M., Mihail, G., and Cojocaru, V. (Inst. Med. Iassy, Romania): Recherches hématologiques dans l'intoxication saturnine expérimentale des animaux homéothermes, à l'aide du microscope à contraste de phases. (HEMATOLOGIC STUDIES IN EXPERIMENTAL LEAD POISONING OF HOMOTHERMIC ANIMALS USING THE PHASE-CONTRAST MICROSCOPE.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 19:233-42 (May-June), 1958.

According to the authors, the 3 fundamental biological signs of Pb poisoning, ie, number of erythrocytes with basophilic stippling, coproporphyrinuria and Pb in blood and urine, vary individually and taken separately do not give a real picture of the degree of poisoning. A hematologic test using the phase-contrast microscope, is described by which stippled erythrocytes and other changes of the blood cells can be determined. As to the mechanism of Pb poisoning, the authors point out that Pb absorption interferes with the cytoplasmic process of oxidoreduction by inhibiting the complete utilization of acid proteins. The small portion of nonutilized proteins constitutes the basophil granulations.

Ten adult rabbits, 2000-2500 g weight, were studied; 6 of them were poisoned by daily intravenous injection of 5 mg/kg of Pb acetate in a 1% solution to a total of 25-30 mg. Blood findings were compared with those of Pb-poisoned pigeons, in order to determine the origin of the granulations. Basophil granulations could easily be differentiated from other alterations of the erythrocytes.

Important alterations were also found in the white cells. In the cytoplasm of granulocytes numerous vacuoles were seen, which were irregular in shape, and probably many of them were toxic granulations. The cytoplasm of the lymphocytes showed large vacuoles and granulations with changes other than seen in erythrocytes. In the erythrocytes, a series of black, round, irregularly distributed granulations were seen. When their number was reduced (5-6), it was hard to distinguish the erythrocyte from the reticulocyte. The small granulations were easy to distinguish from the spinous erythrocyte, because micrometrically it could be seen that these remained dark and enclosed in the body of the erythrocytes. In an advanced stage their number was great and filled the entire erythrocyte. There was also dimensional change and appearance of luminescent vacuoles of various dimensions against the dark background. The monocytes were irregular in shape, with many vacuoles. Thus, in experimental Pb poisoning the phase-contrast microscope permits the identifica-

tion of stippled erythrocytes without vital or postvital staining. The fact that, as seen in the erythrocytes of the pigeon, basophilic granulations develop while the integrity of the nucleus is preserved, vouches in favor of the cytoplasmic origin of the granulations.

- 825 Wisotzky, J., and Hein, J.W. (Colgate-Palmolive Co.; Rutgers State Univ., New Brunswick, N.J.): EFFECT OF DRINKING SOLUTIONS CONTAINING METALLIC IONS ABOVE AND BELOW HYDROGEN IN THE ELECTROMOTIVE SERIES ON DENTAL CARIES IN THE SYRIAN HAMSTER. Journal of the American Dental Association 57:796-800, 1958.

Hamsters 25-35 days old were fed a cariogenic ration and given ad libitum for drinking distilled water which had also been passed through an ion-exchange column. The water for each group contained a metallic salt; the concentration was 1 meq/l except Au and Pb (0.5 meq/l) and Cd (0.25-0.5 meq/l); Pb and K were used as acetates, other metals as chlorides or sulfates. Experimental caries was not influenced by position of the cation in the electromotive series. Caries incidence was not affected by Li sulfate, K manganate, Pb chloride and K acetate, was markedly inhibited by Au bichloride, markedly accelerated by Pt chloride, and accelerated in males by Mg sulfate or Pb acetate. Cd sulfate could not be evaluated because of its toxicity and severe systemic effect. Cu sulfate definitely inhibited caries.

The authors conclude that, on the basis of their findings, strong caries inhibition is not a common property of metallic ions but may be confined to certain groups of elements, eg, the Cu-Hg-Au group. Also that metallic ions can accelerate caries and therefore, any analysis of mineral content in diets in relation to dental caries must include the possibility of a trace element accelerating as well as inhibiting caries.

## 1959

- 826 Akulov, K.I., Zaitseva, A.F., and Yundzel, N.K. (First Inst. Med.; Dept. Communal Hyg., Moscow, USSR): Gigenicheskoe normirovanie dopustimogo soderzhaniya rastvorimykh soedinenii mysh'yaka, svintsa i rtuti v vode vodoema. (SANITARY STANDARDS CONCERNING THE PERMISSIBLE LEVELS OF SOLUBLE COMPOUNDS OF ARSENIC, LEAD, AND MERCURY IN WATER SUPPLIES.) Trudy Pervogo Moskovskogo Meditsinskogo Instituta imeni I.M. Sechenova 5:143-7, 1959.

A study was made to determine the effects of various salts of As, Pb, and Hg on the self-purification of water, on the waterorganoleptic properties, and the toxicity of water containing these elements for rats and rabbits. Soluble Pb salts, even in concentrations as high as 0.1 mg/l had no significant inhibitory effect on the BOD of water and the development of saprophytic microflora. The threshold organoleptic concentrations for Pb salts were 100-200 mg/l. Oral administration of 0.5 mg Pb/kg as solutions of Pb salts produced in animals disturbances in conditioned reflexes. Animals

receiving repeatedly 5 mg Pb/kg showed changes in blood and impairment of kidney function. As a result of these findings, 0.1 mg/l is recommended as the MAC for Pb.

- 827 Baetjer, A.M. (Johns Hopkins Univ., Baltimore, Md.): EFFECTS OF SEASON AND TEMPERATURE ON CHILDHOOD PLUMBISM. *Industrial Medicine and Surgery* 28:137-40; discussion, 140-3 (Mar.), 1959.

Pb poisoning in children has a marked seasonal distribution with almost all cases occurring between the months of May and October. Since the ultraviolet radiation theory did not seem an adequate explanation of this seasonal distribution, the effects of environmental temperature and humidity on the susceptibility of laboratory animals to Pb poisoning was studied.

The author reviews these experiments which were performed by S. Joardar and were the subject of her thesis submitted to the Johns Hopkins University in 1957.

Experiments are currently in progress to test various other theories which might account for the increase in susceptibility of mice to Pb poisoning at high temperature. (21 references)

- 828 Bellrose, F.C.: LEAD POISONING AS A MORTALITY FACTOR IN WATERFOWL POPULATIONS. *Illinois Nat. Hist. Survey, Bull.* 27:235-88, 1959.

Author concludes on the basis of his study that at present Pb poisoning in waterfowl is not of sufficient magnitude as to warrant the prohibition of Pb shot in waterfowl hunting. (From *Chemical Abstracts* 54:1727, 1960)

- 829 Biondi, S. (Univ. Naples, Italy): Sull'impiego delle sieralbumine per la prevenzione del saturnismo. (Ricerche sperimentali). (USE OF SERUM ALBUMIN FOR THE PREVENTION OF LEAD POISONING; EXPERIMENTAL RESEARCH.) *Folia Medica (Naples)* 42:62-76 (Jan.), 1959.

The principle of the use of serum albumin in Pb poisoning is the same as that which was held for milk, ie, the formation in the intestine of Pb albuminates which are insoluble and not absorbable, but are eliminated in feces. The preparation, in addition to animal albumin, consisted of Na phosphate, Ca carbonate, anhydrous Na carbonate, vitamin PP and keratin in order to render it indigestible in the stomach so that the albumin would be liberated in the intestine. Twenty male rabbits were given orally 1 ml of a 10% solution of Pb acetate, or 54 mg/day; directly after Pb, 10 of them received the albumin capsule. After 12 days, the Pb in blood, urine and feces, and CP in urine were determined; the determinations were repeated every 7 days until day 54 after start of treatment by which time all of the rabbits that had not received albumin had died, while of the treated group, 3 died on days 42-44. As judged by the analytical findings, the preparation exerted a protective action; fecal excretion was considerably higher than in rabbits given Pb alone. (23 references)

- 830 Bonati, F. (Bracco Lab. Ind. Chem. Res., Milan, Italy): Rapporti tra costituzione chimica e tossicità di derivati cisteaminici e loro complessi metallici. (RELATION BETWEEN CHEMICAL CONSTITUTION AND TOXICITY OF CYSTEAMINE DERIVATIVES AND THEIR METALLIC COMPLEXES.) *Archivio Italiano di Scienze Farmacologiche* 9:125-7, 1959.

Cysteamines were investigated because of their radioprotective properties. In this study the LD<sub>50</sub>'s of the Pb, Hg, and Bi derivatives were determined. Those for Pb, in male albino rats, intraperitoneally, were (mg/kg); cysteamine-Pb (2:1) 32; Pb cysteamine monoacetic acid 70; Pb-cysteamine diacetic acid 1960, Pb acetate 145.

- 831 Boyadzhiev, V. (Univ. Sofia, Bulgaria): (EFFECT OF DIETARY FACTORS ON THE DEVELOPMENT AND COURSE OF EXPERIMENTAL AND PROFESSIONAL LEAD INTOXICATION.) *Českoslov. gastroenterol. výživa* 13:328-34, 1959.

Rats on a low protein and high fat diet showed the most marked changes after Pb poisoning. The changes were the smallest on a high protein diet. Diets are recommended for persons exposed to Pb. (From *Chemical Abstracts* 54:10158, 1960)

- 832 Brülshcke, G. (Univ. Jena, Germany): Bemerkungen zur Pathogenese der Bleianämie. (COMMENTS ON THE PATHOGENESIS OF LEAD ANEMIA.) *Deutsche Gesundheitswesen* 14:1059-62 (June 4), 1959.

Symptoms of Pb poisoning were reviewed and experiments with guinea pigs described. Normal and splenectomized guinea pigs were poisoned orally with 100 mg Pb/kg body weight as Pb acetate; siderocytes, erythrocytes and hemoglobin were determined. Siderocytes were found to increase after splenectomy alone and also after Pb poisoning. The results of the experiment did not indicate that the spleen, by eliminating siderocytes, might promote the anemia and that after splenectomy a less intense anemia would occur.

- 833 Carminati, G.M. (Univ. Milan, Italy): Il comportamento dell'eritrocitemia e dell'indice emoglobinico nell'intossicazione saturnina cronica. (BEHAVIOR OF THE ERYTHROCYTE COUNT AND HEMOGLOBIN INDEX IN CHRONIC LEAD POISONING.) *Bollettino della Società Italiana di Biologia Sperimentale* 37:426-9 (Apr. 15), 1959.

Male rabbits, about 2.5 kg body weight, were injected iv every 2-3 days with 2-5.5 mg Pb/kg as neutral Pb acetate, for 8-12 times. Erythrocytes and hemoglobin were determined 1 wk before the treatment was started and counts were continued to about 20 days after termination of the treatment. In normal rabbits the erythrocyte and hemoglobin values were 5.84 million/ml and 13.9 g/100 ml, respectively. The experimental rabbits first developed a hypochromic anemia which was followed by a stabilization of the red blood cell count at about 2-3 million below the initial value, and a progressive increase of the hemoglobin value which finally was above the initial one, or a state of

hyperchromic anemia. While the hypochromic anemia was due to the destructive action of Pb on the red blood cells, the subsequent hyperchromic anemia was a consequence of the reduced production of erythrocytes by the bone marrow.

- 834 Carminati, G.M. (Univ. Milan, Italy): L'Effeto antagonista degli estratti epatici e della vitamina B<sub>12</sub> sullo sviluppo dell'anemia da piombo nel coniglio. (THE ANTAGONISTIC EFFECT OF LIVER EXTRACTS AND VITAMIN B<sub>12</sub> UPON THE DEVELOPMENT OF LEAD-INDUCED ANEMIA IN RABBITS.) Farmaco Edizione Scientifica 14:3-14 (Jan.), 1959.

Male adult rabbits, 2.5 kg weight, were subjected to the development of anemia by iv injection of 5.5 mg/kg Pb acetate/day for 3 days. Groups of rabbits were treated with the following: crystalline vitamin B<sub>12</sub>, and 4 preparations of liver extract of various strengths of vitamin B<sub>12</sub>. The results showed that both liver extract and vitamin B<sub>12</sub> exerted a protective action in acute Pb-induced anemia; this action was proportional to the amount of the solution administered.

- 835 Cenacchi, G.C., Tucci, G., and Lodi, A. (Univ. Bologna, Italy): Comportamento di alcuni enzimi sierici ed aspetti istologici in ratti intossicati sperimentalmente. Nota I. Azione dell'acetato di piombo. (THE BEHAVIOR OF SOME SERUM ENZYMES IN EXPERIMENTALLY POISONED RATS. I. THE ACTION OF LEAD ACETATE.) Rivista Medica di Bologna 5:519-36, 1959.

Serum transaminases, aldolase, lactic and malic dehydrogenases were studied in 50 rats injected ip with Pb acetate (6 mg/kg/day) for 30 days; 30 rats served as controls. Determinations made on the 1st, 10th, 20th and 30th days of the experiment were compared with the histological findings on liver, kidney, myocardium and spleen. Liver-cell degeneration and swelling of the kidney tubular cells were observed only on the 30th day. The other organs showed no changes. No significant changes of transaminases were observed. Aldolases, lactic and malic dehydrogenases increased slightly on the 1st day and demonstrated a marked but constant increase on the other days of the experiment. A modification of the serum values of these enzymes in Pb intoxication was observed before the establishment of pathological changes. A direct action of Pb on the mitochondrial enzymic system is discussed. (64 References).

- 836 Dmitriev, V.F., Gazarkh, L.A., and Shipitsyn, S.A.: (CONTENT OF TRACE ELEMENTS IN THE PROTEINS OF BRAIN.) Izvest. Irkutsk. Sel'skokhoz. Inst. 1959, No. 14:10-6.

Analysis of minced brain tissue for trace elements yielded 0.25-0.56 mg% Pb and 0.95-1.8 mg% Mn (in dry protein). (From Chemical Abstracts 55:24979, 1961)

- 837 Fried, J.F., Schubert, J., and Lindenbaum, A. (Argonne Natl. Lab., Lemont, Ill.): ACTION OF EDATHAMIL (EDTA) ANALOGS ON EXPERIMENTAL LEAD POISONING. A.M.A. Archives

of Industrial Health 20:473-6 (Dec.), 1959. Three chelating agents, Ca ethylenediaminetetraacetic acid (EDTA), Ca diethylenetriaminepentaacetic acid (DTPA), and 2:2'-bis (dicarboxymethyl) amino diethyl ether (BAETA), were compared for their protective action against acute Pb poisoning in rats. Pb (as the nitrate) was injected intravenously (iv) at 70 mg/kg (LD<sub>50</sub>), and 1 hr later, EDTA and DTPA were given iv at 118 and 158 mg/kg. In addition, Pb BAETA, Pb DTPA and Pb EDTA were prepared and injected in doses from 110-1260 mg/kg as Pb. Sprague-Dawley female rats, 3-6 mo old (225-285 g) were used. Controls received saline solutions. As determined by survival times, neither EDTA nor DTPA were effective. Pb DTPA was more toxic than Pb EDTA, but both were considerably less toxic than unchelated Pb (LD<sub>50</sub>'s were 1260 mg/kg for Pb DTPA and 55 mg/kg for Pb). Pb BAETA was about as toxic as Pb. The explanation for these results is discussed in terms of the relative affinities of these 3 chelating agents for Pb<sup>++</sup> and Ca<sup>++</sup> and of Pb<sup>++</sup> for the tissue proteins, which were demonstrated in in vitro experiments. (22 references)

- 838 Gentile, G. (Univ. Messina, Italy): Ricerche sperimentali sull'intossicazione saturnina. II. Esperienze di orientamento sulle dosi di nitrato di piombo da usare nelle esperienze di antidotismo. (EXPERIMENTAL RESEARCH ON LEAD POISONING. II. EXPERIMENT ON TRENDS IN DOSAGE OF LEAD NITRATE TO BE USED IN EXPERIMENTS ON ANTIDOTES.) Folia Medica (Naples) 42:138-50 (Feb.), 1959.

Doses of as high as 9 times the intravenous MLD, (as established by Oliva in 1949: 0.0007 g/kg rabbit) given by mouth to rabbits failed to produce considerable damage. Administration of 0.001058 g/day/kg body weight for 13 days caused the death of animals soon after the end of the 13th day. (From author's English summary)

- 839 Gentile, G. (Univ. Messina, Italy): Ricerche sperimentali sull'intossicazione saturnina. III. Avvelenamento da nitrato di piombo e Ca EDTA Na<sub>2</sub>. (EXPERIMENTAL STUDIES ON LEAD POISONING. III. POISONING WITH LEAD NITRATE AND CaNa<sub>2</sub>EDTA). Folia Medica (Naples) 42:427-36 (Apr.), 1959.

Two rabbits were given daily by gastric tube 0.175 g/kg body weight of a 5% solution of Pb nitrate. One of them received at the same time an intravenous injection of 2 mg CaNa<sub>2</sub>EDTA and died after 19 days. The 2nd animal which received a 4 mg dose of CaNa<sub>2</sub>EDTA starting on the 7th day of Pb administration, died after 15 days while controls receiving no antidote, died after an average of 11.5 days. Blood counts (Hb, red and white cells, lymphocytes, monocytes, neutrophils, basophils, eosinophils) did not show fundamental differences in the 2 experimental animals.

- 840 Gentile, G. (Univ. Messina, Italy): Ricerche sperimentali sull'intossicazione saturnina. IV. Avvelenamento da nitrato di piombo e B.A.L. (LEAD POISONING. IV.

LEAD NITRATE POISONING AND BAL.) *Folia Medica* (Naples) 42:580-90 (May), 1959.

Rabbits, poisoned with daily oral doses of 0.175 g Pb nitrate for 16 days and treated in either over the same time with 0.1 g BAL or with 0.2 g BAL beginning on the 7th day of poisoning, showed no life-saving effect of the antidote. Death occurred on the last day of poisoning, except that death was somewhat delayed. Two rabbits survived an average of 4 days longer than those that did not receive the antidote.

- 841 Haumont, S., and Vincent, J. (Univ. Lovanium, Leopoldville, Belgian Congo): Action du versenate de calcium sur le plomb fixe in vivo dans l'os compact. (ACTION OF CALCIUM VERSENATE ON LEAD FIXED IN VIVO IN COMPACT BONE.) *Experimental Cell Research* 18:404-6 (Oct.), 1959.

Pb was administered to dogs in the form of neutral or basic acetate, either in gelatin capsules or in solution mixed with food, in a dose of 50-100 mg/kg/day for 3-6 days. After varying intervals, the long bones were fixed in ethanol at 96°. The center portion of the diaphysis was sawed in transverse sections and the bone calcifications recorded microradiographically. Some of them were then immersed in distilled water for 3 days to serve as controls. The others were placed in a 5% CaEDTA solution for the same length of time.

To visualize the Pb, the sections were treated with aqueous Na sulfide and formic acid solutions. The Pb deposits were of a deep brown color. As shown in a figure of a section removed from a dog sacrificed 1 day after cessation of a 3-day Pb treatment, comparison of histologic and microradiographic images of the same bone section not treated with EDTA by superimposing one on the other, traces of Pb were found to correspond to the most interior calcifications of the osteons in bone formation. Bone sections obtained from the same animal treated with EDTA showed less traces of Pb and it was evident that EDTA had extracted the major portion of the Pb. However, in cases where Pb was incorporated over a 6-wk period, EDTA did not seem to liberate any Pb detectable by the authors' histological techniques.

In a case in which 600 mg/kg EDTA was given 3 times at 2-day intervals to a Pb-intoxicated dog, no evidence of in vivo mobilization of Pb from bones was observed. EDTA cannot remove Pb in significant amounts except in animals with recent intoxication. Later on, Pb is inaccessible to the chelate.

- 842 Hayashi, Y., Kondo, H., and Iwai, S. (School Med., Keio Univ., Tokyo, Japan): A PAPER ELECTROPHOTETIC STUDY ON SERUM PROTEINS IN LEAD POISONED RABBITS. *Japanese Journal of Industrial Health* 1:678-82 (Nov.), 1959.

Pb poisoning was induced by oral, sc, and inhalation exposure, the latter in a chamber equipped with Wright's British-made dust feed mechanism designed for long-term inhalation. Paper electrophoresis showed that the  $\gamma$ -globulin level was elevated in the course of poisoning by sc injection or inhalation. No change was found in the

rabbits poisoned by oral administration. With all 3 techniques of exposure the  $\alpha_2$ -globulin level was slightly increased while the albumin level was significantly decreased especially in the inhalation experiment. It was also noted that the value of serum protein fractions could be affected by foods, ie, commercial rabbit chow and fresh greens. (From authors' English summary; 15 references)

- 843 Inoue, S. (Univ. Kyoto, Japan): (PORPHYRIN METABOLISM IN LEAD POISONING. I. PORPHYRIN METABOLISM IN LEAD-POISONED RABBITS. II. PORPHYRIN METABOLISM IN LEAD-EXPOSED WORKERS. III. PORPHYRIN BIOSYNTHESIS FROM GLYCINE,  $\alpha$ -AMINO- $\beta$ -KETOADIPIC ACID, AND PORPHYRINOGEN.) *Kokumin Eisei* 28:180-4; 185-8; 189-94, 1959.

In acute Pb poisoning in rabbits, porphyrin formation was highly increased even in the early stage. Red blood cells and bone marrow showed remarkable increases of coproporphyrin counts in acute and of protoporphyrin values in chronic Pb poisoning. In determining the porphyrin content of the blood and urine of 31 Pb workers, it was found that the protoporphyrin in the blood cells always increased markedly in chronic Pb poisoning. The importance of porphyrin metabolism in Pb poisoning was discussed. In Pb-poisoned rabbits, protoporphyrin formation from glycine,  $\alpha$ -amino- $\beta$ -ketoacidic acid, and porphyrinogen was highly promoted; the red blood cells and bone marrow were rich in porphyrin precursors. (From Chemical Abstracts 55:2933, 1961)

- 844 Ishikawa, I.: STUDIES ON THE LEAD CONTENT IN THE BODIES OF TEST ANIMALS. 3. LEAD IN BLOOD, URINE AND FECES OF RATS. *Osaka City Medical Journal* 5:109-16 (Mar.), 1959. In: Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 1, April 1949-March 1959, pp. 287-94.

Male adult rats were used throughout. For the determination of Pb in blood, 69 rats were available; for Pb in urine and feces, groups 50 each. A spectrochemical method was used. The Pb values in blood and urine followed a logarithmic normal distribution curve with upper limits of 62 and 78  $\mu$ g/100 g, and means of 25.88 and 21.18  $\mu$ g/100 g, respectively. The arithmetic mean of Pb in feces was 65  $\mu$ g/10 g.

- 845 Ishikawa, I.: STUDIES ON THE LEAD CONTENT IN THE BODIES OF TEST ANIMALS. 2. LEAD IN BLOOD, URINE, AND FECES OF THE GUINEA PIGS. *Osaka City Medical Journal* 5:99-107 (Mar.), 1959. In: Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 1, April 1949-March 1959, pp. 278-86.

The Pb values in blood and urine of 68 normal adult male guinea pigs followed a logarithmic normal distribution curve with upper limits 79 and 83  $\mu$ g/100 g, respectively. Pb in feces had a wide distribution range with the arithmetic mean of 83

µg/10 g. (The analytical method used was developed by Horiuchi et al in 1953.)

- 846 Ishikawa, I.: STUDIES ON THE LEAD CONTENT IN THE BODIES OF TEST ANIMALS. 4. LEAD CONTENT IN THE ORGAN-TISSUES OF RATS. Osaka City Medical Journal 5:117-9 (Mar.), 1959. In: Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 1, April 1949-March 1959, pp. 295-7.

About 10 specimens per organ of rats were analyzed. The Pb values per 10 g fresh weight were the following: Brain, <10-280 µg; lungs, trace-62 µg; heart, trace-320 µg; liver, trace-240 µg; pancreas, trace-29 µg; stomach, trace-25 µg; spleen, trace-10 µg; kidneys, trace-180 µg; intestines, trace-250 µg; muscle, 10-110 µg; bone, 18-2400 µg.

- 847 Iwai, S. (Keio Univ., Japan): AN EXPERIMENTAL STUDY CONCERNING DIAGNOSTIC VALUE OF SYMPTOMS OF LEAD POISONING. Japan Journal of Industrial Health (Tokyo) 1: 746-55 (Nov.), 1959.

Rabbits were exposed to various concentrations of Pb oxide dusts over a 1 1/2-yr period for a maximum of 4 hr/day, 3 days/wk. Symptoms such as stippled cells (SC), polychromasia, reticulocytosis, hemoglobin (Hb) decrease and urinary coproporphyrin (CP) increase were estimated and serum protein fractions were analyzed by paper electrophoresis. To observe disappearance of signs after cessation of exposure, a 2-mo period free of exposure was inserted. It was found that urinary CP level and the SC counts were increased before anemia developed. The increase of SC did not occur until 4-5 mo after the urinary CP became positive. The decrease of Hb occurred immediately after the rise of SC counts. From these facts the author considers it doubtful that the increased excretion of urinary CP is merely due to the blocking by Pb of Fe incorporation into protoporphyrin. Urinary CP, SC counts and reduction of Hb were increased parallel with the amount of Pb inhaled. However, the reticulocyte counts, polychromasia as well as changes of serum protein, ie, elevation of α<sub>2</sub> and γ-globulin levels and decrease of the albumin level had no relation with the degree of Pb absorption. Reduced Hb and increased SC returned rapidly to the normal value after cessation of inhalation, but urinary CP recovered with delay.

- 848 Kerr, S.H., and Brogdon, J.E. (Agr. Exp. Station, Gainesville, Fla.): RELATIVE TOXICITY TO MAMMALS OF 40 PESTICIDES. Agricultural Chemicals 14:44-5, 135-6 (Sept.), 1959.

Pb arsenate is included in the tabulation of lethal doses. According to data found in the literature, (Lehman, 1956) the acute LD<sub>50</sub> of Pb arsenate given orally to rats is 100 mg/kg. This varies considerably with different mammals, and as far as humans are concerned, this can only be used as an indication of relative toxicity.

- 849 Koelsch, F. (Erlangen, Germany): Bleivergiftung und Zahnausfall. (LEAD POISONING

AND LOSS OF TEETH.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 9:114-7 (May), 1959.

The literature concerning the effect of Pb poisoning on the teeth of men or experimental animals (cats) is reviewed. The author reports then his own experiments with 2 rabbits and 2 cats which were poisoned by feeding Pb carbonate along with their food. The first symptoms of poisoning, such as anorexia, loss of weight, Pb line, polychromasia and stippled cells occurred within 1 wk. The gums had become pale and atrophic and the teeth in the rabbits (but not in the cats) became loose and fell out. Necropsy showed grains of Pb in the jaw bones, the gingival mucosa and the dental pulp. Osteoclasia and bone atrophy ensued producing loosening and falling out of the teeth. The possible mechanism of these reactions is discussed. The author points out that loss of teeth due to Pb poisoning must be considered as an occupational hazard and dentures should be provided in such cases. (17 references)

- 850 Koike, S. (Univ. Kyoto, Japan): (ACTIVITY OF δ-AMINOLEVULINIC ACID DEHYDRASE (ALAD) IN LEAD POISONING.) Kokumin Eisei 28:612-6, 1959.

The activity of ALAD is decreased in the bone-marrow of Pb-poisoned rabbits, but it is increased in the spleen and blood of phenylhydrazine-administered rabbits. (From Chemical Abstracts 55: 2934, 1961)

- 851 Kośmider, S., and Petelenz, T. (Silesian Acad. Med., Zabrze, Poland): Badania elektrokardiograficzne w doświadczalnej ołowicy u królików. (ELECTROCARDIOGRAPHIC STUDIES IN EXPERIMENTAL LEAD POISONING IN RABBITS.) Postepy Higieny i Medycyny Doświadczalnej 13:765-75 (Nov.-Dec.), 1959.

The patterns of the EKG were studied in 17 rabbits (2.5-3.5 kg weight) by means of 59 recordings. A drawing is presented of the various leads used on the rabbit. Changes were then followed in 13 rabbits in 71 EKG's after induction of acute Pb poisoning by the administration of 5.9 mg Pb acetate/kg iv. The pathologic changes are described and illustrated in 3 tracings. (18 references)

- 852 Kośmider, S., Szczurek, Z., and Petelenz, T. (Silesian Acad. Med., Zabrze, Poland): Histopatologia układu sercowo-naczyniowego w ołowicy u królików. (HISTOPATHOLOGY OF THE CARDIOVASCULAR SYSTEM IN LEAD POISONING IN RABBITS.) Postepy Higieny i Medycyny Doświadczalnej 13:777-80 (Nov.-Dec.), 1959.

Twenty-nine rabbits (2.5-4.5 kg weight) were injected iv with Pb acetate in doses of 5.9 mg/kg body weight daily for 24 days. EKG's were performed on 13 rabbits, the results of which are tabulated in detail and related to histopathologic findings.

- 853 Kubota, K. (Univ. Kyushu, Japan): EFFECT

OF PARATHION, TETRAETHYLLEAD, CARBONDISULFIDE, AND HEAVY METALS ON TISSUE METABOLISM. Igaku Kenkyu 29, No. 11:4223-47, 1959.

Parathion, tetraethyllead (TEL), Hg, carbon disulfide, or Pb was administered to male mice, weighing ~20 g for ~3 mo, and the respiratory metabolism of their kidney, brain, spleen, and liver was determined by Warburg's first method. The effect of glutathione administration on the tissue metabolism of mice which had been acutely poisoned with parathion, carbondisulfide, or TEL was also investigated. The Qo2 of the kidney, brain, spleen, and liver of normal mice were -16.37, -10.78, -7.70, and -8.34  $\mu$ l/mg, respectively. In the experiment with TEL, 1 hr after injection of 0.1 cc of 60% aqueous solution, Qo2 values for the kidney, brain, spleen, and liver were -13.25, -7.13, -6.3 and -6.92  $\mu$ l/mg, respectively. When the animals lay on their side in a critical state, the Qo2 values were -13.54  $\mu$ l/mg for the kidney, -6.24 for the brain, -6.7 for the spleen, and -6.0 for the liver, and while dying the figures were -11.46, -6.14, -6.24, and -4.46  $\mu$ l/mg, respectively. Two mg of glutathione were sc injected to a group of mice and 1 hr later another 2 mg of glutathione and 0.1 cc of 60% TEL solution were similarly injected. The Qo2 values for the kidney, brain, spleen, and liver, 1 hr after the last injection were -14.67, -7.55, -5.78, and -7.23  $\mu$ l/mg, respectively. The slight improvement of Qo2 in the brain was significant.

Mice were sc injected each with 0.1-0.5 cc Pb acetate solution (equivalent to 0.1-0.5 mg of the solute) every day or every other day, 52 times in all, for ~90 days, and a total of 14.6-21.45 mg. The Qo2 values at the end of the treatment averaged -9.95  $\mu$ l/mg for the kidney, -8.48 for the brain, -6.35 for the spleen, and -6.45 for the liver.

- 854 Link, R.P.: CHEMICAL POISONINGS IN ANIMALS. Mod. Vet. Practice 40, No. 1:36-43, 1959.

A review of the sources, toxic action, clinical signs, diagnosis, post mortem findings and treatment of poisoning by Pb, As, Hg, nitrate, coumarin, chlorinated hydrocarbon and organic phosphorus parasitocides, and sodium fluoroacetate. (From Veterinary Bulletin 29:Abstr. No. 3614, 1959)

- 855 Masuda, Y. (Nippon Univ., Tokyo, Japan): (THE EFFECTS OF POTASSIUM SODIUM CITRATE ON LEAD INTOXICATION.) Nichidai Igaku Zasshi 18:2983-94, 1959.

Male rabbits (12) ranging in weight from 2-2.6 kg were divided into 4 groups: (1) control, (2) given KNa citrate (KNaC) sc (1.5 ml/kg body weight), (3) given Pb orally (0.02 g/kg), (4) Pb in conjunction with KNaC. The experiments were conducted for 7 consecutive days. The effects of KNaC on Pb intoxication were studied, chiefly from the viewpoint of the blood picture. During the period of injection blood was taken for examination from each group every other day, and after injection was finished the blood was collected at intervals of 5-7 days. The rabbits were weighed daily. An increase in the stippled cell count was inhibited in Groups 3 and 4, but to a greater degree in Group 4. An

increase in the lymphocyte and monocyte counts which took place in Group 3 was inhibited in Group 4. No difference in changes in the eosinophil polymorphonuclear leukocyte count was noted between Groups 3 and 4. The basic polymorphonuclear leukocyte count was increased by KNaC in Groups 2 and 4. A decrease in the pseudo eosinophil polymorphonuclear leukocyte count was also produced by the administration of KNaC. The most striking increase in the erythrocyte count developed in Group 4. Pb and KNaC may act jointly. Group 4 showed the most significant increase in the leukocyte and reticulocyte counts. Body weight was decreased after the various drug injections were stopped. KNaC had an antagonistic effect on Pb intoxication in part, but its therapeutic effects were small. (From Chemical Abstracts 61:13796, 1964)

- 856 Matsukubo, M.: (BINDING OF LEAD WITH SERUM PROTEINS.) Tokyo Jikeikai Ika Diagaku Zasshi 74:2484-94, 1959.

<sup>210</sup>Pb-containing solution was incubated with human serum in an ice-box for 33 hr. The mixture was fractionated by paper electrophoresis. Radioactivity was observed in the albumin and  $\alpha_2$ -globulin fractions of the serum of rats injected with <sup>210</sup>Pb. (From Chemical Abstracts 55:23642, 1961)

- 857 Montesana, G.: L'azione dell'acido tiotico nell'intossicazione sperimentale da piombo. (EFFECT OF THIOCTIC ACID IN EXPERIMENTAL LEAD POISONING.) Folia Medica (Naples) 42:399-409 (Apr.), 1959.

After a short survey of the information available on thioctic acid and its possible therapeutical uses the author describes results obtained by treating Pb-poisoned guinea pigs with thioctic acid. The same dosages produce different effects in healthy and Pb-poisoned guinea pigs. While 10 mg/kg of body weight/day of thioctic acid had a eutrophic effect on healthy animals, a dose of 25-50 mg induced a diseased condition. In guinea pigs poisoned with neutral Pb acetate 10 mg doses of thioctic acid failed to produce any protective action, 25 mg had a moderately beneficial action and doses of 50 mg had a very obvious beneficial effect. (From author's summary).

- 858 Miyazaki, M. (Shinshu Univ., Matsumoto, Japan): (EFFECTS OF HEAVY METALS ON COMPLEMENT ACTIVITY.) Med. J. Shinshu Univ. 4:335-43, 1959.

The hemolytic action of the complement from guinea pig serum was tested on bovine red cells. Chlorides of heavy metals, including Pb chloride, at concentrations of 0.0005-0.02M, depending on the metal, inhibited the hemolytic action of the complement. Its activity, however, was restored when the inhibitory salt was removed by dialysis. There was no evidence that the heavy metals had a destructive action on any factor necessary for the hemolytic reaction. (From Chemical Abstracts 56:3979, 1962)

- 859 Mokranjac, M.S., and Radmić, S. (Inst. Chim. Toxicol., Belgrade, Yugoslavia): (ACTION OF LEAD AND COBALT ON THE NUMBER



OF ERYTHROCYTES AND ON THE PROPORTION OF THESE ELEMENTS IN THE BLOOD OF RATS PARTIALLY POISONED BY LEAD.) Glasnik Shumarskog Fak. 22:499-507, 1959.

The normal Pb level in the blood of rats was 12 µg%. Daily intraperitoneal treatment with 0.5-4 mg Pb/kg body wt reduced the erythrocyte count sharply. The effect of simultaneous administration of Pb and Co was also studied. (From Chemical Abstracts 54:13426, 1960)

- 860 Mokranjac, M.S., and Soldatović, D. (Fac. Pharm., Beograd, Yugoslavia): (EFFECT OF SOME ANTIBIOTICS AND SOME SULFONAMIDES ON THE MOBILIZATION OF LEAD BY ANIMALS POISONED WITH SMALL QUANTITIES OF LEAD.) Acta Pharm. Jugoslav. 9:19-26, 1959.

The activity of streptomycin, p-aminosalicylate, terramycin, tetracycline, gantrisin, and sulfadiazine on the Pb mobilization in sheep poisoned with small amounts of Pb was examined. The antibiotics caused a stronger mobilization, visible in an increased Pb level in blood and in urine, while on the contrary the sulfonamides were without influence on the mobilization of Pb. (From Chemical Abstracts 53:14312, 1959)

- 861 Nishino, S. (Gifu Prefectural Med. School, Japan): EFFECTS OF Ca-EDTA AND PARATHYROID HORMONE UPON THE EXPERIMENTAL ACUTE LEAD POISONING. Japanese Journal of Industrial Health 1:607-14 (Nov.), 1959.

Parathyroid hormone (PTH) and CaEDTA were administered iv, independently or combined, to rabbits at an extremely early stage of acute Pb poisoning, and the effect of these drugs in removing Pb from the body was observed. It was found that with PTH injection, the quantity of Pb in the urine did not increase remarkably; however, PTH had the effect of mobilizing Pb deposited within the bone tissue and thus the combined administration of PTH and CaEDTA accelerated removal of Pb from the body. No ill effect developed from PTH injection. (From author's English summary; 12 references)

- 862 Odescalchi, C.P., and Andreuzzi, P. (Univ. Pavia, Italy): Comportamento della resistenza capillare nell'intossicazione subacuta da piombo; ricerche sperimentali sul ratto. (CAPILLARY RESISTANCE IN SUBACUTE LEAD POISONING. EXPERIMENTS IN RATS.) Folia Medica (Naples) 42:111-31 (Feb.), 1959.

Rats were injected ip and iv daily for 4 days with 30 mg Pb acetate/kg to induce subacute poisoning; capillary resistance was measured daily from the day before experiment to the 8th day from the start, and 5 days after termination of treatment. In the 2nd series, the rats received at the same time as Pb as above, ascorbic acid, methylescutol, cortisone, and 5-hydroxytryptamine. The results showed that the reduction in capillary resistance observed in subacute poisoning must be considered to be due to functional disturbance, since under the action of the above substances, this reduction

was rapidly reversed to normal. The changes are attributed to a relative deficiency in cortico-adrenal secretions. (26 references)

- 863 Oliver, W.T., Geib, L.W., and Sorrell, B.: LEAD POISONING IN A DOG. Can. J. Comp. Med. 23:21-2, 1959.

Pb poisoning in a dog is described which resulted from eating linoleum. Symptoms included listlessness, inappetence, vomiting, constipation followed by diarrhea, muscular spasms and convulsions. Acidophilic, acid-fast inclusion bodies in the nuclei of renal parenchymal cells, degenerative changes in the Purkinje cells, together with degenerative changes in the parenchymal organs, and cerebral edema, are regarded as characteristic of Pb poisoning in this species. (From Veterinary Bulletin 29:Abstr. 2637, 1959)

- 864 Oshima, M.: (STUDIES ON THE LEAD POISONING. PART 3, EXPERIMENTAL STUDIES ON THE URINARY CALCIUM AND LEAD EXCRETION IN LEAD POISONING.) Shikoku Acta Med. 15:701-10 (Sept.), 1959.

Rabbits were injected subcutaneously with Pb acetate. No significant changes in the level of serum and urinary Ca were noted between the experimental and control animals. After EDTA administration insignificant transitory changes of the serum Ca level occurred which increased with the size of the EDTA dose. There was a remarkable transitory increase of urinary Pb. No significant differences of Pb concentration were noted in liver and bone. (From Bulletin of Hygiene 35:347-8, 1960)

- 865 Pernis, B., Bairati, A., Jr., and Giubileo, M. (Univ. Milan, Italy): Alterazioni delle emazie nel saturnismo sperimentale visibili al microscopio elettronico. (ALTERATIONS OF THE RED BLOOD CELLS IN EXPERIMENTAL SATURNISM, AS OBSERVED WITH THE ELECTRON MICROSCOPE.) Medicina del Lavoro 50:358-67 (May), 1959.

Guinea pigs, intoxicated by daily oral administration of 2-3 ml of 10% Pb acetate for 15 days, developed a syndrome of Pb anemia with stippled erythrocytes varying from 35,000-50,000/million. Examination of ultrathin sections of erythrocytes and erythroblasts by electron microscope showed the presence of swollen and altered mitochondria and/or clusters of dense granules with high electron scattering power (ferritin molecules).

Since it is known that Pb interferes with the synthesis of heme and that several stages of this synthesis take place in the mitochondria, it is assumed that the morphological changes in the mitochondria are caused by biochemical alterations due to Pb. Also, the accumulation of ferritin might be related to the reduced utilization of Fe for heme formation. (28 references)

- 866 Savay, G., and Csillik, B. (Univ. Szeged, Hungary): LEAD-REACTIVE SUBSTANCES IN PERIPHERAL SYNAPSES. Experimentia 15:396-7 (Oct. 15), 1959.

Under urethane anesthesia, rats were injected percutaneously into the short flexor muscle of the hind pad with a solution of 1 g Pb nitrate, urea and formalin, and killed 15 min later. Frozen sections showed the characteristic microscopic pattern of the subneural apparatus of the striated muscles and the synaptic structures of the ganglia. The authors discuss the question whether the Pb reactive material is identical with SH groups or with cholinesterase. (14 references)

- 867 Sroczyński, J.: Układ krwiotwórczy królików w ostrym zatruciu ołowiem. (HEMOPOIETIC SYSTEM IN ACUTE LEAD POISONING.) Postepy Hig. i Med. Doswiadczalnej 13, No. 6:741-53, 1959.

Intravenous injection of Pb oxide in doses of 4-7 mg/kg led to acute intoxication ending in death. Anemia accompanied by erythroblastemia occurred rapidly. The increase in sideroblasts indicates weakening of the ability of erythrocytes to use Fe. The pseudoeosinophils displayed considerable hypoplasia in conjunction with considerable disturbance of erythrocytopoiesis. The clinical picture is similar to Fe-deficiency anemia. Pb acts first on the bone marrow, and then produces aplasia. Pb poisoning basically produces the same hematological changes in rabbits as it does in man. (From Biological Abstracts 35:59541, 1960)

- 868 Sroczyński, J., and Jonderko, G. (Silesian Acad. Sci., Zabrze, Poland): Poziom glutationu we krwi w przebiegu ostrej ołowicy u królików. (BLOOD GLUTATHIONE LEVEL DURING THE COURSE OF ACUTE PLUMBISM IN RABBITS.) Postepy Higieny i Medycyny Doswiadczalnej 13:755-8 (Nov.-Dec.), 1959.

Pb acetate (4 mg/kg) was injected iv into 12 rabbits, and the glutathione (GT) level of the blood was determined by Rausch's method. The longest survival was observed in animals with the least decrease in GT or with its higher concentration before poisoning. (As determined in all rabbits, 31-44 mg% before, to levels as low as 10 mg% after poisoning.)

These observations suggested to the authors that GT was a protective factor in Pb poisoning in rabbits.

- 869 Sroczyński, J., and Piekarski, B.: Obraz białek surowicy krwi królików w ostrym zatruciu ołowiem. (SERUM PROTEIN PICTURE IN THE BLOOD OF RABBITS IN ACUTE LEAD POISONING.) Postepy Hig. i Med. Doswiadczalnej 13, No. 6:781-5, 1959.

Quantitative measurements of blood plasma proteins and their fractions were taken at the start of the series, at onset of anemia, and subsequently. On the average albumin decreased, and globulin increased, but not in the same absolute amounts, so that total protein decreased. The most clearcut increase was in  $\beta$ -globulin, while  $\alpha_1$  and  $\alpha_2$  also increased.  $\gamma$ -Globulin was variable. (From Biological Abstracts 35:59542, 1960)

- 870 Sroczyński, J., and Wieczorek, M.: Bada-

nia anatomopatologiczne u królików w ostrym zatruciu ołowiem. (ANATOMIC AND PATHOLOGIC STUDIES IN RABBITS IN ACUTE LEAD POISONING.) Postepy Hig. i Med. Doswiadczalnej 13, No. 6:759-63, 1959.

Autopsies were performed on 20 rabbits who died from experimental Pb poisoning and changes in the liver, kidneys, heart muscles, lungs, intestinal tract, and adrenals were described. The results are similar to those obtained by other investigators of the results of Pb poisoning. (From Biological Abstracts 35:59543, 1960)

- 871 Stover, B.J. (Univ. Utah, Salt Lake City): Pb<sup>212</sup> (ThB) TRACER STUDIES IN ADULT BEAGLE DOGS. Proceedings of the Society of Experimental Biology and Medicine 100, No. 2: 269-72, 1959.

Metabolism of shortlived <sup>212</sup>Pb was studied in the beagle following intravenous (iv) injection, and after transfusion of blood cells tagged with <sup>212</sup>Pb in vitro. The latter proved to be a satisfactory method to determine blood volume. When <sup>212</sup>Pb was given iv, in vivo tagging of blood cells occurred. A maximum of 65% of the activity in cells was reached at 2-3 hr after injection, then <sup>212</sup>Pb in blood cells decreased with a biological  $t_{1/2}$  = 37 hr and an effective  $t_{1/2}$  = 8.2 hr. The same decrease occurred after injection of in vitro tagged cells. In both experiments essentially all <sup>212</sup>Pb decayed inside the dog. Half decayed in blood in the in vivo tagging experiment; 4/5 decayed in blood when tagging was done in vitro. (From author's summary)

- 872 Sumiya, C. (Univ. Kyoto, Japan): (A FOLLOW-UP STUDY OF PORPHYRIN METABOLISM IN LEAD POISONING. I. RELATION BETWEEN GLYCINE AND REDUCED GLUTATHIONE (GSH)). Kokumin Eisei 28:617-26, 1959.

In rabbits, Pb poisoning causes an increase in glycine in red blood cells and bone marrow. (From Chemical Abstracts 55:1752, 1961)

- 873 Sumiya, C. (Univ. Kyoto, Japan): (A FOLLOW-UP STUDY OF PORPHYRIN METABOLISM IN LEAD POISONING. II. IRON INCORPORATION INTO THE PORPHYRIN RING IN LEAD POISONING.) Kokumin Eisei 28:627-35, 1959.

The biosynthesis of protoporphyrin, coproporphyrin, and uroporphyrin in chicken red blood cells is markedly inhibited by Pb acetate, while Fe incorporation into porphyrin is not inhibited as much, and both Fe<sup>++</sup> and Fe<sup>+++</sup> can be incorporated. In Pb poisoning heme synthesis proceeds markedly in the peripheral blood, which may be ascribed to the enzyme system in the mitochondria existing in the basophilic stippled cells and reticulocytes. The activity of carboxylase in converting coproporphyrin to protoporphyrin seen in the mitochondria of liver and bone marrow is not reduced even in Pb poisoning. (From Chemical Abstracts 55:1752, 1961)

- 874 Sykora, J., Kocher, Z., and Eybl, V.: (EFFECT OF CaNa<sub>2</sub>EDTA ON THE EXCRETION OF LEAD IN EXPERIMENTAL LEAD POISONING.)

- Cesk. Fysiol. 8:325 (July), 1959. (From Cumulative Index Medicus 1:A-1247, 1960)
- 875** Tanabe, Y. (Univ. Kyoto, Japan): (METABOLISM OF  $\delta$ -AMINOLEVULINIC ACID (ALA) AND PORPHOBILINOGEN (PBG) IN LEAD POISONING. I. AMOUNTS OF ALA AND PBG IN THE URINE AND BLOOD.) Kokumin Eisei 28:386-97, 1959.
- In rabbits, Pb poisoning caused an increase of ALA and PBG in urine and blood, and increased coproporphyrin in urine. In porphyrinuria of the hepatic type, caused by allylisopropylacetamide or allylisopropylacetylcarbamide (Sedormid), PBG is excreted in a larger amount than ALA, as contrasted with Pb poisoning. (From Chemical Abstracts 55:2933, 1961)
- 876** Tanabe, Y. (Univ. Kyoto, Japan): (METABOLISM OF  $\delta$ -AMINOLEVULINIC ACID (ALA) AND PORPHOBILINOGEN (PBG) IN LEAD POISONING. II. INTERMEDIARY METABOLISM OF PORPHYRIN WITH ALA ADMINISTRATION.) Kokumin Eisei 28:552-9, 1959.
- Intravenous injection of ALA into Pb poisoned, normal, and allylisopropylacetamide-administered rabbits, respectively, caused excretion of large amounts of ALA, PBG, uroporphyrin and coproporphyrin converted from ALA. In Pb poisoning, urinary coproporphyrin was twice as high as that of normal rabbit, and excretion of PBG and uroporphyrin was significantly reduced. With allylisopropylacetamide, all 3 were increased. (From Chemical Abstracts 55:2934, 1961)
- 877** Tanabe, Y. (Univ. Kyoto, Japan): (METABOLISM OF  $\delta$ -AMINOLEVULINIC ACID (ALA) AND PORPHOBILINOGEN (PBG) IN LEAD POISONING. III. EFFECTS OF Ca ETHYLENEDIAMINETETRAACETATE (EDTA) UPON THE INTERMEDIARY METABOLISM OF PORPHYRINS.) Kokumin Eisei 28:560-7, 1959.
- In normal rabbits, urinary excretion of ALA, PBG, coproporphyrin or uroporphyrin is not affected by the administration of CaEDTA, but in poisoned rabbits, small doses of it cause excretion of ALA and PBG in large amounts, while no increase is observed at large doses. (From Chemical Abstracts 55:2934, 1961)
- 878** Tarabaeva, G.I.: (DISTRIBUTION OF RADIOACTIVE LEAD IN THE SEXUAL ORGANS OF ANIMALS.) Izvest. Akad. Nauk Kazakh. SSR Ser. Med. i Fiziol. 1959, No. 2:95-101.
- In guinea pigs, orally administered radioactive Pb was found in highest concentrations in the chorion, placenta, liver, and spleen. Animals previously administered 2 ml/kg of 2% Pb acetate for 5-6 mo, showed lower values in the tissues after 1 day, but greater than normal values after 5 days. (From Chemical Abstracts 54:23059, 1960)
- 879** Timm, F., and Neth, R. (Max-Planck-Inst. Exptl. Med., Göttingen, Germany): Die normalen Schwermetalle der Niere. (NORMAL OCCURRENCE OF HEAVY METALS IN THE KIDNEY.) Histochemie 1, No. 6:403-19, 1959.
- In histochemical examination of frozen sections of kidneys from various animals (horse, cattle, sheep, goat, dog, cat, pigs, rabbit, guinea pig, rat, mouse) small quantities of Fe, Zn, Cu, Cd, Pb could be detected by means of the sulfide reaction. (The method used is described in detail.) The detectable fractions of the trace elements were present predominantly in the cell plasma, and found to be mobile; only very seldom were they seen in the nuclei of normal kidneys. Fe, Zn, Pb and Hg were found to be absorbed and emitted by the epithelial cells of the glomerulus. They were also detected in the basement membrane, in the tubular cells and lumina. A narrow ridge below the brush border of the cells was found to bind metals with an affinity to S, Zn, Cu, Pb, Hg.
- 880** Van Esch, G.J., and Van Genderen, H.; Walpole, A.L., and Williams, M.H.C.: Personal Communication (on Lead-induced Tumors), 1959.
- See Abstract No. 891.
- 881** Voigt, G.E., and Larsson, L.E. (Univ. Lund, Sweden): DISTRIBUTION OF LEAD AND MERCURY IN FEMUR OF ACUTELY POISONED RATS. Acta Pathologica et Microbiologica Scandinavica 47:256-8, 1959.
- When rats were given Pb acetate im and killed after 15 min-4 hr, the Ag sulfide method showed the presence of Pb around and in Haversian canals.
- 882** Yokohashi, G. (Inst. Publ. Health, Tokyo, Japan): ABSORPTION AND EXCRETION OF LEAD THROUGH WALLS OF DIGESTIVE CANALS. ESPECIALLY ON THEIR RELATIVE EASE BY SEGMENTS OF CANALS. Bulletin of the Institute of Public Health (Tokyo) 8:14-21, 1959.
- Experiments with rabbits showed, by use of  $^{210}\text{Pb}$ , that absorption of Pb occurred mostly in the small intestine, while the stomach and colon were very inactive, and the cecum was the most inactive. In the excretion of Pb, the small intestines with the duodenum were the most active, followed by the colon, while the stomach and the cecum were very inactive. It is concluded that Pb passes freely in either direction through the membrane cells of the digestive canals which show their own resistance to the passage of Pb. (From author's English summary)
- 883** Yokohashi, G. (Inst. Pub. Health, Tokyo, Japan): IONIC AND NON-IONIC LEAD IN BLOOD PLASMA AND CELLS OF RABBITS. Bulletin of the Institute of Public Health (Tokyo) 8:22-8, 1959.
- Rabbits were injected for 5 days with doses of 1.5 mg/Pb as chloride daily, to estimate the relative amount of ionic and non-ionic Pb in blood components of the animals. For Pb in blood plasma, extraction with Na diethyldithiocarbamate and dialysis with cellophane membrane and adsorption by cation-exchange resin were applied. Pb was also determined by measuring the added  $^{210}\text{Pb}$  as a tracer. Although ionic Pb could be estimated satisfactorily in blood plasma, by the above methods, its ratio to non-ionic Pb varied so widely that no definite value could be established. Using fractionation

of blood cells into endoplasm and stroma, using toluene, showed 80% of the Pb to be present in the latter and 20% in the former. The relative amounts of Pb in the endoplasm were 10-20% for the ionic, and the non-ionic which were bound by hemoglobin constituted 80-90%. Endoplasm was fractionated into heme and globin by hydrolysis with acetone-HCl mixture; about 90% of the Pb was in the heme fraction and only 10% in the globin fraction; however, >90% was found to be absorbed on cation-exchange resin for the 1.5% HCl hydrolyzate of endoplasm. Therefore, the whole amount of Pb in the heme fraction cannot be interpreted to be of metal-porphyrin form, for Pb that was dissociated from the globin moiety by acid may have been transferred into the acid-acetone layer (heme fraction). (From author's English abstract.)

## 1960

- 884** Abramova, Zh.I., and Kuz'minskaya, G.N.: (THE SPECIFIC FEATURES IN THE PICTURE OF LEAD POISONING IN RATS WHO HAD SUSTAINED RADIATION INJURY.) Radiol. 5:80-1 (Dec.), 1960.

Compensatory hematopoietic reactions to Pb poisoning were studied in 123 male rats 1-3 mo after whole-body irradiation with 300 r and exposure for 24 days to Pb poisoning (daily doses of 0.3 ml of 40% solution/100 g weight). The irradiated animals exhibited a higher resistance to toxic anemia and a much more rapid development of young cells in the peripheral blood. However, along with increased erythropoiesis were observed increased disturbances in the bone marrow and greater degenerative dystrophic changes in the spleen and liver. (From Nuclear Science Abstracts 15:Abstract No. 12784, 1961)

- 885** Afonova, V.N.: THE METABOLISM OF PROTEINS AND PROTEIN NITROGEN IN THE BLOOD SERUM IN EXPERIMENTAL LEAD-POISONING. Sb. Nauchn. Tr. Ryazansk. Med. Inst. 12, No. 2:129-32, 1960.

Administration per os of an aqueous solution of Pb acetate (at the rate of 10 mg/kg) to rabbits elicited a shift of the blood proteins. Total proteins were reduced by an average of 17.64%; globulins were increased by an average of 21.66%. In cases of chronic Pb poisoning the blood non-protein N rose to 64.18-157.77 mg%. (From Chemical Abstracts 59:10683, 1963)

- 886** Aldanazarov, A.T., and Sabdenova, Sh.S.: (EFFECT OF VITAMIN B<sub>12</sub> AND FOLIC ACID ON THE APPEARANCE AND DEVELOPMENT OF LEAD-POISONING SYMPTOMS IN EXPERIMENTAL ANIMALS.) Trudy Inst. Kraevoi Patol. Akad. Nauk Kazakh. SSR 8:62-8, 1960.

Simultaneous administration of vitamin B<sub>12</sub> with toxic doses of Pb (1 ml/kg body wt of 1% Pb acetate daily for 3-7 mo) to rabbits delayed the appearance and reduced the severity of Pb intoxication symptoms. Better results were obtained when both vitamin B<sub>12</sub> and folic acid were administered. No reduction of hemoglobin level was observed in animals receiving both vitamins, and in some cases

basophilic stippling was completely absent. (From Chemical Abstracts 55:26264, 1961)

- 887** Baetjer, A.M., Joardar, S.N.D. and McQuary, W.A. (John Hopkins Univ., Baltimore, Md.): EFFECT OF ENVIRONMENTAL TEMPERATURE AND HUMIDITY ON LEAD POISONING IN ANIMALS. Archives of Environmental Health 1:463-77 (Dec.), 1960.

Swiss strain male mice were used in most of the experiments. Groups of mice, injected ip or iv with approximate LD<sub>50</sub> doses of Pb acetate or nitrate and exposed to various temperatures, showed a higher mortality rate and shorter average survival time at 95°F than at 72°F. This effect of high temperature on acute Pb poisoning was more marked when the exposure followed immediately after the injection of Pb than when exposure to heat also preceded the Pb poisoning. The results were similar whether a high or low humidity accompanied the high temperature. Prolonged exposure to heat preceding the injection of Pb did not reduce the harmful effect of heat exposure. Removal from heat at nights alleviated the effect to some extent. Exposure of rats to high temperature similarly increased their mortality following the iv injection of Pb. Mice exposed to an environmental temperature of 60°F had a higher mortality and longer average survival time than those exposed to 72°F temperature when injected ip with Pb, but no significant differences were found when the Pb was injected iv. Mice with chronic Pb poisoning produced by repeated injections of Pb, began to die sooner and had a higher mortality when exposed to a high temperature following cessation of Pb injections.

Severe dehydration produced by restricting water consumption increased the mortality of mice from acute Pb poisoning at all temperatures. The effect was much more marked when the Pb was injected ip than when injected iv. An increase in basal metabolism at normal temperature, produced by thyroxine, increased the susceptibility of female mice to Pb poisoning comparable to that produced by heat but did not significantly affect male mice. The influence of food and water restriction on mortality was also studied. Food restriction and isolation at normal temperature did not increase susceptibility to Pb. (24 references)

- 888** Bezzubov, A.D. Vasil'eva, O.G., and Khatina, A.I. (Inst. Ind. Hyg. Occup. Dis., Acad. Med. Sci., USSR): Vliyaniye pektina na vyvedeniye svintsya iz organizma. (INFLUENCE OF PECTIN ON THE ELIMINATION OF LEAD FROM THE BODY.) Gigiena Truda i Professional'nye Zabolevaniya 4, No. 3: 32-7, 1960.

In in-vitro experiments, the authors had found that in an aqueous medium at pH 3.76, pectin bound 91-92% of Pb, and in a gastric acid medium, 52-69%. Mice, rats, guinea pigs and rabbits received various oral doses of Pb acetate and pectin; in some experiments, CaNa<sub>2</sub>EDTA was also administered with the pectin. Although in acute poisoning at high dosage of Pb (500 mg/kg) full protection was not obtained (of the Pb group 5 of 10 animals died, and of the Pb + pectin + EDTA group, 2 of

10 died), in chronic poisoning the drugs produced marked increases in the elimination of Pb. With pectin, the largest amounts were eliminated in the 5th-6th wk after start of Pb dosage. The administration of pectin and EDTA greatly ameliorated the signs of Pb poisoning.

- 889** Boyadzhiev, V. (Dept. Health, Ind. Hyg., Clin. Occup. Dis., Sofia, Bulgaria): Vliyanie na nyakoi beltuchinni i mastni rezhimi za vuznikvaneto i protichaneto na olovnoto otravyane. (EFFECT OF CERTAIN PROTEIN AND FAT DIETS ON THE APPEARANCE AND COURSE OF LEAD POISONING.) Nauchni Trudove na Visshiya Meditsinski Institut, Sofia 39, No. 3:171-88, 1960.

The effect of 4 different diets, low and high fat, and low and high protein, respectively, on the higher nervous system was studied in white rats given orally 213 mg Pb acetate/kg body weight/day for 3 mo. The results showed that the variables in the diets did not prevent the appearance of Pb poisoning, but influenced the severity of its course according to the criteria studied. Between the 1st and the 9th day of poisoning, alterations in the conditioned reflex activity of rats on diets 1, 2, 3, and 4 (independently of the diet) were observed which corresponded to changes in the regulatory reaction of the cortex under the influence of the poisoning. These changes had a cyclic course and in passing through the different phases, especially of the narcotic and paradoxical phases, were marked by an inhibition of the conditioned reflex activity of the cortex. Following repeated poisoning, alterations of the conditioned reflex activity quickly set in (from 1-4 days after beginning of the poisoning). The most severe disturbances appeared in animals fed the high-fat diet, followed by those on low-protein, low-fat and high protein diets. Changes in conditioned reflex activity under the influence of low fat and high protein content in the diet were, to a certain extent, similar. The author considers that changes in conditioned reflex activity can serve as an early sign of Pb poisoning.

- 890** Boyadzhiev, V., and Tyutyulkov, N.: (MODIFICATION OF LEAD CONCENTRATION IN THE BLOOD OF EXPERIMENTAL ANIMALS BY VITAMIN C AND SODIUM THIOSULFATE.) Gigiena, Epidemiol. i Mikrobiol. 4, No. 1:7-15, 1960.

The effect of vitamin C (50 mg/kg) or  $\text{Na}_2\text{S}_2\text{O}_3$  (2.5 ml 20% solution/kg) on Pb concentration in blood of guinea pigs was studied during chronic Pb intoxication induced by oral administration of 2 ml/kg of 5% Pb acetate solution, up to 55 mg Pb/kg body weight. The degree of intoxication was determined from the number of erythrocytes, leukocytes, stippled cells, reticulocytes, and concentration of hemoglobin in blood. Administration of  $\text{Na}_2\text{S}_2\text{O}_3$  and vitamin C did not prevent the development of Pb poisoning. The concentration of Pb in the blood was lowest in the animals treated with  $\text{Na}_2\text{S}_2\text{O}_3$  and the changes of the blood components investigated paralleled Pb concentration. (From Chemical Abstracts 56:7951, 1962)

- 891** Boyland, E.: RECENT PROGRESS IN CARCINOGENESIS. BIOCHEMICAL ASPECTS. Progress in

Experimental Tumor Research 1:162-78, 1960. The review (55 references) contains the following concerning Pb: "The induction of tumor of the kidney with Pb phosphate first described by Zolinger (1953) and confirmed by Van Esch and Van Genderen (1959) and by Walpole and Williams (1959) remains remarkable. In the first place it is surprising that rats should live for as long as 1 yr on diets containing 1% of Pb phosphate or Pb acetate. Treatment with Pb salts disturbs hemoglobin metabolism leading to excretion of coproporphyrin in the urine. The immediate carcinogen might therefore be the excreted porphyrin. Ingested Pb is usually deposited in bone, so that if the Pb itself were the carcinogenic agent, bone tumors would have been expected." (Van Esch, and Walpole: Personal communications to author.)

- 892** De Nicola, P., Petronio, L., Nespoli, M., and Caraccia, G.C. (Univ. Pavia, Italy): Ulteriori osservazioni sulle attivita' enzimatiche nel siero in alcune intossicazioni sperimentali. (ENZYMATIC ACTIVITIES IN SERUM IN SOME EXPERIMENTAL INTOXICATIONS.) Bollettino della Societa' Italiana di Biologia Sperimentale 36, No. 21: 1145-8, 1960.

The experiments reported deal with the behavior of several enzymes in the blood of rabbits poisoned by Pb, As, C, sulfide and Ca. Pb poisoning was obtained in 4 rabbits, average weight 2.5 kg, by daily treatment with 6 mg Pb acetate/kg body weight for 30 days. Enzymatic activities in the serum were determined before, and on the 15th and 30th days of the experiment. The animals survived treatment, but died shortly thereafter. Aldolase had increased from a normal of 17.1 units/ml serum to 44.2 at 15 and 38.6 at 30 days. The increases in activity of other enzymes were more moderate: glutamic oxalacetic transaminase, from 27.6 to 33.2 and 46.7; glutamic pyruvic transaminase, from 22.6 to 24 and 28.2; lactic dehydrogenase, from 410 to 495 and 444; malic dehydrogenase, from 180 to 208 and 292, respectively. The authors conclude that no relation exists between the histologic alterations caused by Pb and the increases in the activity of enzymes.

- 893** Dhar, D.C., and Ghatak, S. (Central Drug Research Inst., Lucknow, India): STUDIES ON EXPERIMENTAL LEAD ANAEMIA: PART VI. CHANGES IN ASCORBIC ACID METABOLISM DURING LEAD ANAEMIA AND THE ROLE OF VARIOUS HAEMOPOIETIC SUBSTANCES. Journal of Scientific and Industrial Research (India) 19C, No. 11:259-63, 1960.

Anemia induced in rats (~150 g weight) by intravenous injection of Pb acetate (6 mg/100 g body weight) caused a marked decrease in the level of ascorbic acid in blood, urine, adrenal gland, liver, spleen, testes, kidney, heart, and muscle, but not in brain and lung tissue. The adrenal gland was affected most. Hemopoietic agents (vitamin B<sub>12</sub>, liver extract, folic acid, and leucovorin) alleviated the deficiency of ascorbic acid in most of the tissues but none of the supplements raised its level in heart tissue.

- 894** Foreman, H.: THE PHARMACOLOGY OF SOME

USEFUL CHELATING AGENTS. In Seven, M.J., and Johnson, L.A., ed.: *Metal-Binding in Medicine*. Philadelphia, Lippincott, 1960, pp. 82-94.

The tissue distribution and excretion of  $\text{CaNa}_2\text{EDTA}$  in experimental animals is first discussed and illustrated in tables. This is followed by similar studies in humans; kidney toxicity by EDTA in animals, as well as by  $\text{CaNa}_2\text{DTPA}$ ; behavior of other metal chelates in the body;  $\text{Na}_2\text{EDTA}$  and  $\text{Na}_2\text{DTPA}$  chelated with Pb, Co, Fe, Zn, Cr, and Y and whole body retention of ions subsequent to chelation. In closing, the natural binding capacity of the body for the various injected ions is:  $\text{Fe} > \text{Zn} > \text{Pb} > \text{Cr} > \text{Co} > \text{Y}$ ; the order of effectiveness of EDTA for mobilization is about equal for Zn, Cr, Y, followed by Co, Pb, Fe; with DTPA,  $\text{Y} > \text{Co} > \text{Cr} > \text{Pb} > \text{Zn} > \text{Fe}$ .

- 895** Gajdos-Török, M., Gajdos, A., and Bénard, H.: Localisation de l'inhibition de la synthèse de l'hème par le plomb. (LOCALIZATION OF THE INHIBITION OF THE SYNTHESIS OF HEME BY LEAD.) *Comptes Rendus de Séances de la Société de Biologie et de ses Filiales* 154:508-9, 1960.

For the study of the anemia of Pb poisoning, believed to be due to the inhibition of heme formation beginning with the protoporphyrins, the authors gave a daily dose of 200-400 mg of Pb acetate to adult rabbits by gastric tube and bled the animals on the 8th day. Blood was incubated with radioactive Fe and glycocholate in order to measure the heme formation in vitro. The remainder of the blood was used to extract the hemesynthetase (according to Goldberg) whose activity was measured by incubation with pure protoporphyrins and radioactive Fe. Immediately before being bled, 1 of the rabbits showed signs of a Pb-induced anemia. The rabbit showed 3,460,000 red cells; 73% hemoglobin; 1.9% reticulocytes stippled cells 4/100 white cells; 9 mg ALA, 103 mg porphobilinogen, 767  $\mu\text{g}$  uroporphyrin, and 2640  $\mu\text{g}$  coproporphyrin/1 urine; in 3 other Pb poisoned rabbits, the same results were seen. Measurement of heme formation showed a weak incorporation of Fe into the protoporphyrins. Measurement of the hemesynthetase activity showed it to be elevated.

For an explanation of this contradiction, ie, weak Fe incorporation into protoporphyrins and an elevated hemesynthetase activity, the observations by Allen and Jandl are cited. Using radioactive Fe, these authors had noted that Fe passes through 3 steps in order to combine with the siderophilins of plasma in the Hb stage in the rabbit reticulocytes. The conclusions of these authors are taken for an explanation of the apparent contradiction of the observations in this report, namely, the inhibition of heme synthesis at the time of incubation with radioactive Fe in the red cells of Pb-intoxicated rabbits which contain an abundance of active hemesynthetase. In this sense, their experiments confirm those of Allen and Jandl and demonstrate the extreme biochemical complexity of hemoglobinogenesis.

- 896** Gorby, C.K., and Rieders, F. (Jefferson Med. Coll. of Philadelphia, Pa): THE EFFECT OF SIMULTANEOUS ORAL EDATHAMIL CAL-

CIUM DISODIUM AND LEAD ACETATE ON LEAD ACCUMULATION IN TISSUES OF RATS. *Archives Internationales de Pharmacodynamie* 125: 153-60 (Apr. 1), 1960.

The Pb uptake by susceptible tissues from the chelate in the interval between intestinal absorption and urinary excretion was studied in male and female Sherman albino rats. One group of 50 rats (25 males, 25 females) served as controls. The food and drinking water of the other groups contained the following amounts of drugs: Group A, 2 ppm Pb as acetate; Group B, 760 ppm  $\text{Na}_2\text{CaEDTA} \cdot 2\text{H}_2\text{O}$ ; Group C, 3 ppm Pb and 760 ppm  $\text{Na}_2\text{CaEDTA} \cdot 2\text{H}_2\text{O}$ ; chemical analysis showed for C, 3 ppm Pb, with 1 ppm introduced by EDTA. Pb analyses of kidney, small intestine, brain, skeletal muscle, blood, and food were done by a dithizone technique. Incorporation of the EDTA into Pb-containing diets retarded Pb accumulation mainly in brain and renal tissues of male rats. Food and water consumption and growth of the rats were not affected by 2 ppm Pb or 3 ppm Pb + 760 ppm EDTA in the diet. Hematologic studies, including red blood cell counts, white blood cell counts, and hemoglobin determinations did not show significant differences between the Pb and Pb-EDTA groups. Breeding studies showed that the Pb group had least ability to raise its young to weaning age. The EDTA group showed some reduction, and the Pb-EDTA, though having the lowest mean litter numbers, showed no reduction in raising litters. A protective effect of EDTA is suggested. There was an unexplained increase in infection incidence in males on diets containing Pb + EDTA.

- 897** Gorham, J.R., Farrell, R.K., and Burger, D.: DISEASES AND PARASITES OF MINK. *Veterinary Scope* (Upjohn Company) 5, No. 3:2-12, 1960.

Paints containing Pb should not be used on wire netting and the interior of pens or nest boxes for minks. Acute Pb poisoning in minks is characterized by stupor, weakness, convulsions, coma and sudden death. In chronic Pb poisoning no characteristic signs develop, but the animals gradually lose weight and die within 2-4 mo. Microcytic hypochromic anemia and basophilic stippling has been observed; there is increased Pb in liver and blood. Treatment with  $\text{CaEDTA}$  is suggested but has not yet been tried.

- 898** Gusev, M.I.: LIMITS OF ALLOWABLE LEAD CONCENTRATION IN THE AIR OF INHABITED LOCALITIES. In Ryazanov, V.A., ed.: *Limits of Allowable Concentrations of Atmospheric Pollutants*, Book 4, Moscow, Medgiz, 1960, translated by B.S. Levine. Washington, US Department of Commerce, Office of Technical Services, 1961, pp. 5-31.

Since Pb is used extensively in the national economy of the USSR, a study of the effects of Pb in air on the higher nervous activity was made to determine the limit of allowable concentration with the aid of physiological and biological methods of application. Using changes in the motor conditioned reflex as the vital index, 14 young male white rats (~100 g weight) were divided into 3 groups for exposure 6 hr/day for 6 mo (total of 148-150 days) to average Pb concentrations in air:

1st group, 6 rats, 11  $\mu\text{g}/\text{m}^3$ ; 2nd group, 6 rats, 1.13  $\mu\text{g}/\text{m}^3$ ; 3rd group, 2 rats, control. At the higher concentration, functional shifts in the higher nervous activity of the rats were noted; pathologic and histologic changes were observed in the organs and tissues, especially in the brain and spinal cord; the content of Pb in the bone was 10 times greater than that in the bone of the control animals. The lower exposure (1.13  $\mu\text{g}/\text{m}^3$ ) produced no changes in the activity of cerebral cortex. An additional 9 rats were exposed to the same concentrations of Pb oxide for supplemental blood studies. No differences were noted between the blood composition of control and test animals.

To study the effect of low Pb concentrations on porphyrin metabolism, 2 groups of 3 rabbits each (weight 1160-2140 g each) were exposed 6 hr/day for 6.5 mo to 10  $\mu\text{g Pb}/\text{m}^3$  air or 3.9  $\mu\text{g}/\text{m}^3$  air respectively. Rabbits exposed to the higher concentration eliminated twice as much coproporphyrin as did a control group. No changes in porphyrin metabolism were discernible in the animals exposed to the lower concentration. Pathohistological changes in the nervous system and microscopic changes of tissues and organs were found in the rabbits exposed to 10  $\mu\text{g}$ . The accumulation of Pb in the bones of these rabbits was 8 times as great as that in the control animals.

The author concluded that his studies confirmed the USSR limit of allowable 24-hr average concentration of 0.7  $\mu\text{g}/\text{m}^3$  in ambient air, and 10  $\mu\text{g}/\text{m}^3$  of single concentration for workroom air. (29 references)

- 899** Hammond, P.B., and Aronson, A.L. (Div. Physiol. Pharmacol., Univ. Minnesota, St. Paul): THE MOBILIZATION AND EXCRETION OF LEAD IN CATTLE: A COMPARATIVE STUDY OF VARIOUS CHELATING AGENTS. *Annals of the New York Academy of Sciences* 88, Art. 2: 498-511 (Aug. 18), 1960.

The authors studied the following chelating agents to determine their effect in the treatment of Pb poisoning: Ca ethylenediaminetetraacetate (CaEDTA), ethylenediaminediacetic acid (EDDA), N,N'-dihydroxyethylenediaminediacetic acid (HEDDA), diethylenetriaminepentaacetic acid (DTPA), cyclohexanediaminetetraacetic acid (CDTA), 2,3-dimercaptopropanol (BAL), 2,3-dimercaptopropionic acid (BAL acid), ethane-1,2-dithiol, propane-1,3-dithiol, 2,5-dithiohexane, penicillamine, 2-aminoethanethiol, Na citrate, di-Na catechol-1,3-disulfonate. Pb nitrate was administered orally in doses of 0.25-1.0 g at 1-3-day intervals to female Holstein-Friesian calves, age 2-4 mo, until a concentration of 0.3-1.0 ppm Pb in the blood was reached. Experimental studies were begun 3-5 days after the last dose of Pb. Signs of Pb poisoning were found in only 1 case. In the 24-hr period before administration of chelating agents, the base line rate of Pb excretion in urine and feces and the rate of decrease of Pb in blood were established. Chelating agents were administered intravenously in a 10-min period. Pb analyses were done with acid oxidizers to digest biomaterials and a standard dithizone spectrophotometric procedure. Eight calves were given 110 mg CaEDTA/kg, the dosage found to give maximal response. Results showed increased Pb excretion in the urine lasting for 48 hr, increased

Pb concentration in blood plasma, and decreased Pb concentration in erythrocytes. The authors inferred that there was a steady state relationship between the concentration of Pb in erythrocytes and the amount which can be mobilized and excreted in the urine by CaEDTA. Around 10% of Pb excreted in urine could be accounted for by a decrease in erythrocyte Pb. The remaining 90% was shown to originate in other tissues, eg, liver. CaEDTA could only remove part of the Pb from soft tissue. The kidney was found to be the major route of PbEDTA excretion. Unless otherwise noted, in all the following studies, the dose administered was equivalent to 110 mg/kg CaEDTA. Of the polyaminoacetic acids studied, CaEDDA was inferior to CaEDTA, while CaHEDDA, CaCDTA, and CaDTPA acted similarly to CaEDTA.

The authors conclude that in spite of the distinct possibility that permeability factors may impose serious limitations upon the activity of polyaminoacetic acids, it remains to be demonstrated that there exists a "stability constant plateau" that exhausts the possibility of improving upon detoxification by increasing the stability of the metal-ligand bond. BAL (dose equivalent to 55 mg/kg CaEDTA), administered to 4 calves, produced an increased urinary Pb excretion, but less than that with CaEDTA. Blood Pb decreased and then showed a partial rebound after BAL administration. Of the other dithiols studied (dose equivalent to 55 mg/kg), 2,5-dithiohexane and propane-1,3-dithiol showed no effect, ethane-1,2-dithiol caused a decrease of erythrocyte Pb and a complete rebound, and BAL acid seemed to be as active as CaEDTA. BAL acid is toxic unless administered together with Ca chloride. DL-Penicillamine acted similarly to CaEDTA; 2-aminoethanethiol, Na citrate, and di-Na catechol-1,3-disulfonate had no effect. (14 references)

- 900** Hashimoto, K.: AN EXPERIMENTAL STUDY ON THE BILIARY EXCRETION OF LEAD IN DOGS. *Journal of Osaka City Medical Center* 9: 2317-39 (July), 1960. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 2, April 1959-March 1961, pp. 27-31.

Thirty mg Pb acetate (16.38 mg Pb/kg of body weight) was administered orally, intravenously (iv), and intratracheally to adult male dogs in order to elucidate a Pb excretion in the bile. The biliary Pb excretion was compared with blood concentrations, urinary excretion, and distribution of Pb thus introduced into the animals' bodies. It was found that the blood levels of Pb after iv injection were higher than those of cases administered by other routes. Following the oral administration, the biliary excretion of Pb reached the maximum within about 10 hr, and then decreased rapidly. For 30 hr after the administration, a small portion (1/1000-1/4000) of the Pb absorbed into the body was excreted into the bile. A total dose of the Pb eliminated in the urine was 2-7 times that in the bile. Following intratracheal administration, the appearance of Pb in the bile was diverse in time among the animals. The amount of Pb excreted in the bile was 1/400-1/2700 portion of the absorbed Pb. A total dose of Pb eliminated in

the urine was 3 times that in the bile during the experiment. Following iv administration, the biliary excretion of Pb showed a sharp increase with the peak at about 3 hr. About 1/4500 portion of administered Pb was excreted in the bile and the Pb excreted in the bile was 1/15-1/21 portion of the Pb in urine. Little relation was found between biliary pH values and Pb concentrations. Concentrations of Pb in the liver were higher than in the bile for all cases.

- 901 Iordanidis, P. (Inst. Ind. Med. Hyg., Paris, France): Étude comparative de l'hématie ponctuée, du sidérocyte et du réticulocyte dans le saturnisme expérimental. (A COMPARATIVE STUDY OF STIPPLED ERYTHROCYTES, SIDEROCYTES, AND RETICULOCYTES IN EXPERIMENTAL LEAD POISONING.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 21:719-26 (Dec.), 1960.

Nineteen guinea pigs (age ranging from 7-14 mo; weight, 580-720 g) which had never been used in other studies, and the females among whom had never been pregnant, were placed into 3 groups: (1) 3 males and 2 females; (2) 2 males, 2 females; (3) 6 males, 4 females. After an observation period of 20 days, each animal received intraperitoneally 1 mg Pb acetate (aqueous 0.5% solution)/100 g body weight every 2 days. As soon as stippled cells exceeded  $100 \pm 10/100$  white cells, the dose was doubled and administered twice/wk until the counts reached  $200 \pm 10$  stippled cells. The results of the control tests showed no stippled cells, nor siderocytes in the blood and bone marrow. Stippled cells appeared first in the bone marrow,  $3 \pm 1$  days after the 1st injection and  $8 \pm 2$  days in the peripheral blood. Siderocytes appeared in the bone marrow around day  $16 \pm 2$ , and in the blood, on day  $19 \pm 4$  after injection. Their evolution was transient and they disappeared before the stippled cells did (av  $112 \pm 3$  days vs  $124 \pm 3$  days in blood; bone marrow stippled cells disappeared after an av  $142 \pm 5$  days). There appeared to be no correlation between these 2 constituents. Reticulocytes, however, increased in number before stippled cells did; however reticulocytosis is a commonplace finding and for this reason is of no true interest in the diagnosis of occupational Pb poisoning. An increase in the bone marrow reticulocytes was seen from day  $5 \pm 1$  after the 1st injection, and on day  $6 \pm 1$  in the blood. In this case also there was no close correlation to stippled erythrocytes. No Heinz bodies were found. (56 references)

- 902 Ishii, Y.: A STUDY ON THE EXCRETION OF LEAD ADMINISTERED INTO THE INTESTINAL CANAL. Journal of Osaka City Medical Center 12:5001-14 (Dec.), 1960. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 2, April 1959-March 1961, pp. 38-9.

Vella-Like fistulae were made in the ileocecal region of 30 adult dogs to obtain samples of intestinal fluid continuously. Normal intestinal fluid contained  $\sim 1 \mu\text{g}$  Pb/hr excretion. There was a slight increase of Pb in the fluid after intra-

venous administration of 300 mg Pb acetate and a marked increase after administration of 600 mg (15-26 mg/hr, and a total of 50-90  $\mu\text{g}$  24 hr after administration).

- 903 Kar, A.B., and Sarkar, S.L. (Central Drug Research Inst., Lucknow, India): EFFECT OF SOME METALS ON THE ACTION OF MALE AND FEMALE SEX HORMONES. J. Sci. Ind. Res. (India) 19C:241-3, 1960.

Gonadectomized albino rats received 0.04 mM/kg body weight of aqueous metal salts sc for 4 days and, concurrently, intramuscular injections of testosterone propionate and estradiol dipropionate (62.5 mg/day/rat) and were sacrificed 1 day later. Studies of the seminal vesicles, ventral prostate, levator ani muscle, and uterus showed that Pb was among the elements which depressed androgenic, myotropic and estrogenic activity of the hormones. (From Chemical Abstracts 55:8633, 1961)

- 904 Klimmer, O.R., and Nebel, I.U. (Univ. Bonn, Germany): Experimentelle Untersuchungen zur Frage der Toxizität einiger Stabilisatoren in Kunststoffen aus Polyvinylchlorid. (EXPERIMENTAL STUDIES CONCERNING THE TOXICITY OF SOME STABILIZERS IN POLY-VINYLCHLORIDE PLASTICS.) Arzneimittel-Forschung 10:44-8, 1960.

The aim of the investigation was to examine the extent to which stabilizers used for the manufacture of PVC packaging materials and pipes can escape into foods, beverages and water and the magnitude of their toxicity.

Examined were 10 types of PVC foils and 3 powders containing 1 or more of the following: S-containing di-n-octyl and dibutyl Sn compounds; dibasic Pb phosphite and stearate; Cd stearate; 2-phenyl indol + Sr stearate. The stabilizers, softeners and (emulsifiers) were tested in amounts used commercially.

The PVC foils were cut into 5 x 1 cm strips of 0.2 mm thickness, folded and 5 g of each type of foil suspended in flasks containing 75 ml each of tap water, Mosel wine, olive oil, synthetic wine, synthetic fruit and marmalade juices, and commercial herring brine. After extraction, 14 days (336 hr) at 32° C, the extracts were analyzed, either by the colorimetric dithizone method or by paper chromatography.

From the "hard" PVC foils (without softener), only small amounts of stabilizer were extracted into the non-fatty liquids (dibasic Pb phosphite = 0, or  $< 1$  ppm ( $\mu\text{g}/\text{ml}$ ) for water, wine and olive oil). The amounts of stabilizers extracted from the foils increased as the pH value decreased and the fat-soluble properties of the solutions increased. From the "soft" PVC foils (with softener), the stabilizers escaped into the extracts in much greater amounts (dibasic Pb stearate = 0, or  $< 1$  ppm for water and wine, 8 ppm for olive oil).

The toxicity of stabilizers was tested in male rats. The largely water-insoluble substances were given orally in peanut oil with alcohol or emulsified with "Tween 80." Due to the considerable scatter of values, the LD<sub>50</sub> range was established as well as the LD<sub>50</sub> values. In the case of the Pb compounds the acute oral toxicity was very low. The oral LD<sub>50</sub> range for dibasic Pb phosphite and



Pb stearate was >6000 mg/kg (0% lethality at 6000). All animals tested remained well, gained weight, showed normal behavior and survived. Necropsy showed no pathological changes in the organs.

PVC powders were also tested in rats. Of 26 male white rats that received 3 ppm Pb stearate/rat/day orally for 7 calendar months, 2 died of intercurrent bronchopneumonia. All other rats, including controls (fed PVC powder without additives) survived and showed normal behavior. Blood and urine analyses were normal. No pathological changes were seen at necropsy.

It is assumed that the absence of pathological changes is due to the poor absorption of the largely insoluble PVC stabilizers from the gastrointestinal tract.

- 905 Koga, T. (Kyush Univ. School Med., Japan): (RELATIONS BETWEEN CALCIUM AND LEAD METABOLISM.) *Igaku Kenkyu* 30:1860-9, 1960.

Experiments on rabbits and rats demonstrated a probable relation between Ca and Pb metabolism, and the possibility was suggested that Pb excretion in chronic Pb intoxication could be enhanced by altering the Ca metabolism. (From Chemical Abstracts 55:26179, 1961)

- 906 Kornakova, A.L. (Kazakh Acad. Sci., USSR): Vliyanie dzhusalinskoi mineral'noi vody na krovotvornuyu funktsiyu organizma pri eksperimental'noi svintsovoi anemii. (EFFECT OF DZHUSALY MINERAL WATER ON THE HEMATOPOIETIC FUNCTION OF THE ORGANISM IN EXPERIMENTAL LEAD POISONING.) *Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Meditsiny i Fiziologii* 1960, No. 2:85-90.

The Dzhusal mineral spring water (near Karkaralinsk) was investigated in rabbits for their curative properties in Pb-induced anemia. This water has a high Fe content ( $\text{Fe}^{++} + \text{Fe}^{+++}$ , 157.75 mg/l, in organic form and predominantly as ferrous oxide) and in addition, many trace elements, I, Br, Zn, traces of As. The rabbits were made anemic by the administration of a 0.5% solution of Pb acetate in doses of 2 mg/kg, which produced in 3 days an anemia evident in smears of peripheral blood. Groups of 10 rabbits each received the mineral water as such, bottled mineral water or ordinary water. The results as described and shown in 3 graphs confirmed the beneficial effect on hematopoietic function of the organism in experimental anemia. The stimulating action of this water is attributed to the high content in Fe in its ferrous form. The use of bottled water after long storage (2-3 mo) caused loss in its beneficial action on the blood picture, probably because of lower content of its ferrous compounds. The physiologic activity of the water remains preserved when stored in bottled water for a month or less, and can be used in medical practice in Fe-deficiency anemias.

- 907 Leščinskaite, A.: VITAMIN  $\text{B}_{12}$ , SAPROPEL, AND COBALT CHLORIDE INFLUENCE IN EXPERIMENTAL ANILINE AND LEAD POISONING. *Lietuvos TSR Mokslų Akad. Darbai, Ser. C* 1960, No. 2:163-74.

In white rats (no data), injections of Pb acetate at doses of 150 mg/kg body weight caused decrease in body weight, erythrocyte count, hemoglobin, and

carbonic anhydrase activity while changes in protein were insignificant. Animals receiving sapropele (50 units of vitamin  $\text{B}_{12}$ /kg food) and a Co equivalent,  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$  supplemented diet calculated 4.5% Co in vitamin  $\text{B}_{12}$ , showed the least changes in erythrocytes and in carbonic anhydrase activity, the fastest hemoglobin recovery, and a decreasing leukocyte count. (From Chemical Abstracts 55:10618, 1961)

- 908 Mambeeva, A.A. (Acad. Sci. Kazak SSR): Izmenenie interotseptivnykh refleksov pri svintsovoi intoksikatsii. (CHANGES OF INTEROCEPTIVE REFLEXES IN LEAD POISONING.) *Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Meditsiny i Fiziologii* 1960, No. 2:59-65.

In 26 experiments with cats under urethane narcotics, the effects of acute Pb poisoning on the interoceptive reflexes were studied on the isolated intestine which was perfused with Ringer-Locke solution; stimuli on the chemoreceptors were produced by addition of nicotine solutions at various concentrations. Acute poisoning was produced in cats by iv injection of 1 or 2 ml of 3 or 5% Pb acetate solution/kg. The results showed that small doses stimulated, but large doses suppressed nervous reflexes, as demonstrated by changes in breathing and blood pressure.

- 909 Mambeeva, A.A. (Acad. Sci., Kazakh SSR): Izmeneniya intramural'nogo nervnogo apparata zheludka i kishechnika pri eksperimental'noi svintsovoi intoksikatsii. (CHANGES IN THE INTRAMURAL NERVOUS APPARATUS OF THE STOMACH AND INTESTINE IN EXPERIMENTAL LEAD POISONING.) *Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Meditsiny i Fiziologii* 1960, No. 2:66-74.

Acute, subacute and chronic poisoning was induced in 20 animals (dogs and cats) by daily oral doses of 2 ml of a 5% Pb acetate solution/kg (sacrificed in 7-10 days), with 2 ml 2.5% solution/kg for 1.5-2 mo, and 1 ml of 2.5% solution/kg for 3-6 mo, respectively. In acute poisoning, microscopic findings in the intramural nerves of the stomach and intestine pointed to marked changes which were of diffuse dystrophic nature. In summary, the intramural ganglia showed in the milder stages of poisoning a large number of nonmedullary and medullary fibers to be unchanged. Changes appeared in the form of argentophil reaction and destruction of fibers with varicose distention or compression. In the more severe types of poisoning, there was also vacuolization and fragmentation of medullary and nonmedullary fibers in various segments.

- 910 Massei, G., Villani, C., and Guidicini, F. (Univ. Pisa, Italy): Indagini sull'atteggiamento dinamico della eritropoiesi e sulla sopravvivenza eritrocitaria nella disemia saturnina sperimentale. (INVESTIGATIONS OF THE DYNAMIC BEHAVIOR OF ERYTHROPOIESIS AND OF THE ERYTHROCYTE SURVIVAL IN EXPERIMENTAL SATURNINE BLOOD DISORDERS.) *Haematologica* 45:1169-80, 1960.

Pb poisoning was induced in 12 of a total of 20 male rabbits used, weight 1500 g, by oral admin-

istration of 200 mg Pb acetate, on alternate days for 1 mo. The remaining 8 rabbits served as controls in the 2 experiments, one of which was to follow erythropoiesis in Pb poisoning, and the other to determine the survival of red cells, using radioactive Cr. The rate of removal of Fe from the plasma of the experimental animals increased from 0.69%–0.86% per min, the coefficient of Fe utilization was 44% in both poisoned and control animals, and the rate of emission of erythrocytes into the circulation decreased from 5.3%–2.5% per hr. The survival time of erythrocytes from poisoned rabbits, when transfused into normal rabbits, was 12.3 days compared to 23.3 days when erythrocytes from normal rabbits were transfused into poisoned ones.

The hypothesis was advanced that the anemia in Pb poisoning is due either to an inhibition by Pb of the enzymatic mechanisms which regulate the utilization of Fe in the synthesis of hemoglobin or to an increased erythrocytolysis caused by an increased fragility of the erythrocytes. (21 references)

- 911 Morita, Z. (Univ. Tottori, Japan): (STUDIES ON THE RELATIONSHIP BETWEEN THE HAIR COLOR AND THE METALLIC ELEMENTS IN DOMESTIC ANIMALS.) Transactions of the Tottori Society of Agricultural Science 12:112–16 (Mar.), 1960.

Al, Ba, C, Cu, Fe, Hg, Mg, Mn, Mo, P, Pb, Si, Ti, and Zn were found in the ashes of hairs and feathers of several domestic animals. Remarkable differences were noted among animals in the content of Al, Ba, Cu, P, Pb, and Zn. These elements seemed to have no relation to the color of hairs and feathers. (From author's English summary)

- 912 Mozgovaya, E.N., and Arnautov, N.V.: (THE TRACE ELEMENT CONTENTS OF THE LIVER AND PANCREAS OF CATTLE.) Izvest. Sibir. Otdel. Akad. Nauk SSSR. 1960, No. 2:104–10.

The ash of liver and pancreas of young adult cattle from various locations contained 0.005–0.3 and 0.003–0.1% Mn, respectively, and 0.001–0.006 and 0.001–0.01% Pb, respectively. (From Chemical Abstracts 55:1845, 1961)

- 913 Pecora, L., Vecchione, C., and Fati, S. (Univ. Naples, Italy): Rapporti tra ferro e piombo nell'intossicazione saturnina. (THE RELATIONSHIP BETWEEN IRON AND LEAD IN CASES OF LEAD INTOXICATION.) Folia Medica (Naples) 43:776–84 (Aug.), 1960.

Pb acetate (2 ml/day of 20% solution) was administered by gastric tube to 24 rabbits for 15 days, and 12 of these animals received concurrently intramuscular injections of Fe saccharate at doses of 15 mg/kg/day. These rabbits showed no Fe reduction in tissues, and average Pb accumulation in lungs, liver, bone marrow, brachial and sciatic plexus was 600, 620, 520, 650, and 350 µg%, respectively. The corresponding Pb values for the group not receiving Fe supplements were 950, 1130, 450, 1250 and 708 µg%, and these animals showed also marked reduction of Fe in tissues which was in direct proportion to Pb accumulation. In another experiment, 16 rabbits received similarly Pb acetate for 15 days, and 8 of these animals

were treated with Fe saccharate for 15 days thereafter. At the end of this period, the animals receiving Fe showed Pb values in blood and urine and coproporphyrin levels close to normal, even though protoporphyrin values remained at pathological levels; the untreated rabbits showed the same values in blood and urine as at the end of the poisoning period.

- 914 Rubanovskaya, A.A. (Inst. Ind. Hyg. Occup. Dis., Acad. Sci. USSR): Effektivnost kompleksina i CaNa<sub>2</sub> EDTA pri ostrom otravlenii solyami svintsya. (EFFECTIVENESS OF COMPLEXON AND CaNa<sub>2</sub>EDTA DURING ACUTE POISONING BY LEAD SALTS.) Gigiena Truda i Professional'nye Zabollevaniya, 4, No 3: 37–41, 1960.

Three groups of 40, 36 and 30 mice received ip injections of 8 mg Pb nitrate to produce acute poisoning; half of 1 group received ip 10 mg Complexon IV (CaNa<sub>2</sub> cyclohexylenediaminetetraacetate) 1–2 min and 30 min after poisoning. The survival rate was 80–100% while mortality in controls was 100%. A sharply increased elimination of Pb by the title chelators was evident also when 30 mg was injected ip immediately after administration of Pb nitrate and 15 min later to half another group. Pb elimination increased 176–216-fold. They were also effective in the 3rd lot of mice when injected 3 days after poisoning. The author assumes that the 2 preparations, which were comparable in effectiveness, will be also effective in chronic poisoning.

- 915 Sano, S., Tanabe, Y., Sumiya, C. (Univ. Kyoto, Japan): THE METABOLISM OF δ-AMINO-LAEVULINIC ACID, PORPHOBILINOGEN, UROPORPHYRIN AND COPROPORPHYRIN IN LEAD POISONING. Acta Scholae Medicinalis, Universitatis in Kyoto 36, No. 3:186–90, 1960.

Rabbits were poisoned by subcutaneous injection with a solution of Pb acetate containing 20 mg Pb/kg of body weight for 5 days or by oral administration of 200 mg/kg of allylisopropylacetamide or sedormid for 10 days. δ-Aminolevulinic acid (ALA) and porphobilinogen (PBG) in urine and blood and copro- and uroporphyrin were determined in both experimental groups. ALA and PBG increased in the blood of the Pb-poisoned animals and their urinary excretion increased parallel with the increase of coproporphyrin. The excretion of ALA increased 2 or 3 times as much as that of PBG. An increase of basophilic stippled cells was seen after the appearance of ALA and PBG, but maximum values occurred at almost the same time. The levels of ALA, PBG and porphyrin in allylisopropylacetamide intoxication were much higher than in Pb poisoning.

To study the mechanism of the changes, 50 mg ALA, in 5 ml saline was administered intravenously to normal and Pb-poisoned rabbits. The controls excreted much PBG and uroporphyrin, and the Pb-poisoned, much less. However, coproporphyrin excretion in the latter was twice as high as in the controls. The authors consider that in Pb poisoning ALA dehydrase and conversion of PBG into uroporphyrin might be inhibited, but ALA and PBG are changed at some step to coproporphyrin.

- 916 Scarinci, V. (Inst. Pharm. Univ., Urbino, Italy): Su un antidoto del piombotetraetile. (AN ANTIDOTE FOR TETRAETHYLLEAD.) Archivio di Scienze Biologiche (Bologna) 44:153-65 (Apr.-June), 1960.

An antidote for TEL "thiopon," composed of an aqueous solution of Na-trithiodilactate (2.88%) and Na-thiolactate (3.84%) in 1:3 molecular relation, was tested in vitro and in vivo. In vitro tests showed that TEL formed a water-soluble Pb salt with the antidote, in which the metal was not in ionic form. TEL was applied directly to the shaved and partly abraded abdominal skin of rabbits at doses up to 1.2 ml/kg (MLD 0.6 ml/kg) and was absorbed rapidly. The animals became excitable after 4-6 hr, then convulsive, and died after 10-12 hr. When the antidote was injected im or iv at 2 ml/kg within 2 hr after toxic signs appeared or in 4 doses of 0.5 ml/kg, the 1st given 15 min after intoxication and the others 30-min intervals, 100% of the rabbits survived. Only 50% of the rabbits survived when treated with 1.5 ml/kg 2 hr after intoxication or with 2 ml/kg later than 2 hr after signs appeared. All animals treated with lower doses or else after 3 hr of intoxication with any dose, died. Pb excretion in urine, tested before and after treatment showed an impressive elimination of Pb, which decreased after the 2nd day of treatment until it reached its normal value (0.3-0.4 mg/l).

In reviewing the occurrence of TEL intoxication, the author states in a footnote that he had seen a fatal case of poisoning (unpublished), referred to him by "Societa SLOI" of Trento in 1952. A worker engaged in mixing operations was inundated with TEL when a drum burst. Although he was promptly hospitalized, acute, characteristic signs appeared after a few hours and terminated in death from bulbar paralysis after 7 days. (21 references)

- 917 Schubert, J., and Lindenbaum, A.: THE MECHANISM OF ACTION OF CHELATING AGENTS ON METALLIC ELEMENTS IN THE INTACT ANIMAL. In Seven, J.J., and Johnson, L.A., ed.: Metal-Binding in Medicine. Philadelphia, Lippincott, 1960, pp. 68-74.

As summarized by the authors, some of the factors involved in the use of chelating agents in the treatment of poisoning by metals (including Pb) have been described by giving specific examples: practical importance of the net binding of the chelate with the toxic metal as a reflection of the reactivity of the chelate with omnipresent Ca, proteins and other interfering substances in the tissues; the ability of the chelate to come in contact with the toxic metal in situ; possibilities for the induction of naturally produced chelating agents in effective concentrations within the tissues; the feasibility of in situ inactivation of difficultly removed nonradioactive toxic metals; the usefulness of chelates in introducing effective forms of other types of therapeutic substances into the tissues. Specific mention of Pb is in connection with the difficulty to get a chelating agent in contact with the metal in the body. In such cases, it is possible to induce the body to form its own chelating or complexing agents by injecting small amounts of metabolic

inhibitors. This was done by injecting small amounts of fluoroacetic acid to form citric acid accumulation in the body of rats with Pb poisoning; subsequent injection of Na citrate provided the animals with protection against Pb poisoning, whereas no significant protection was observed when massive doses of Na citrate were injected because of rapid destruction of citric acid. In connection with the concept of relative binding constants: in contrast to Mn poisoning where Na<sub>3</sub>DTPA is more effective than Na<sub>3</sub>EDTA, in Pb poisoning there is almost no difference in effect of the 2 chelates; the reason for this is the high order of Pb binding with proteins, offering additional competition to the chelate. Pb is also given in an illustration of the ability of a chelate to render a radioelement diffusible in the presence of plasma proteins.

- 918 Shapiro, R.: CHELATES IN CONTRAST ROENTGENOGRAPHY. In Seven, M.K., and Johnson, L.A., ed.: Metal-Binding in Medicine. Philadelphia, Lippincott, 1960, pp. 249-54.

The preparation, toxicity, and use of PbNa<sub>2</sub>EDTA in radiology are reviewed, and preliminary findings of the author's studies with mono-Pb-trisodium diethylenetriaminepentaacetate (DTPA) and mono-Pb-disodium 1,2-diaminocyclohexane-N,N'-tetraacetate (CDTA) are described. The acute iv LD<sub>50</sub> of 34% PbNa<sub>2</sub>EDTA in guinea pigs and rabbits was found to be 800 mg/kg. Single, large (>LD<sub>50</sub>), rapid iv injections caused increased irritability, generalized convulsions, respiratory failure and rapid death. Therefore, no significant findings were noted at necropsy, but suggested central nervous system irritation with respiratory center depression. Gross hematuria was found in rabbits given smaller doses (300-500 mg/kg). In the rabbits that died or were sacrificed, hepatorenal damage was found. The acute ip LD<sub>50</sub> for rabbits was similar to that found by Bauer (1952), 350 mg/kg; im, 2 g/kg 34% solution brought death of rabbits in 18 hr, preceded by hematuria. Orally, 1 g/kg was not evidently toxic to cats. No significant diminution in toxicity was noted when rabbits received iv 500 mg/kg of CaNa<sub>2</sub>EDTA before PbNa<sub>2</sub>EDTA. Contrary to some reports, PbNa<sub>2</sub>EDTA is toxic in spite of considerable species variability; also, although it contains little "free" ionic Pb in vitro, in vivo it dissociates with release of Pb. The studies with PbDTPA and CDTA are incomplete, but it does not appear that they are significantly less toxic, and radiopacification from the 25% solution is less satisfactory than that of the EDTA. The latter produced excellent contrast visualization of numerous organs upon iv or oral administration to animals. Unfortunately, it is too toxic for clinical applicability. (12 references)

- 919 Stevens, C.D., Feldhake, C.J., and Kehoe, R.A. (Univ. Cincinnati, O.): ISOLATION OF TRIETHYLLEAD ION FROM LIVER AFTER INHALATION OF TETRAETHYLLEAD. Journal of Pharmacology and Experimental Therapeutics 128:90-4 (Jan.), 1960.

Among possible metabolites of TEL, 2 organic ions, triethyl lead (TrEL) and diethyl lead (DiEL) are

of interest. Two qualitative methods for the isolation of TrEL from livers are described. The similar findings confirmed the recognized instability of the organic Pb ions, which makes their interconversion possible in various mild circumstances.

Method I was applied in an experiment in which male rats in groups of 5 were exposed to TEL vapor for 2 hr with 0.02-0.03 ml vaporized in 4-5 l. air. Rats were killed 15-23 hr after end of exposure. These rats (Hamilton strain) did not show the typical tremors and red tears shown by rats of the Charles River strain used in an experiment in which Method II was applied. In this, a rat was exposed for 4 hr to 16 mg TEL vapor and killed 20 hr later. In both cases, TrEL was extracted from liver a day after termination of experiment. The materials isolated from liver were characterized by infrared spectra, Pb analyses and melting points as impure TrEL benzoate. The isolation of the TrEL ion from the liver suggests that an appreciable part of the inhaled TEL is converted to the TrEL ion which then persists for some time in the body. This is at variance with Harnack's view (1878) that the rapidity with which the animals recovered was evidence that the TrEL ion had decomposed. The authors consider that their findings carry implications for the treatment of TEL intoxication. Apart from being concerned with TEL molecule, therapy must also take into account the TrEL ion, a monovalent electrolyte that probably cannot be chelated but does react with thiol and other groups.

- 920 Stöber, M.: Zur Behandlung der Bleivergiftung beim Rind. (TREATMENT OF LEAD POISONING IN CATTLE.) Deut. tierärztl. Wochschr. 67:85-8, 1960.

Of 31 cattle with Pb poisoning, 28 recovered after daily intravenous infusion, for 3-5 days, of 20-80 ml of 24% aqueous solution of  $\text{CaNa}_2\text{EDTA}$  in saline or glucose solution. (From Veterinary Bulletin 30:A:5tr. No. 1950 (June), 1960)

- 921 Uzbekov, G.A. (Ryazansk Med. Inst., USSR): Serovodorod kak antidot protiv otravlenii soedineniyami tyazhelykh metallov i biokhimicheskii mekhanizm ego desintoksikatsionnogo deistviya. (HYDROGEN SULFIDE AS AN ANTIDOTE AGAINST HEAVY METAL POISONING, AND THE MECHANISM OF ITS PROPHYLACTIC ACTION.) Sbornik Nauchnykh Trudov, Ryazanskii Meditsinskii Institut 12, No. 2:122-9, 1960.

White rats and rabbits were subjected in 3 series of experiments to poisoning by Hg and Cd chlorides, Ag nitrate and Pb acetate solutions by sc injections for 6 or 8 days (concentrations of  $1.84 \times 10^{-3}\text{M}$  for Hg, Cd, and Ag, and  $1.23 \times 10^{-4}$  for Pb in rats, and  $1.54 \times 10^{-5}\text{M/kg}$  in rabbits) alone or together with oral administration of  $\text{H}_2\text{S}$  solution. The results of the experiments showed that the administration of  $\text{H}_2\text{S}$  prevented the decrease in the amino, carboxyl and sulfhydryl groups of the tissue proteins which occurred in the animals not protected by  $\text{H}_2\text{S}$ . The biocatalytic activity of the enzymes dehydrase and cytochrome oxidase which was sharply inhibited during poisoning was restored by repeated administration of  $\text{H}_2\text{S}$ .  $\text{H}_2\text{S}$

also freed the metals from the proteins and hastened their elimination from the organism. The author recommends the systematic administration of  $\text{H}_2\text{S}$ , after clinical trials, for the prevention and/or therapy of heavy metal poisoning.

- 922 Vermande-Van Eck, G.J., and Meigs, J.W. (Yale Univ. School Med., New Haven, Conn.): CHANGES IN THE OVARY OF THE RHESUS MONKEY AFTER CHRONIC LEAD INTOXICATION. Fertility and Sterility 11:223-34, 1960.

Eleven female Rhesus monkeys received 20 mg Pb chloride/wk as an iv injection for 6-8 mo, which resulted in clinical Pb intoxication with signs of anemia, basophilic stippling of erythrocytes, increased urinary Pb excretion and albuminuria and a Pb line on the gums. A marked depression of the estrogenic activity was noticed, evidenced by the cessation of the menstrual periods and the disappearance of the sex skin color. Microscopically the ovaries showed damage to the primordial oocytes and a marked inhibition of follicle growth, failure of ovulation and increase of connective tissue. Reversal to normal ovarian function and structure was obtained ~8 mo after Pb administration was discontinued. It is suggested that previous clinical observations on menstrual abnormalities and infertility in women following exposure to Pb can be explained by the same mechanism. (From authors' summary)

- 923 Yagihara, T. (Univ. Kyoto, Japan): (PHOSPHATASE ACTIVITY IN YOUNG RABBITS ADMINISTERED LEAD.) Ann. Paediat. Japon. 6:489-94, 1960.

Pb intoxication was produced in immature rabbits by feeding 0.03 or 0.05 g/kg/day Pb acetate. There was no significant change in serum inorganic P, Ca, alkaline and acid phosphatase, but, both phosphatase activities decreased in kidney, liver, small intestine, and bone marrow. After prolonged administration of large amounts of Pb these activities rose slightly. (From Chemical Abstracts 55:27642, 1961)

- 924 Yamaguchi, S., and Koga, T. (Kyushu Univ., Fukuoka, Japan): (AN EXPERIMENTAL STUDY ON THE RELATION BETWEEN LEAD AND CALCIUM METABOLISM.) Kyushu J. Med. Sci. 11:137-46, 1960.

A rabbit which had been injected with Pb salts over a 5-mo period, and was treated 2.5 yr later with  $\text{CaEDTA}$  for 10 days, showed additional rapid increase in Pb and Ca excretion after receiving an injection of parathyroid hormone on the 4th day of treatment. In another study, 15 rats were used as follows: group I received 41.8 mg of Pb acetate subcutaneously, group II received additional parotin, and group III received both, and a  $\text{CaCl}_2$  solution. Reticulocyte counts were increased in all animals but were highest in group II which also showed a slight reduction in hemoglobin. The Pb content of various organs was determined; the highest Pb deposition in bone was found in group II, but differences between the groups were not statistically significant. (From Chemical Abstracts 55:5759, 1961)

- 925 Aldanazarov, A.T., and Bul'vakhter, Ya.L.: (DISTRIBUTION OF RADIOACTIVE LEAD IN THE FRACTIONS OF THE BLOOD AND IN SOME OTHER ORGANS.) *Izvest. Akad. Nauk Kazakh. SSR, Ser. Med. i Fiziol.* 1961, No. 2:18-26.

Rad was administered orally in aqueous solution to white rats and rabbits. The maximum concentration in the various blood fractions occurred during the 1st 6 hr, in the internal organs from the 6th to the 24th hr, and in the bones from the 2nd to the 15th day. The majority was excreted in the feces, but large amounts were excreted in the urine also. There is a constant exchange of Pb between the various tissues, blood, and excretory organs. (From Chemical Abstracts 56:6328, 1962)

- 926 Arkhipova, O.G., Bezzubov, A.D., and Khatina, A.I. (Sci. Res. Inst. Confectionery Ind., USSR): *Svyazyvanie i vyvedenie svintsa iz organizma pod vliyaniem pektina.* (BINDING AND EXCRETION OF LEAD AS INFLUENCED BY PECTIN.) *Toksikologiya Novykh Promyshlennykh Khimicheskikh Veshchestv* 1961, No. 2: 148-65.

After the binding capacity of pectin with Pb had been determined in vitro, experiments were performed with Pb-poisoned guinea pigs. It was found that pectin increased the excretion of Pb by the intestinal tract, decreased the degree of Pb intoxication, and maintained the normal content of Pb in bones and liver. The advantage of pectin is discussed in comparison with other prophylactic agents which may not be added to the diet.

- 927 Atchavarov, B.A., Makashev, K.K., and Shestakova, N.P.: (DESTINY OF THE LEAD INTRODUCED INTO THE ORGANISM.) *Vestnik Akad. Kazakh. SSR* 17, No. 5:48-55, 1961.

A single dose of 1000 impulses/min  $^{210}\text{Pb}$  was fed to 23 rats with induced chronic Pb poisoning and to 23 healthy rats and the radioactivity of the tissues and excretions was measured. Pb appeared in blood during the 1st hr and reached its maximum during the 1st 24 hr in all tissues and excreta. Highest counts were in blood, kidneys, pituitary, bone, and liver and minimum counts in the central nervous system, muscles, and skin. In chronically poisoned animals the absorption was diminished. The excretion was maximum during the 1st 5 days and was 2-3 times larger through the kidneys than the bowel. The bones did not retain more Pb than other tissues but they did exchange it more slowly. Pb blood level remained high for 1 mo. (From Chemical Abstracts 56:6335, 1962)

- 928 Beaver, D.L. (Wash. Univ., School of Med., St. Louis, Mo.): THE ULTRASTRUCTURE OF THE KIDNEY IN LEAD INTOXICATION WITH PARTICULAR REFERENCE TO INTRANUCLEAR INCLUSIONS. *American Journal of Pathology* 39: 195-208 (Aug.), 1961.

Twenty albino rats, divided into groups, were given drinking water (ad lib) containing concentrations of Pb acetate at 0.05%, 0.1%, and for a limited time, 1%. Animals were sacrificed at intervals of 1-2 mo and the experiment was termina-

ted at the end of 7 mo. Five rats served as controls. Rats receiving 1% Pb acetate for 2 mo were given an additional 10 g% of Pb mixed in their food for 6 wk to induce acute poisoning and killed at the end of that period. None of the animals developed overt symptoms of Pb intoxication, and none died spontaneously. Rats receiving the highest dose of Pb exhibited only pallor and severe emaciation.

Upon sacrifice, specimens were taken from the renal cortex and medulla, and prepared for electron and light microscopy. Intranuclear inclusions in the kidney were observed in rats receiving 0.1% or more Pb acetate after 1 mo. Inclusion-bearing cells occurred focally and in groups but were limited to the proximal convoluted tubules. With chrome-osmium fixation the inclusion ultrastructurally consisted of 3 portions: a compact core; a looser, filamentous periphery; and scattered electron-dense particles. Metallic or ionic Pb could not be demonstrated, and the inclusion developed independently of the nucleolus. Electron microscopically the inclusions produced by Pb differed from intracellular inclusions of viral origin. (51 references)

- 929 Binns, W., Lynn, F.J., Beeson, K.C., and Holly, R.W.: A CONGENITAL DEFORMITY EXPERIMENTALLY PRODUCED IN CALVES BY FEEDING LUPINE AND LEAD. *Proceedings of the American College of Veterinary Toxicologists* 1961:29-30.

Calves born to heifers, 18-24 mo old, which had been fed *Lupinus sericeus* and Pb acetate (5 mg/kg daily for 56-120 days), suffered from a congenital deformity typical of "crooked calf disease." No effect on the fetus was noted in a heifer which died of Pb poisoning when 128 days in gestation. A possible interaction between a mineral and a plant may be the cause of the disease.

- 930 Black, S.C. (St. Mary's Hosp., Grand Junction, Colo.): LOW-LEVEL POLONIUM AND RADIOLEAD ANALYSIS. *Health Physics* 7:87-91 (Dec.), 1961.

Methods of analysis of urine volumes up to 1 l., 10-20 g bone and 50-60 g tissues for their contents of  $^{210}\text{Po}$  and  $^{210}\text{Pb}$  in the  $\mu\text{Ci}$  range are described. By using test animals (such as rats, mice or bats) exposed to Rn, it was shown that  $^{210}\text{Pb}$  accumulates in the animals, particularly in the skeleton, and that it has a relatively long effective half-life in mice. Po content of the animals investigated was about 40% of the Pb content. Since both Po and Pb decrease with time after exposure, a measurement of excreted Po may be an indicator of stored  $^{210}\text{Pb}$  which in turn is related to the Rn exposure of the animals. (From author's summary)

- 931 Buck, W.B., James L., and Binns, W. (Agric. Res. Serv., Logan, Utah): CHANGES IN SERUM TRANSAMINASE ACTIVITIES ASSOCIATED WITH PLANT AND MINERAL TOXICITY IN SHEEP AND CATTLE. *Cornell Veterinarian* 51:568-85, 1961.

Three ewes in early pregnancy were fed Pb acetate daily for 44-108 days. A dose of 5 mg/kg/day for 44 days produced no objective symptoms while 9 mg/

kg/day fed for 60 days caused severe toxicity and death. The 3rd ewe, fed 5 mg/kg/day for 48 days, followed by 9 mg/kg/day for 30 days and 2.5 mg/kg/day for 30 additional days, aborted and was sacrificed. An 18-mo-old pregnant heifer, fed 9 mg/kg/day Pb acetate together with *Lupinus sericeus*, showed severe toxicity on the 25th day but recovered when Pb administration was discontinued for 8 days and then continued at 1/2 the original dosage. Another 18-mo-old heifer, fed 9 mg/kg/day Pb acetate died after 75 days. Necropsy of the animals that had died or had been sacrificed showed gross liver and kidney damage. No appreciable elevations of serum transaminase activity were found in any of the animals. (From Proceedings of the American College of Veterinary Toxicologists; 53 references)

- 932 Cremer, J.E. (MRC Lab., Carshalton, Surrey, England): THE TOXICITY OF TETRAETHYL LEAD AND RELATED ALKYL METALLIC COMPOUNDS. *Annals of Occupational Hygiene* 3:226-30 (June), 1961.

This is a summary of experiments with rats which have already been published. The main purpose here was to show how biochemical studies can contribute towards understanding of the mechanism in TEL poisoning.

In rats, the injected LD<sub>50</sub> of TEL (I) and triethyllead (II) was 15.4 and 11.2 mg/kg, respectively. Onset and development of poisoning appeared to be identical for both compounds, with high excitability within 24-48 hr followed by tremors with intermittent convulsions leading to death. Rats which did not develop severe tremors recovered within a few days. Diethyllead (III) or Pb acetate (IV) injections caused loss in body weight, but recovery was complete within 2 wk. In vitro studies on slices of rat cerebral cortex showed that II at concentrations of  $7 \times 10^{-7}$  -  $2 \times 10^{-6}$  M inhibited the combustion of glucose, while TEL, even at 100 times higher concentrations, showed no effect on glucose metabolism. III, at the same concentration as II, had virtually no effect, but at higher concentrations, it inhibited O consumption and caused a small increase in lactic acid. IV, at  $10^{-4}$  M had practically no effect. Brain slices from rats injected with 20 mg TEL/kg or 10 mg/kg of II chloride, and killed 4 hr later, showed identical lowered O consumption and increased lactic acid values. After 40 mg/kg of III chloride or 100 mg IV/kg, no changes were observed as compared to controls. In the rats administered TEL, the II content of blood, liver, kidney, and brain was (µg/g wet weight) 76, 45, 23, and 2.4, respectively, after 4 hr, and 62, 29, 25, and 19.0, respectively, after 24 hr. The values were very similar in the animals injected with II. Approximate LD<sub>50</sub> values for tetra- and triethyllead were 105 and 25-30 mg/kg, respectively, and for tetra- and tripropyllead they were 200 and 20-30 mg/kg, respectively.

In discussing the findings, the anomalous results with TEL point to the conversion in the body to II. The site of conversion is the liver whence it is carried by the blood to the brain. Although the amount of II in the brain was low, it was calculated to be sufficient to account for the altered metabolism of glucose in brain slices from poisoned rats.

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Cremer, J.E., and Callaway, S. (Med. Res. Council Lab., Carshalton; War Office Chem. Defence Exptl. Establ., Porton Down, Salisbury, England): FURTHER STUDIES ON THE TOXICITY OF SOME TETRA AND TRIALKYL LEAD COMPOUNDS. *British Journal of Industrial Medicine* 18:277-82 (Oct.), 1961.

In experiments with rats, the following approximate LD<sub>50</sub> values were established (mg/kg): trimethyl Pb chloride ip, 25.5; TML orally, 109.3; tripropyl Pb chloride orally, 26.67; tetrapropyl Pb produced no effects at doses of 40 mg/kg iv, but 395 mg/kg orally killed 4/4 animals within 3-4 days. Inhalation experiments with rats showed that the LC<sub>50</sub> was 0.85 mg/l of TEL or 8.87 mg/l of TML. One adult rabbit receiving ip 15 mg/kg of trimethyl Pb chloride died after 12 hr, and another receiving 7.5 mg/kg first seemed hyperesthetic when handled by the head, but appeared normal after 2 wk. Two rabbits receiving iv 20 and 40 mg TML/kg showed no effects within a 3-wk period, but 1 rabbit given iv 31 mg TEL/kg immediately showed signs of poisoning and died after 16 hr. In rats poisoned by 15 mg/kg trimethyl Pb and killed 4 or 24 hr later, the compound was found mostly in the blood (160 and 180 µg/g wet weight), liver (40 and 28.5), and kidney (23 and 25.5); in brain, 2.25 and 43 µg/g. In rats poisoned with tripropyl Pb, only traces of the compound were found in the blood. (When the same compounds were added to whole rat blood in vitro, over 90% of each was recovered in the red cells.) A slow conversion of the tetra to the trialkyl Pb forms was observed in the rats in vivo. Glucose metabolism was markedly inhibited in brain slices from rats given tripropyl Pb, but no such inhibition was observed in slices from rats given trimethyl or tetrapropyl Pb.

The findings are discussed as supporting the hypothesis that TEL itself is nontoxic, but that it is converted enzymatically by the liver to triethyl Pb which is toxic and to which the metabolic processes of brain tissue are particularly sensitive. Referring to the relatively low toxicity of TML as demonstrated in rats and rabbits, the author points out that the effects might be different in man, and recommends that the precautions taken in handling TEL should be applied equally to TML.

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Dhar, D.C. (Central Drug Research Inst., Lucknow, India): INFLUENCE OF ADRENAL CORTEX ON LEAD ANAEMIA AND THE EFFECT OF ACTH AND CORTISONE. *Indian Journal of Medical Research* 49:33-41 (Jan.), 1961.

Male albino rats (150-160 g weight), made anemic by intravenous injections of 6 mg Pb acetate/100 g body weight, were divided into 3 groups to study the effects of removal of adrenal, of substitution of cortisone, and of substitution of adrenocorticotropin (ACTH). ACTH and cortisone in single and repeated doses increased regeneration of red blood cells and hemoglobin in the anemic rats: ACTH was comparatively more effective than cortisone. The doses were fatal to adrenalectomized rats with or without ACTH treatment. (20 references)

935

Dukes, C.E. (St. Mark's Hosp., London,

- England): CLUES TO THE CAUSES OF CANCER OF THE KIDNEY. *Lancet* 2:1157-60 (Nov. 25), 1961.
- The carcinogenic activity of Pb acetate was investigated in 20 male rats, fed a diet containing 1% Pb acetate for >1 yr. Fifteen of them developed renal tumors. The first tumor was discovered in a rat that had received Pb acetate for 11 mo and necropsy of the animal revealed an early focus of carcinoma in the right kidney. Mostly adenomas, some of them malignant, with their histology closely resembling that of renal adenocarcinoma as seen in man, were found in 3 of 4 other rats killed and examined. Neoplasms (some adenomas and other carcinomas) were found in all 11 rats which survived for >12 mo. All rats fed Pb acetate developed chronic cystic nephritis within 6 mo, tumors developing later. (40 references)
- 936 Edwards, C., Olson, K.B., Heggen, G., and Glenn, J. (Albany Med. Coll., N.Y.): INTRACELLULAR DISTRIBUTION OF TRACE ELEMENTS IN LIVER TISSUE. *Proceedings of the Society for Experimental Biology and Medicine* 107:94-7 (May), 1961.
- Determination of metals in whole liver tissue revealed a general pattern of concentrations. In this study, an attempt was made to determine the intracellular distribution of selected metals found in liver tissue fractionated by differential centrifugation. The fractionation procedure followed was essentially that of Hogeboom, Schneider and Pallade (1948). The mean values for normal liver (Wistar rats, and humans) are presented in a table. Metals sought but not found in determinable quantities were Ag, Co, Ni, Pb, Sn, Ti, and V.
- 937 Fati, S. (Univ. Naples, Italy): (THE METABOLISM OF TRYPTOPHAN IN EXPERIMENTAL LEAD TOXICITY.) *Biochim. Appl.* 8:280-93, 1961.
- Rabbits treated with Pb acetate excreted more xanthurenic acid in the urine after test loads of tryptophan than did control rabbits. They also showed high concentrations of free protoporphyrin in red blood cells and of coproporphyrin in urine, which decreased after large intramuscular doses of vitamin B<sub>6</sub>. (From Chemical Abstracts 57:17002, 1962)
- 938 Federov, V.A. (Kiev Distr. Agr. Station, USSR): Otravlenie krupnogo rogatogo skota soedineiyami svintsya. (THE POISONING OF CATTLE WITH LEAD COMPOUNDS.) *Veterinariya* 11:56-8, 1961.
- On a collective farm 42% of the cattle were poisoned after eating sugar-beet pulp containing Pb compounds. The course of the illness was fulminating (<0.5 hr), acute (2-3 days) or more prolonged (3-6 days). Treatment with drugs had no effect in the fulminating form and very little in the acute form. Three cattle died and 6 had to be killed. The presence of 0.1-0.5 mg Pb/kg was established spectroscopically in 106 samples of meat. The meat was classified as usable with restrictions, and the secondary products were rejected.
- 939 Gajdos, A., Gajdos-Török, M., and Bénard, H. (Hôtel Dieu, Paris, France): Quelques données nouvelles sur l'utilisation du fer pour la synthèse de l'hémoglobine au cours du saturnisme expérimental. (SOME NEW DATA ON THE UTILIZATION OF IRON IN THE COURSE OF EXPERIMENTAL SATURNISM.) *Nouvelle Revue Française d'Hématologie* 1:263-9 (Mar.-Apr.), 1961.
- Pb intoxication was induced in rabbits by daily administration by gastric tube of Pb acetate in doses, increasing from 200-800 mg. On the 8th day of intoxication blood was withdrawn from the animals and incubated with <sup>59</sup>Fe. A decrease in the synthesis of heme and protoporphyrin was observed which was attributed to inhibition of the heme synthetase. Along with this phenomenon there was a decrease in the transfer of plasma Fe into the red blood cells and a fixation in the stroma of a large part of the Fe which had penetrated the cellular membranes.
- 940 Gajdos, A., Gajdos-Török, M., and Danieli, G. (Hotel Dieu, Paris, France): Traitement du saturnisme expérimental du lapin par l'acide adénosine-5-monophosphorique. Action sur les troubles métaboliques des porphyrines et sur l'anémie. (TREATMENT OF EXPERIMENTAL SATURNISM IN RABBITS BY ADENOSINE-5-MONOPHOSPHORIC ACID. ACTION ON THE METABOLIC DISORDERS OF PORPHYRINS AND ON THE ANEMIA.) *Revue Française d'Études Cliniques et Biologiques* 6:888-96 (Nov.), 1961.
- Sixteen rabbits, weighing ~3 kg each, were injected sc with 100 mg/kg of neutral Pb acetate. Starting on the following day 8 of these rabbits were injected daily with 100 mg adenosine-5-monophosphoric acid (AMP) for 25 days. In the untreated animals ALA in urine and blood plasma, porphobilinogen, coproporphyrin, uroporphyrin and free protoporphyrin (PP) in the erythrocytes increased and the level of hemoglobin decreased significantly while in the rabbits treated with AMP excretion of urinary porphyrins and their precursors decreased rapidly. AMP also inhibited the occurrence of anemia but did not influence the level of ALA in the plasma and of free PP in the erythrocytes. The mechanism of the action of AMP on the porphyrin synthesis and on Pb anemia was discussed.
- 941 Gherardi, M., and Salvi, G. (Univ. Parma, Italy): Azione di alcuni inibitori enzimatici sull'intossicazione acuta sperimentale da composti tetra-alchilici di piombo. (ACTION OF SOME ENZYMATIC INHIBITORS ON ACUTE EXPERIMENTAL POISONING BY TETRAALKYLLEAD COMPOUNDS.) *Folia Medica (Naples)* 44:987-97 (Nov.), 1961.
- TEL or TML in a dose of 54.5 mg/kg was injected sc into 255 adult Swiss albino mice (av 22 g body weight) SKF 525-A (β-diethylaminoethyl-diphenyl-propylacetate-HCl), Marsilid (1-isonicotinyl-2-isopropyl-hydrazine), at 25-50 mg/kg, or Marplan (1-benzyl-2-(5-methyl-3-isoxazolyl-carbonyl)hydrazine), at 2.5-5 mg/kg, were injected ip in single or repeated doses on the 1st, 2nd and 3rd day of the intoxication. SKF 525-A and Marplan did not exert any protective action on TML poisoning, whereas a single injection of Marsilid gave a sig-

nificant prolongation of the interval between TML exposure and the onset of symptoms. Repeated administration of Marsilid prevented the appearance of toxic symptoms. All compounds were ineffective in protecting mice from TEL poisoning.

The authors conclude that the action of Marsilid in TML poisoning might be explained through its inhibitory action on the demethylating enzymic systems contained in liver microsomes, thus preventing the formation of such degradation products as the trimethyllead ion. This also proves that the toxicity of TML is mainly due to its decomposition in the body.

- 942 Grishchenko, E.D. (Academy of Medical Sciences, Moscow, USSR): THE BLOOD: ORGAN RATIOS OF RADIOACTIVITY IN NORMAL AND LEAD-POISONED RATS AFTER INJECTION OF METHIONINE  $^{35}\text{S}$ . *Acta Physiologica Academiae Scientiarum Hungaricae* 20, No. 1: 77-80, 1961.

Two groups of rats, one previously given orally 100-200 mg of Pb nitrate/day for 50 days, were injected intraperitoneally with 10 Ci of methionine  $^{35}\text{S}$ . Controls were sacrificed after 1, 2, 3, 8, or 16 days and the Pb rats after 22 days and the radioactivity of the blood and tissues was determined. The Pb-intoxicated animals showed no signs of dysfunction on all tests except basophilic granulation of erythrocytes, and were thus considered to be in the 2nd period of intoxication, as classified by the author (ie, after 3 mo, when temporary normalization of vital functions occurs, the 1st being when rate of methionine  $^{35}\text{S}$  incorporation decreases, and the 3rd when irreversible aggravation in nearly all values occurs). Changes in the blood/organ ratio of radioactivity with passage of time differed in the normal and Pb intoxicated rats. The increase of blood/organ ratio of radioactivity was not as great in the Pb intoxicated animals as in the normal ones, indicating a disturbance in the metabolic activity of the tissues. This method has therefore a diagnostic value in detecting metabolic disturbances not detected by other tests.

- 943 Harashima, S., Kondo, H., Satowa, S., and Sakurai, H. (Keio Univ., Japan): GLUCURONIC ACID EXCRETION IN URINE OF RABBITS BY EXPOSURE TO CARBON DISULFIDE, BENZOL, AND LEAD. *Japanese Journal of Hygiene* 16:423-9 (Dec.), 1961.

The importance of glucuronic acid in the detoxication mechanisms has been widely recognized. The present experiments were made with rabbits which were exposed to C disulfide, benzene and Pb which are usually used in the today's Japanese industry. An exposure chamber for C disulfide was designed so as to regulate its concentration as high as 500 ppm. The animals were divided into 3 groups and each group was exposed twice with a single exposure duration of 3, 6.5 and 12 hr. In order to induce Pb and benzene absorption, the animals were injected sc twice with Pb acetate solution, corresponding to 10 mg/kg for Pb and once with 176 mg/kg of benzene, respectively.

Analyses of urinary glucuronic acid and ether glucuronide were carried out by the naphthoresorcin picrate method. The concentration of urinary

glucuronic acid was corrected by the concentration of urinary creatinine. Thus the concentration of glucuronic acid was expressed as G/C ratio in urine.

Principal results obtained were as follows: The decrease in G/C ratio and little change in plasma cholesterol, A/G ratio and serum GPT after exposure to C disulfide suggested that the decreased excretion of urinary glucuronic acid was not due to impairment of the liver but to other, perhaps neurologic or endocrinologic mechanisms. Benzene administration caused an increase in G/C ratio in urine. As to Pb, no change was found in the excretion of urinary glucuronic acid.

- 944 Hausman, R., Sturtevant, R.A., and Wilson, W.J., Jr. (Office of Med. Examiner, Bexar County, Texas; San Antonio Zoo): LEAD INTOXICATION IN PRIMATES. *Journal of Forensic Sciences* 6:180-95 (Apr.), 1961.

A rapidly progressing fatal paralysis over a period of 24 days in an orangutan of the San Antonio, Texas, Zoo was found to be caused by Pb arsenate intoxication. The gross and microscopic findings included changes in the heart, liver, kidneys, intestine, brain, and spinal cord, the most striking being found in the spinal cord. Combined pieces of kidney and liver contained 0.189 mg Pb/100 g wet tissue (dithizone method). The source of the poison was about a dozen roach hives containing 1.85-g wafers of 16.2% Pb arsenate, located in a recess at the top of the cage within reach of the animal.

Another unpublished case of fatal Pb intoxication in a mandrill is also described. The signs were convulsions and wrist drop which were first cured but then reappeared accompanied by complete blindness, leading to a coma after ~5 mo. Autopsy showed, among other findings, tubular degeneration and scattered hyperchromatic and enlarged nuclei with inclusions of eosinophilic globules or irregular eosinophilic or basophilic masses. The Pb content in mg/100 g wet tissue was: liver 1.16; kidney 0.840. Scrapings of paint from the cage contained 5.05% Pb as PbO.

- 945 Horande, M., and Perez Castrillo, R. (Inst. Med. Exptl., Caracas, Venezuela): Influence de l'intoxication saturnine subaigue sur la captation de l'iode  $^{131}\text{I}$  par la thyroïde du rat. (INFLUENCE OF SUBACUTE LEAD POISONING ON IODINE- $^{131}\text{I}$  UPTAKE BY THE RAT THYROID.) *Annales d'Endocrinologie (Paris)* 22:898-901 (Nov.-Dec.), 1961.

Four groups of Sprague-Dawley male rats, composed of 15, 10, 20, and 25 rats, respectively (av 300 g weight), were injected ip with 0.2 ml of 18% basic Pb acetate/250 g of body weight daily, for 4 days. All surviving animals, except those in group II, were also injected ip with 10  $\mu\text{m}^3$  of  $^{131}\text{I}$ . The uptake of  $^{131}\text{I}$  by the thyroid gland, measured 1, 2, and 3 wk after the 1st Pb acetate injection in group I, III, and IV, respectively, was 19, 11.2 and 11% respectively, as compared to 6.4 in controls. Histologic examination of the thyroid gland of rats in group II, performed 1, 2, and 3 wk after the 1st injection of Pb acetate, failed to show significant differences between the normal and intoxicated rats. The increase in  $^{131}\text{I}$  uptake is



considered to be a nonspecific type of thyroid response forming a part of the general syndrome of adaptation to Pb.

- 946 Horiuchi, I., and Horiuchi, S.: THE FATE OF LEAD IN THE BODY -- EXPERIMENT WITH RAD. In Proceedings of the Second Japan Conference on Radioisotopes, February 1958. Translated from a publication of the Japan Atomic Industrial Forum, Inc., Tokyo, 1958. US Atomic Energy Commission Document No. AEC-tr-4482, 1961, pp. 751-67.

To a rat which had already been given Pb poisoning by the administration of Pb acetate,  $^{210}\text{Pb}$  was given as a tracer by means of sc injection, parenteral administration, and inhalatory administration. Subsequently the level of  $^{210}\text{Pb}$  in the urine and feces was measured daily. The  $^{210}\text{Pb}$  in the organs and tissues of rats which were bled to death 3-20 days after administration of the  $^{210}\text{Pb}$  was also measured. The isotope concentration was determined in the whole blood, cerebral cortex, lung, liver, and spleen, gastro-intestinal tract, kidneys, muscle, and bones and teeth. It was found that on the 20th day after administration, 5% of the  $^{210}\text{Pb}$  was absorbed within the body after parenteral administration and 32 and 24% respectively after inhalatory administration and sc injection. It was observed that most of the absorbed  $^{210}\text{Pb}$  was accumulated in the firm tissue such as bones and teeth, and very little was found in the soft tissue. (From Nuclear Science Abstracts 15:Abstract No. 25821, 1961)

- 947 Horiuchi, K., and Horiguchi, S.: APPLICATION OF RADIO-ISOTOPES IN THE RESEARCH FIELD OF TOXICITY OF HEAVY METALS: A REVIEW. Saishin Igaku 14, No. 4:972-5, 1960. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School. Vol. 2, April 1959-March 1961, p. 112.

- 948 Iordanidis, P. (Inst. Ind. Hyg. Occup. Med., Paris, France): Influence du B.A.L. et du Ca EDTA Na<sub>2</sub> sur le taux des hématies ponctuées après l'intoxication plombique subaiguë du cobaye. (THE EFFECT OF BAL AND CaNa<sub>2</sub>EDTA ON THE PUNCTATE ERYTHROCYTE COUNT FOLLOWING SUBACUTE LEAD POISONING IN THE GUINEA PIG.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 16:208-16 (Apr.-May), 1961.

Ten groups of 4 guinea pigs each (2 male, 2 female), 6-8 mo old, 410-715 g weight, were first maintained under quarantine for 25 days; the standard ration was regulated so as to maintain the weight of the animals almost constant during the experimental period. The weekly ration contained 0.8785 mg Pb. Two groups served as controls. All animals received a total of 13 ip injections of 6 mg Pb (metal)/kg body weight in a 1% aqueous solution every 2 days. Two days after the last dose, groups 3, 4 and 5 started receiving 20 mg/100 g of CaNa<sub>2</sub>EDTA in 8 intramuscular injections at 2-day intervals; groups 6, 7 and 8 received 1.5 mg/100 g weight of BAL in the same manner. Groups 9 and 10 received EDTA and BAL, respectively, in

a single dose. Blood smears were examined throughout the experimental period: 25 days of quarantine, 25 of intoxication, 16 of detoxication, and 18 additional days of observation. In groups 1 and 2, the stippled cell count increased steadily within 20-24 days following the last Pb injection and then started downward, but in all cases at the end of the 2nd stage of observation (the 34th day), the counts were still much higher than those observed at the time of the last injection. In the guinea pigs receiving EDTA or BAL, no statistically significant increases in stippled cell counts appeared within 36 days; the animals receiving the chelates in single doses showed a slight decrease in these values within the following 48 hr.

- 949 Klinger, W., and Kersten, L. (Pharmacol. Inst., Friedrich-Schiller-Univ., Jena, Germany): Untersuchungen über die Wirkung von Calciumthiosulfat und Dicalcium- und Dinatriumcalcium-Versenat. II. Die Schutzwirkung gegen die Blei- und Oxalatvergiftung und Beeinflussung der Membranpermeabilität. (STUDIES ON THE EFFECT OF CALCIUM THIOSULFATE AND DICALCIUM- AND DISODIUMCALCIUM VERSENATE. II. PROTECTIVE ACTION AGAINST LEAD AND OXALATE POISONING AND ALTERATION OF MEMBRANE PERMEABILITY.) Acta Biologica et Medica Germanica 6:498-508, 1961.

A study was conducted on the comparative effectiveness of Ca thiosulfate and CaEDTA in treatment of induced Pb intoxication in mice. The LD<sub>50</sub> of ip administered Pb acetate, as determined in 77 mice was 8 mg/20 g of body weight. When simultaneous ip injections of 8 or 13 mg Pb acetate and 0.02 ml Ca thiosulfate or 0.03 ml CaEDTA, respectively, were given to mice, better protection was obtained with the thiosulfate. In prophylactic treatment, however, when 0.06 ml Ca thiosulfate or 0.1 ml CaEDTA was administered ip 20 min prior to a 13 mg dose of Pb acetate, CaEDTA proved more effective. In further experiments with rabbits, rats, and in vitro, both drugs caused a drop in serum Ca; the thiosulfate effected a greater rise in blood pressure than did EDTA, but it rendered the membrane impermeable (in vivo: inflamed ear of mouse; in vitro: guinea pig ileum), while EDTA had either no effect or caused loosening of the membrane.

- 950 Kośmider, S., and Sroczyński, J. (Silesian Clinic Int. Dis., Zabrze, Poland): Zmiany elektrokardiograficzne w przewlekłej, doświadczalnej ołowicy u królików. (ELECTROCARDIOGRAPHIC CHANGES IN CHRONIC EXPERIMENTAL PLUMBISM IN RABBITS.) Postępy Higieny i Medycyny Doświadczalnej 15:353-7 (May-June), 1961.

Chronic Pb poisoning was induced in 10 rabbits (2.5-3.5 kg weight) by the iv injection of 5 mg Pb acetate/kg every 7 days; the animals were observed for 83-180 days. EKG examinations were conducted from the 3rd mo of poisoning. The results are described and illustrated in 3 figures and compared in a table with histopathologic findings. The authors conclude that in Pb poisoning abnormal EKG's reflect changes in the heart muscle.

- 951 Kulagina, N.K.: (THE USE OF FOLIC ACID IN THE TREATMENT OF Pb INTOXICATION.) Toksikol. Novykh Prom. Khim. Veshchestv 1961, No. 2:172-82.

The treatment with 0.2 mg folic acid/kg/day influenced favorably the Pb intoxication in guinea pigs. The onset of anemia and other symptoms was slower and the survival of treated animals was higher than that of controls. The use of folic acid in the diet as a prophylactic measure for humans is discussed. (From Chemical Abstracts 57:12824, 1962)

- 952 Lawford, D.J. (Med. Res. Council, London Hosp., England): AN ABNORMAL SERUM COMPONENT IN EXPERIMENTAL POISONING BY CADMIUM AND OTHER METALS. Biochemical Pharmacology 7:109-22, 1961.

The production of an abnormal serum component, which was observed 24 hr after an ip injection of a single dose of 1 mg/kg Cd to albino rats, was also tested with Pb. A pair of Chester-Beatty adult male rats were injected ip with 1 mg/kg Pb acetate. After 24 hr the animals were bled and the sera examined by starch gel electrophoresis, using the continuous buffer system. No reaction comparable to that caused by Cd was produced with Pb.

- 953 Liégois, F., Derivaux, J., and Depelchin, A. (Brussels, Belgium): L'Intoxication Saturnine chez les animaux. (LEAD POISONING IN ANIMALS.) Annales de Médecine Vétérinaire 105, No. 2:57-81, 1961.

The etiology and toxic doses for domestic animals are reviewed and the metabolism of Pb in the organism and the damage it may cause to the tissues are described together with the action on cells as well as symptoms of Pb poisoning. When sheep and dogs were given 1 g Pb acetate, no basophilic granulations were noted in the sheep and in 1 dog they were present only in the early stages. Although these granulations in animals may constitute a means of diagnosis, their absence does not exclude Pb poisoning. Administration of 1 g Pb acetate daily for 5 days with or without EDTA to sheep and dogs did not affect significantly the blood content of Ca, P, Mg, Na, K, protein, glucose, urea, sugar, hemoglobin. Urinary Pb excretion >85-100 mg/l/24 hr is indicative of Pb poisoning. Pb retention was higher in the liver than in bone in all experimental animals, except in 1 dog, and EDTA mobilized Pb better from the liver than from bones. Methods of treatment were reviewed and intravenous doses of EDTA were recommended.

- 954 Lyubetskii, Kh.Z., Kazakov, K.S., and Kazakova, T.S.: (TRANSAMINATION IN LEAD POISONING AND THERAPY WITH ETHYLENEDIAMINETETRAACETATE (EDTA).) Sb. Nauchn. Tr. Tashkentsk. Gos. Med. Inst. 20:151-5, 1961.

Glutamic-pyruvic transaminase activity of the heart, liver, kidneys and muscles was studied in rabbits which were injected iv with 10 mg/kg Pb acetate. The glutamic-pyruvic transaminase activities in the organs tested were seriously affected in the rabbits which developed acute Pb intoxication. Iv administration of 150-200 mg EDTA/kg en-

hanced the concentration of the enzyme in the organs and prevented the onset of the pathological conditions. (From Chemical Abstracts 58:7287, 1963)

- 955 Makashev, K.K., and Shestakova, N.P.: (DISTRIBUTION OF LEAD IN THE TISSUES AND ORGANS AND ITS ELIMINATION IN NORMAL ANIMALS AND IN ANIMALS POISONED WITH LEAD.) Tr. Inst. Kraevoi Patol., Akad. Nauk Kaz. SSR 9:129-35, 1961.

Normal rats and rats poisoned by feeding non-radioactive Pb for 4-6 mo, received a single dose of  $^{210}\text{Pb}$  per os. Radioactivity determinations were made after 1-10 hr and 1-30 days in all tissues and organs of the animals, and in urine and feces collected daily. One hr after the administration of  $^{210}\text{Pb}$  to normal rats all tissues and organs were radioactive, the radioactivity decreasing in the order: kidney, gastrointestinal tract, bones, liver, blood, spleen, thyroid gland, hypophysis, lung, brain tissue, muscles. After 24 hr the highest concentrations of  $^{210}\text{Pb}$  were found in kidney, bones, and blood, and after 30 days, only bones, kidney, and blood (in that order of accumulation) contained appreciable quantities of  $^{210}\text{Pb}$ . The maximum excretion of  $^{210}\text{Pb}$  was observed during the first 6 days (31.4% with the feces, and 5% with the urine). Subsequently, the rate of excretion diminished,  $^{210}\text{Pb}$  being eliminated mainly with the urine. The distribution pattern and the excretion of  $^{210}\text{Pb}$  in Pb-poisoned rats were essentially the same as in normal animals, but  $^{210}\text{Pb}$  was absorbed more slowly from the intestinal tract, accumulated in tissues and organs in smaller quantities, and its rate of excretion was lower. (From Chemical Abstracts 57:4977, 1962)

- 956 Nurmaganbetov, E.K.: (FUNCTIONAL STATE OF THE ADRENAL CORTEX IN CHRONIC LEAD POISONING. A PRELIMINARY REPORT.) Izvest. Akad. Nauk Kazakh. SSR, Ser. Med. i Fiziol. 1961, No. 2:41-50.

Rabbits, given 1 ml/kg of body weight of a 2% solution of Pb acetate, after 7-8 mo showed adrenals 2-3 times larger than those of controls. Histologic studies revealed hypertrophy of some cells with increased formation of keto steroids and necrosis in other portions. Chronic Pb poisoning leads to suppression of the activity of the adrenal cortex. (From Chemical Abstracts 56:5071, 1962)

- 957 Ogawa, E., Fukuda, R., and Suzuki, S. (Gunma Univ., Maebashi, Japan): EXPERIMENTAL STUDIES ON THE EXCRETION OF RADIOACTIVE STRONTIUM. Nippon Yakurigaku Zasshi 57, No. 2:29, 1961.

The effect of some drugs on urinary and fecal excretion of  $^{90}\text{Sr}$  was studied in male mice, weighing 20 g, which had been injected daily for 3 days with 1  $\mu\text{Ci}$  of  $^{90}\text{Sr}$ . The animals were then killed and  $^{90}\text{Sr}$  in bone was determined with a G-M counter. Administration of Mg and ammonium chlorides, Na thiosulfate and sulfate increased the excretion of  $^{90}\text{Sr}$ , that of a number of chelates, including NaPb citrate (Pb acetate/Na citrate = 0.2) at doses of 40 and 20 mg/kg did not change excretion of  $^{90}\text{Sr}$  or its storage in bone. (From Nuclear Science Ab-

- 958 Otsuka, I.: (LEAD POISONING-METALLIC ELEMENT DISTRIBUTION IN ORGANS OF RABBITS ADMINISTERED LEAD ACETATE.) Kyoto Firisu Ika Daigaku Zasshi 69:149-63, 1961.

Rabbits were injected with 3 mg/kg of body weight Pb acetate on alternate days for 60 days. Na, Mg, Al, Si, P, K, Ca, Ti, Cr, Mn, Fe, Cu, Zn, Ag, and Pb were detected by emission spectral analysis in the organs of both normal and Pb-intoxicated rabbits. Ti, Cr, Ag, and Pb were not detected throughout every organ or individual. (From Chemical Abstracts 57:12823, 1962)

- 959 Popović, S.N., Stanković, M., and Popović, S.V. (Yugoslavia): Prilog prouchavanu blastoftornog dejstva olova. (CONTRIBUTION TO THE BLASTOPHTHORIC EFFECT OF LEAD.) Glasnik Higijenskog Instituta 9:97-103 (July-Dec.), 1961.

Two groups of rats were given daily doses of 1 ml of 25% solution of Pb acetate for 16 and 19 days, respectively. One testis from each animal was taken for histological examination and the other one for Pb determination. The testes of rats poisoned for a period of 16 days contained less Pb and showed less pronounced histopathological changes than those of rats poisoned for 19 days. A correlation of the Pb content in the testes (0.6077-0.9020 mg% in 7 rats treated 16 days; 0.275-2.874 mg% in 9 treated 19 days; 0.0389-0.0428 in 2 controls), and their histopathological changes were not noted.

- 960 Porte, A., and Batzenschlager, A. (Inst. d'Histologie, Strasbourg, France): Sur la formation d'inclusions intranucléaires, provoquées par les sels de plomb dans les cellules des tubes contournés du rein. Ultrastructure et histochimie. (ON THE FORMATION OF INTRANUCLEAR INCLUSIONS INDUCED BY LEAD SALTS IN THE CELLS OF THE DISTORTED KIDNEY TUBES. ULTRASTRUCTURE AND HISTOCHEMISTRY.) Comptes Rendus des Séances la Société de Biologie et de ses Filiales 155:125-7, 1961.

Nuclear modifications of liver and kidney cells were studied in mice fed with basic Pb acetate (no data). Renal and liver fragments were examined at weekly intervals. After 3 wk of ingesting Pb acetate a large number of nuclei in the cells of the renal tubes contained basophilic, osmiophilic, Feulgen-positive material; under the electron microscope it appeared to be quite heterogeneous, composed of coarse fibrous material which was considered to be derived from chromatin and consisting of desoxyribonucleic acid. The signs of cytoplasmic degeneration followed the formation of these bodies. The mode of action of Pb on the nucleus remained obscure, since the histochemical reactions of Pb in the nucleus were negative. The Feulgen-positive characteristics of the intranuclear bodies were considered to be a major argument in favor of their viral origin. However, the lesions caused by Pb showed that the inclusion bodies may result from nuclear changes other than viral in origin.

- 961 Quatrini, U., and Caiola, G. (Univ. Palermo, Italy): Intossicazione acuta sperimentale da Pb acetato ed attività latticodeidrogenasica nel ratto albino. (ACUTE EXPERIMENTAL POISONING BY LEAD ACETATE AND LACTIC DEHYDROGENASE ACTIVITY IN THE WHITE RAT.) Società Italiana di Biologia Sperimentale 37:341-3 (Apr. 30), 1961.

Albino rats were injected intraperitoneally with 30 mg of Pb acetate, daily, for 3-4 days. After a few days all animals developed signs of acute intoxication (diarrhea, cutaneous hemorrhages, etc). The lactic dehydrogenase (LDH) activity in the serum was measured on the 1st, 3rd, 4th, 5th days after intoxication and compared with results obtained in a control group. During the first 3 days, the enzymatic activity did not differ from that in the control group, but increased after the 4th day (av 80%), and the 5th day (av 123%). All animals were sacrificed and fragments of heart and liver tissues were tested for enzymatic activity. Macroscopic examination revealed degeneration and necrosis, especially in the liver. LDH activity increased both in the liver (av 49.9%) and in the heart (34.6%).

- 962 Sakai, G.: (EFFECTS OF ANEMIA AND MERCURY AND LEAD POISONINGS UPON METHEMOGLOBIN REDUCTION.) Tokyo Jikeikai Ika-daigaku Zasshi 76, No. 11:2463-7, 1961.

The time needed for methemoglobin reduction was followed by measuring the oxidation-reduction potential of methemoglobin-containing rabbit red cells suspended in rabbit serum. Methemoglobin was produced by adding  $\text{NaNO}_2$ . A marked retardation of the reduction was observed in red cells of rabbits with hemorrhagic anemia and Hg (0.5 mg Hg as  $\text{HgCl}_2$ /kg body weight daily, for 40 days) and Pb poisoning (20 mg Pb as Pb acetate/kg body weight, twice/wk, for 7 wk). (From Chemical Abstracts 61:7593, 1964)

- 963 Salvi, G., and Gherardi, M. (Univ. Parma, Italy): Azione di nuovi composti sulfidrilici sull'intossicazione sperimentale da cloruro di piombo trietile. (ACTION OF NEW SULFHYDRYL COMPOUNDS ON EXPERIMENTAL POISONING BY LEAD TRIETHYL CHLORIDE.) Folia Medica (Naples) 44:13-20 (Jan.), 1961.

Four groups of adult male mice (average weight 22 g), were injected sc with 0.3 mg of triethyllead chloride (13.635 mg/kg causing 95% fatality). The animals developed neurological symptoms (hyperexcitability, tremors, first localized then generalized, tonic-clonic convulsions, etc) after a 12-16 hr latency period, identical with TEL intoxication. Three groups (20 animals in each group), were injected on the 1st, 2nd and 3rd days of the experiment intraperitoneally with 1.6 mg of  $\beta$ -mercaptoethylamine, 1.6 mg of  $\beta$ -mercaptoguanidine, and 22 mg of cysteamineacetic acid, respectively, corresponding to 1/3 of  $\text{LD}_{50}$ . After 6 days 25% of the animals of the  $\beta$ -mercaptoethylamine group, 35% of the  $\beta$ -mercaptoguanidine and 65% of the cysteamineacetic acid group survived. In the control group (39 animals), survival was practically zero. The Pb content between 24 and 48 hr after intoxication was highest in the brain

(93 µg/g dry weight, decreasing after 5 days to 17.3), intermediate in the kidneys (72 µg/g dry weight), and lowest in the liver (28 µg/g dry weight). The Pb content of tissues 30 days after intoxication was negligible.

- 964 Salvi, G., and Gherardi, M. (Univ. Parma, Italy): Influenza della β-mercaptoguanidina sulla intossicazione da tetraetile e tetrametile di piombo. (INFLUENCE OF β-MERCAPTOGUANIDINE ON INTOXICATION BY TETRAETHYL AND TETRAMETHYL LEAD.) *Folia Medica* (Naples) 44:983-6 (Nov.), 1961.

Swiss albino mice (weight ~22 g each), poisoned by sc injection of 49.9 mg/kg of body weight of TEL or 45.4-54.5 mg/kg of TML, were treated intraperitoneally with 1.6 mg β-mercaptoguanidine in physiologic solution at pH 7. The drug was administered on day 1, 2, 3 or 2, 3, 4 or 3, 4, 5, respectively. Neurologic symptoms appeared in the mice within 28-30 hr after poisoning with either TEL or TML and, in the case of TML, led to paralysis of the hind limbs. β-Mercaptoguanidine had no protective effect on either intoxication. Subacute poisoning by TML was aggravated by treatment with the drug.

- 965 Sanderson, G.C., and Thomas, R.M. (Illinois State Natural History Surv.; Univ. Illinois Coll. Vet. Med., Urbana): INCIDENCE OF LEAD IN LIVERS OF ILLINOIS RACCOONS. *Journal of Wildlife Management* 25: 160-8, 1961.

Concentrations of Pb ranging from 1-32 µg/g of liver were found in 100 wild raccoons killed in Illinois by hunters and trappers during late fall of 1958 and January 1959. Only 1 liver was negative for Pb. Livers collected from raccoons during July-September had significantly less Pb than did those collected during the fall. Adrenal weights of raccoons with lower levels of Pb were significantly heavier than those from raccoons with higher levels of Pb. In the absence of other obvious causes of stress, levels of Pb up to 32 µg/g of liver caused no obvious symptoms of Pb intoxication in the raccoon, which appears to be resistant to high levels. However, Pb intoxication, along with other factors, may be a cause of mortality in wild raccoons. (From authors' summary; 21 references)

- 966 Sato, T.: (EFFECTS OF POISONING WITH NITROBENZENE, ANILINE, AND HEAVY METALS ON THE SYNTHESIS OF ACETYLCHOLINE IN THE BRAIN.) *Tokyo Jikeikai Ika Daigaku Zasshi* 76, No. 8:1911-6, 1961.

Whereas a significant decrease of acetylcholine synthesis was observed in the cortex, thalamus and nucleus caudatus of the brain of rabbits with chronic Hg poisoning, no such change was found in chronic poisoning with Pb and Mn. (From Chemical Abstracts 60:7355, 1964)

- 967 Shipochliev, T. (Bulgaria): Deistvie na preparatite ot breznishkata mineralna voda pri venozno prilagane na zaitsi s eksperimentalno poluchena olovnointoksikatsionna anemiya. (THE EFFECT OF PREPARATIONS FROM BREZNIK MINERAL WATERS ON SOME BLOOD IN-

DICES FOLLOWING INTRAVENOUS ADMINISTRATION TO RABBITS WITH EXPERIMENTAL LEAD POISONING.) *Suvremenna Meditsina* (Sofia) 12, No. 2:43-6, 1961.

Ferro Breznik (Ca glyc), Ferro Breznik gluconatum (CaNa) and Ferro Breznik (Na) prepared by the author from Breznik mineral water were well tolerated iv by rabbits made anemic by administration of Pb, and showed a moderate hematopoietic effect. (From author's summary)

- 968 Shone, D.K.: CHEMICAL POISONING OF DOMESTIC ANIMALS. *Rhodesia Agr. J.* 58:223-9, 1961.

Symptoms, diagnosis, treatment, and postmortem findings are given for poisoning with Pb and other chemicals. (From Chemical Abstracts 56:15775, 1962)

- 969 Solomina, V.F.: (EFFECT OF LEAD ACETATE AND SILICA ON THE DEVELOPMENT OF EXPERIMENTAL CANCER OF THE SKIN.) *Izvest. Akad. Nauk Kazakh. S.S.R., Serv. Med. i Fiziol.* 1961, No. 2:55-67.

If 0.2 ml of 0.1% Pb acetate solution is introduced into the stomach of white mice every 5th day, for 4 mo, the development of cancer on application of 9,10-dimethyl-1,2-benzanthracene to the skin is accelerated. (From Chemical Abstracts 56:5285, 1962)

- 970 Sroczynski, J.: (BASOPHILIC PUNCTATE ERYTHROCYTES AND RETICULOCYTES IN EXPERIMENTAL LEAD POISONING.) *Postepy Hig. i Med. Doswiadczalnej* 15:185-99, 1961.

Pb intoxication was produced in rabbits by injection of 4-6 mg/kg 0.9% solution of Pb acetate every 7th day during 6 mo. In all animals the amount of basophilic erythrocytes and reticulocytes was determined weekly. Basophilic erythrocytes were observed 24-48 hr after Pb injection and increased up to 88%. The amount of reticulocytes increased up to 218%. Ribonucleic acid was found in the basophilic erythrocytes, but no deoxyribonucleic acid, Pb, lipids, SH, S-S groups, proteins, polysaccharides, mucopolysaccharides, mucoproteins, or glycolipids were found. (From Chemical Abstracts 55:27650, 1961)

- 971 Tara, S. (France): Saturnisme animal. (LEAD INTOXICATION IN ANIMALS.) *Revue de Pathologie Générale et Comparée* 61:757-60, 1961.

A case of Pb intoxication in a 4-yr-old cow, caused by Pb pollution of the drinking water, is presented. The cow suffered from continuous diarrhea, difficulty of moving anterior limbs and a decrease in lactation. The amount of Pb in the milk was 80 µg/l. Analysis of the drinking water showed 1.8 mm Pb/l (sic) which originated from Pb-containing paint on the water pipe. Following treatment with 10 g CaEDTA over a period of 3 days, the cow became free of symptoms.

- 972 Tarmas, J., and Sroczynski, J. (Silesian Acad. Med., Zabre, Poland): Zmiany w komórkach nerwowych rdzenia kregowego królików pod wpływem dozylnie podanego ołowiu. (CHANGES IN NERVE CELLS OF

THE SPINAL CORD IN RABBITS UNDER THE INFLUENCE OF INTRAVENOUS LEAD ACETATE.)

Archiwum Immunologii i Terapii Doświadczalnej 9:45-50, 1961.

Rabbits (2.2-3.4 kg) were injected iv with a Pb acetate solution in doses of 4 mg/kg body weight 1 or 2 times/wk over a period of 11-24 wk. Serial sections of the spinal cord were stained with hematoxylineosin, according to Mallory and Parker's or Nissl's techniques. Pb acetate was demonstrable in the spinal cord, mostly in the nerve cells. Histologic changes, found mostly in the cells of motor and autonomic nuclei exhibited tigrolysis, vacuolization, and pyknosis.

- 973 Teuchmann, J.K. (Central Inst. Ind. Hyg., Warsaw, Poland): Vergleichsuntersuchungen von Bleivergiftung bei in verschiedenen Druckereiabteilungen (in verschiedenartiger Höhe) untergebrachten Tieren. (COMPARATIVE INVESTIGATIONS OF LEAD POISONING IN ANIMALS MAINTAINED IN DIFFERENT DEPARTMENTS OF A PRINTING INDUSTRY (OF VARYING LEVELS OF EXPOSURE).) Proceedings of the International Symposium on Maximum Allowable Concentrations of Toxic Substances in Industry, Prague, Czechoslovakia, April, 1959. Pure and Applied Chemistry 3, Nos. 1-2: 307-12, 1961.

Guinea pigs were kept for 1 yr in Pb-contaminated atmospheres in 2 departments of a printing firm (10/cage) in 10 cages, 1 of them, a control, placed outside the building; those inside the plant were placed at 3 different height levels in the linotype room (LR) and the Pb casting room (CR)). The results showed that body weight was not affected in the LR animals, in fact was higher than in controls. In the CR animals some insignificant decreases were observed. Pb content in blood also gave generally negative findings. There were large periodic variations from 0.07-0.33 mg%. However, animals closest to the floor had a higher blood Pb content, and higher basophilic red cell counts, especially those in the CR. No marked differences compared with controls were observed in general appearance, radiologic findings on growth of bone, anatomic and histopathologic examination. Only the Pb content of bones showed distinct elevation in the CR room in animals housed at the floor level (up to 3.8 mg% in the CR vs 2.5 mg% in the LR animals).

The author concludes that the generally accepted threshold limit of 0.03 mg% Pb in blood is too low.

- 974 Tolgskaya, M.S. (USSR): Soderzhanie sulfidril'nykh grupp v nervnoi sisteme eksperimental'nykh zhivotnykh pri intoksikatsiyakh svintsom i mysh'yakom. (THE SH-GROUP CONTENT IN THE NERVOUS SYSTEM OF EXPERIMENTAL ANIMALS AFTER LEAD AND ARSENIC INTOXICATION.) Toksikologiya Novykh Promyshlennykh Khimicheskikh Veshchestv 1961, No. 2:115-25.

In the experiments with Pb, 39 white rats were given sc or orally from 0.008-0.14 g/kg; As was given to 33 rats in sc doses of 0.0025-0.024 g/kg. The results showed a decrease in SH-groups in all tissues of the brain of intoxicated animals. The decrease was greater with a single application of

a lethal dose than with the chronic one, beginning sooner and more marked in the nerve cells than in brain tunic, glia, and ependymal cells. The histochemical changes in the nervous system point to disorder of enzyme exchange caused by small doses of Pb. (22 references)

- 975 Toya, T., Harada, H., and Tamura, Y. (Tokyo Eisei Kenkyusho, Japan): SYSTEMATIC STUDIES ON THE METABOLISM OF METALS. IV. DISTRIBUTION OF ORALLY ADMINISTERED LEAD, THALLIUM, AND CADMIUM IN RATS AND ITS EFFECT ON THE ENDOGENOUS COPPER AND ZINC. Tokyo-to Ritsui Eisei Kenkyusho Nempo 1961, No. 13:178-94.

Pb, Tl and Cd acetates, 800 µg/dl each, were given separately in drinking water for 80 days. Pb and Tl were most accumulated in the adrenal, low in the brain, spinal cord, and bone and Cd was highest in the pancreas. Endogenous Cu and Zn were generally decreased by the administration of the above metals. Cu dropped to below 30% of the control, especially in the heart, liver, testis, and blood in the Pb-administered group, in the cerebrum, lung, liver, muscle, and blood in the Tl-administered group, and in the spleen in the Cd-administered group. Zn decreased, but less than Cu, especially in the spinal cord, muscle, and testis in the Pb-administered group, in the cerebellum in the Tl-administered group, and in the spinal cord in the Cd-administered group. (From authors' English summary)

- 976 Umegaki, E. (Univ. Kyoto, Japan): LEAD POISONING. BLOOD PICTURE OF THE RABBIT AFTER ADMINISTRATION OF LEAD. Kyoto Furitsu Ika Daigaku Zasshi 69, No. 4:1239-56, 1961.

Mature male rabbits were given 3 mg Pb/kg (as Pb acetate) orally or sc for 60 days. The erythrocyte count decreased from the 1st to the 16th day, then remained unchanged to the 32nd day and thereafter decreased again. After oral administration the count returned to normal after treatment was discontinued, while after sc injection it continued to decrease. The amount of hemochrome decreased during Pb injection and did not return to normal after injections were discontinued. When Pb was given orally, hemochrome did not decrease markedly until the 56th day of administration; after administration was stopped, it increased considerably but did not recover its initial value. Hemoglobin increased during both methods of administration. When Pb injections were discontinued, it kept on increasing greatly; after oral administration, however, it decreased almost to normal. Serum proteins decreased markedly in both cases, reaching a minimum between the 24th and 40th day. Heinz bodies increased in both cases without returning to normal after the end of administration. Leucocytes increased also in both cases, and returned to normal after administration of Pb was stopped. Basophilic leucocytes decreased during injection and increased with oral administration. The number of eosinophils did not change. Lymphocytes decreased slightly only when Pb was injected, while monocytes decreased strongly; the latter increased slightly with oral administration. The author believes that the blood picture is a better criterion

ion of the degree of poisoning than the amount of Pb in the blood, although the blood changes caused by Pb are not specific. (From author's English summary; 38 references)

- 977 Umegaki, E. (Kyoto Prefect. Med. Univ., Japan): (ACCUMULATION RATE OF LEAD IN ANIMAL BODY.) Kyoto Furitsu Ika Daigaku Zasshi 69:1308-10, 1961.

Mice were given each 10 subcutaneous injections of 3 mg Pb/kg as Pb acetate on alternate days and the total Pb content of the body was determined polarographically. Of the amount of Pb administered 45.1-50.8% was found to accumulate in the body and 0.025-0.037 mg Pb was found in the body of control mice. (From Chemical Abstracts 57:2535, 1962)

- 978 Vardanis, A., and Quastel J.H. (McGill-Montreal Gen. Hosp. Res. Inst., Quebec): THE EFFECTS OF LEAD AND TIN ORGANOMETALLIC COMPOUNDS ON THE METABOLISM OF RAT BRAIN CORTEX SLICES. Canadian Journal of Biochemistry and Physiology 39:1811-27 (Dec.), 1961.

The effects of TEL, tetraethyl tin (TESn), triethyl Pb (TrEL) and triethyl tin (TrESn) on the metabolism of rat brain cortex slices were studied. TEL ( $8.1 \times 10^{-4}M$ ) inhibited the oxygen uptake of brain slices when glutamic acid was the sole substrate. Inhibition was found to be even greater when glucose as well as glutamic acid were present. The transport of glycine, serine or alanine into the brain cortex tissues decreased considerably in the presence of glucose, and TEL ( $10^{-4}M$ ) inhibited the glucose-dependent uptake of these amino acids by brain slices. TEL also abolished K-stimulated brain slice respiration in presence of glucose, but had little or no effect on unstimulated brain slice respiration. The respiration of rat brain cortex slices previously treated with phospholipase A (30 min) became highly sensitive to TEL. In comparing the effect of TEL and TrEL on brain slices, it was noted that although TEL showed a definite effect on amino acid metabolism, it showed none on glucose breakdown, while TrEL, at concentrations affecting amino acid metabolism, ( $10^{-4}$ - $10^{-6}M$ ) also affected glucose metabolism.

Rats were injected intraperitoneally daily with 10 mg TEL/kg body weight. After 3-4 injections, a decrease in body weight, difficulty in breathing and partial paralysis of the posterior extremities were noted. Animals were sacrificed after a definite number of injections and brain cortex slices were prepared. After 2 injections of TEL (before signs appeared), the brain activity was no different than in the control group aside from the partial inability of the brain slices to concentrate glutamic acid. After 4 injections results were similar to the ones obtained in vitro in the presence of TEL ( $10^{-4}M$ ).

It is assumed that some of the neurological symptoms of TEL intoxication may result from the failure of the brain cell to transport amino acid across the neuronal membrane.

- 979 Vasil'eva, O.G. (Inst. Ind. Hyg. Occup. Dis., Acad. Med. Sci., USSR): O nekotorykh storonakh deistviya  $CaNa_2$  EDTA pri svintsovoi intoksikatsii v eksperimente. (SIDE

# EFFECTS OF $CaNa_2$ ETHYLENEDIAMINETETRAACETATE IN EXPERIMENTAL LEAD INTOXICATION.)

Gigiena i Sanitariya 26:22-5 (Mar.), 1961.

Ten of 30 guinea pigs received daily oral doses of Pb (as Pb nitrate) of 45 mg/kg; 10 received in addition 2 ml 10%  $CaNa_2$ EDTA orally; 10 served as controls. Urinary and fecal Pb was followed, using the chromate method. Pb content in bone was also determined. The duration of treatment was apparently 4 wk. Orally administered EDTA resulted in increased urinary and decreased fecal excretion of Pb; Pb concentration in bones increased, causing aggravation of Pb poisoning. Of 10 animals in the EDTA group, 6 died during the experiment. Upon necropsy, aside from other findings, fatty degeneration of the liver was seen.

In another experiment, the effect of EDTA on Cu metabolism was studied by ip injection of  $CaNa_2$ EDTA (2 ml 10% solution) to rats given sc  $^{64}Cu$ -labeled  $CuSO_4$ . After 3 days, the Cu content of the blood, liver, kidney and intestines sharply decreased. The author concludes that prolonged use of EDTA would tend to deplete the body of Cu, and that prevention of Pb poisoning with EDTA is undesirable.

- 980 Watanabe, K. (Kyoto Univ., Japan): IMMUNOLOGICAL STUDY ON EXPERIMENTAL HEMOLYTIC ANEMIA INDUCED BY LEAD ACETATE. 2. IMMUNOLOGICAL STUDIES ON COOMBS POSITIVE ERYTHROCYTES IN VITRO AND INFLUENCES OF VARIOUS TREATMENTS GIVEN TO THE EXPERIMENTAL ANIMALS ON THE INCIDENCE OF COOMBS POSITIVE ERYTHROCYTES. Japanese Archives of Internal Medicine 8:568-79 (July), 1961.

Results of this research were as follows: (1) The erythrocyte-coating substance of Coombs positive erythrocytes is species-specific since Coombs positive erythrocytes were agglutinated only by the species-specific antiglobulin serum to the experimental animals, but were not agglutinated by other kinds of antiglobulin serum which is specific for other animals and humans. The precipitation test on the eluate with the Coombs serum, which had been obtained from the Coombs positive erythrocytes, was positive. (2) The eluate was inactive in sensitizing the erythrocytes. The immunoelectrophoretic analysis of the eluate was carried out unsuccessfully. (3) It was impossible to elaborate the Coombs positive erythrocytes in vitro by damaging them with Pb acetate and adding their host's serum under various conditions. (4) Injection of rabbit erythrocytes into a dog before Pb acetate administration seemed to enhance the appearance of Coombs positive erythrocytes, but injection of the previous dog's erythrocytes into a rabbit was not effective. (5) Administration of synthetic glucocorticoid delayed the appearance of Coombs positive erythrocytes in a dog subjected to Pb acetate injection. (6) X-ray irradiation did not give any influence upon the Coombs test on rabbits given Pb acetate injection. (From author's English summary; 24 references, 13 in English, 11 in Japanese)

1962

- 981 Afonova, V.N., and Moshchenko, A.I. (Med. Inst. Ryazan, SSSR): (BLOOD SERUM AMINO-NITROGEN IN LEAD INTOXICATION.) Sb.

Nauchn. Tr., Ryazansk. Med. Inst. 15:3-5, 1962.

The decrease (av 33%) in blood serum amino-nitrogen and of proteins, as found in 5 rabbits from the 5th day after treatment with 5 mg Pb acetate daily, is recommended as a means for early diagnosis of Pb intoxication. (From Chemical Abstracts 61:15251, 1964)

- 982 Aldanazarov, A.T. (Kazakh Akad. Sciences, USSR): *Izmenenie nekotorykh geometricheskikh parametrov eritrotsitov pri anemii, obuslovennoi svintsovi intoksikatsiei, v eksperimente u sobak.* (Predvaritel'noe soobshchenie). (THE CHANGES OF SOME GEOMETRICAL INDEXES OF ERYTHROCYTES UNDER EXPERIMENTAL LEAD INTOXICATION ANEMIA IN DOGS. PRELIMINARY REPORT.) Trudy Instituta Kraevoi Patologii, Akademiya Nauk Kazakhskoi SSR 10:108-15, 1962.

Of 41 adult dogs, 8-25 kg weight, after quarantine and a 3-day observation period, 32 received 1 mg/kg/24 hr of a 2.5% Pb acetate solution in food, and 9 received the same dose of a 5% solution; throughout the experiment, the dogs had ingested 23 and 115 g Pb respectively. Signs of intoxication in the 2.5% group appeared in 100-170 days, and in the 5% group, in 210-340 days. The diameter of erythrocytes increased from an av 6.2  $\mu$  (5.82-6.95) before poisoning, by 0.8  $\mu$  (0.4-1.74); the volume increased by 2-12  $\mu^3$  (av 6.3) to 85.1  $\mu^3$ ; the thickness (before poisoning 2.54  $\mu$  (2-3)) decreased in 28 dogs by 0.2-0.8  $\mu$  (av 0.4), in 2 it increased, and in 11 was unchanged; the spherical index, before poisoning 2.44 (2-3.57), in the course of poisoning in 75% of the dogs was increased by an av 0.85 (0.24-2.19).

On the basis of these results which the authors consider insufficient, they do not attempt to explain the reason for, and mechanism of, the changes observed.

- 983 Arkhipova, O.G.: (INFLUENCE OF VARIOUS CHELATING AGENTS DURING INTOXICATIONS WITH INDUSTRIAL POISONS.) Prom. Toksikol. i Klinika Prof. Zaboilevanii, Khimika Etiol. (Moscow:Goz. Izd. Med. Lit.) Sb. 1962, 203.

Calcium disodium edetate, calcium trisodium pentetate, aminopolyposphonic acids, and pectin were injected into animals during intoxications with Pb, Mn, and Hg to study their effectiveness as prophylactic substances. Pectin was an effective chelating agent for a number of metals and was completely harmless. It can be used in pectin-containing food products for workers who come in contact with Pb, Mn and other metals. (From Referativnyi Zhurnal, Khimiya 1963:Abstr. No. 151242; Chemical Abstracts 60:15045, 1964)

- 984 Black, S.C. (Univ. Rochester Atomic Energy Project, N.Y.): STORAGE AND EXCRETION OF LEAD 210 IN DOGS. Archives of Environmental Health 5:423-9 (Nov.), 1962.

It has been suggested that the cumulative lung dose of an individual exposed to Rn and its daughters in mining and processing of U may be estimated by measurement of the Rn daughters  $^{210}\text{Pb}$  or  $^{210}\text{Po}$  excreted in the urine. To study what frac-

tion of bone-stored  $^{210}\text{Pb}$  is excreted/day and what fraction of  $^{210}\text{Pb}$  formed in the lung is deposited in bone, experiments were made with female beagle dogs, 4-6 yr old, weighing 9.1-11.8 kg. Two dogs were placed in an exposure chamber in which a relatively constant Rn concentration was maintained; a number of other dogs were placed in U mines. Urinary  $^{210}\text{Pb}$  excretion and its content in liver, kidney, lung, muscle and skeleton were determined and the data obtained were statistically interpreted. The results showed that initial urinary Pb excretion did not correlate with either the  $^{210}\text{Pb}$  deposited in lung or that in the whole body for the 2 types of exposure. Based on fecal elimination at 21, 100, and 630 days, the average fecal to urinary output ratios calculated for each period were found to be 2.0, 5.8, and 8.7, respectively. As based on these values and the urinary excretion data together with the results of tissue analysis, the total initial burden of Pb was calculated for each group of dogs. From the curve obtained, representing late postexposure excretion, an effective half-time of 330 days was determined which was postulated to represent loss from the skeletal compartment. The integration of the excretion equations from 840 days to infinity predicted a remaining Pb burden for the mine dogs of 306  $\mu\text{Ci}$ , whereas the tissue analysis at 840 days yielded a body content of 300  $\mu\text{Ci}$ . The same calculations for the chamber dogs gave 1200  $\mu\text{Ci}$  and 1575  $\mu\text{Ci}$ , respectively.

In commenting on the results on dogs, the author states that the skeleton contained ~90% of the body content of  $^{210}\text{Pb}$ , whereas for man the skeleton was reported also to contain 90% of the body content of stable Pb (Aub, et al, 1949). While the ratio of daily fecal to urinary excretion in dogs varied from 2.0-8.7 (av 5.1), for stable Pb in man this ratio was reported to be 2.5-6.7 (Aub, et al, 1949; Cholak, et al, 1943). The biological half-time for loss of Pb from the skeleton of the dogs was 346 days; that for the whole body of man could be set on the basis of the loss of experimentally produced Pb burdens (Kehoe, et al, 1943) at 670-840 days, the precise number depending on interpretation. Since the mine dogs were exposed to the same type of atmosphere as a U miner would be, it is probable that 5% of the  $^{210}\text{Pb}$  measured in a urine sample obtained from a working miner would come from the bone store of Pb. This would represent 0.005% of the skeletal  $^{210}\text{Pb}$  which, in turn, represents 64% of the Pb deposited in the lungs. Thus, an estimated lung dose for a miner breathing Rn and its daughters could be calculated by measuring the average  $^{210}\text{Pb}$  content of several urine samples, spaced about a week apart. (11 references)

- 985 Boyadzhiev, V.: (INFLUENCE OF SOME PROTEIN AND FAT DIETS ON THE APPEARANCE AND EVOLUTION OF LEAD INTOXICATIONS.) Nauchni Tr. Vissh. Med. Inst. Sofia 41, No. 5:83-98, 1962.

The author reports the changes observed in test animals poisoned with Pb acetate and then fed on 4 different diets: protein-rich and protein-deficient and fat-rich and fat-deficient diets. By repeated blood analyses it was found that following Pb intoxication, the protein-poor diet favored

the appearance of pronounced changes in the blood picture. The hematologic changes were least in animals fed on a protein-rich diet. With the fat-rich diet the blood changes were almost as pronounced as with the protein-poor diet. With the fat-poor diet, the effect of Pb poisoning on the red blood picture resembled that with the protein-poor diet. Also in the white blood picture there were effects noted from the protein-rich diet and the fat-rich diet. It was concluded that fat-rich diets, following Pb poisoning, led to greater changes than did protein-deficient diets but that in the majority of cases the changes were within physiological limits. This was unlike the protein-deficient diets where pathological changes were often observed. (From APCA Abstracts 8:5167, 1963)

- 986** Boyland, E., Dukes, C.E., Grover, P.L., and Mitchley, B.C.V. (Chester Beatty Res. Inst., Inst. Cancer Res.; Royal Cancer Hosp., London, England): THE INDUCTION OF RENAL TUMOURS BY FEEDING LEAD ACETATE TO RATS. *British Journal of Cancer* 16:283-88 (June), 1962.

Twenty male 10-wk-old Wistar rats were fed a diet containing 1% Pb acetate for 1 yr. Four rats died within 6 mo and showed degenerative changes in kidneys but no neoplasms. Renal tumors were first discovered in 4 out of 5 rats examined after 11 mo of Pb acetate feeding. All 11 surviving rats developed renal tumors which were often bilateral and associated with small adenomas, hyperplastic foci, and nodules of regenerating tubular epithelium. The small neoplastic lesions were usually solid collections of cuboidal cells, but the larger tumors tended to develop a tubular or papillary pattern with vacuolated cells similar to those of human carcinomas. The excretion of coproporphyrin in urine collected from pairs of adult rats when fed 1% Pb acetate and 16 days after cessation of the Pb diet was 93 and 33  $\mu\text{g}/2$  rats/day, respectively. The authors point out that the question whether porphyrin or Pb derivative of the latter is the carcinogen causing renal tumors remains presently open and that further tests should be carried out.

- 987** Brown, J.R., and Mastromatteo, E. (Univ. Toronto, Canada): ACUTE ORAL AND PARENTERAL TOXICITY OF FOUR TITANATE COMPOUNDS IN THE RAT. *Industrial Medicine and Surgery* 31:302-4 (July), 1962.

The acute oral and ip toxicity of Pb titanate was studied in Wistar rats, weighing  $\sim 250$  g each. The other titanates investigated were the Ba, Bi, and Ca. Rats survived oral dosages exceeding 10 g/kg of body weight; the minimum lethal dose by the oral route exceeded 12 g/kg. The ip LD<sub>50</sub> was 2 g/kg. Rats that survived appeared normal at the end of 1 mo. Histologic study of the rats that died from ip injection showed evidence of inflammatory changes in the liver, kidney, spleen and lung and hemorrhagic areas in the kidneys. Repeated daily administration of 100 mg Pb titanate to rats, weighing 100 g, by oral and ip routes, did not produce any evidence of a cumulative effect during a 2-wk period. It is concluded that in ordinary handling Pb titanate would present little hazard in industrial exposure.

- 988** Caccuri, S., and Pecora, L. (Univ. Naples, Italy): THE CHELATING ACTION OF PORPHYRINS IN LEAD POISONING. *Panminerva Medica* 4:367-8 (Sept.), 1962.

Rabbits were poisoned by 10% Pb acetate (2 ml orally/day for 10 days) to determine whether and to what extent CaEDTA interferes with the chelating action of porphyrins. Before poisoning, the free erythrocyte protoporphyrin (FEP) levels were determined 5 and 10 days from poisoning, and 5 days after poisoning was suspended. Pb levels were also determined in all the hydrochloric extracts (HClE) on which protoporphyrin levels had been determined. Although initially Pb was absent from the HClE, it subsequently appeared and increased as poisoning progressed and the protoporphyrins accumulated in the red cells. Means for FEP and Pb in HClE respectively were: before poisoning, 0.46  $\mu\text{g}$ , --; after 5 days' poisoning, 1.63, 1.05  $\mu\text{g}$ ; after 10 days' poisoning, 2.47, 1.41; 1 day after termination of Pb poisoning, 2.44, 1.36. Even after 5 days' interval, the same levels as those found at the completion of poisoning were noted. A 2nd series of rabbits treated with Pb for 10 days and receiving a daily iv dose of 0.20 ml of 10% CaEDTA solution for 10 days after discontinuance of the poisoning showed the same results as the 1st series of rabbits; FEP and Pb in HClE respectively: before poisoning, 0.48  $\mu\text{g}$ , --; after 5 days' poisoning, 1.81, 1.37  $\mu\text{g}$ ; after 10 days' poisoning, 1.90, 1.48; after 10 days' CaEDTA treatment, 2.23, 1.21.

The authors feel that these results confirm the independent action (including the chelating action) of erythrocyte free protoporphyrin and CaEDTA.

- 989** Camerada, P., Congiu, M., and Leo, P. (Univ. Cagliari, Italy): Comportamento dell'acido neuraminico e del seromucoside in ratti intossicati con piombo. (BEHAVIOR OF NEURAMINIC ACID AND SEROMUCOID IN RATS INTOXICATED WITH LEAD.) *Bollettino della Società Italiana di Biologia Sperimentale* 38:1027-8, 1962.

Workers exposed to Pb and showing no obvious signs of intoxication in spite of uptake of the metal, showed an increase in serum mucoid and a decrease in serum neuraminic acid. Ten adult male rats were injected ip with Pb acetate equivalent to 5 mg Pb/100 g body weight. Ten similar untreated rats were used as controls. The rats were decapitated 8 hr after the injection and the serum mucoid and neuraminic acid were determined. The mean content (mg%) for treated and controls was, respectively: seromucoid, 226, 243; neuraminic acid, 67, 111. The difference in the means of neuraminic acid was highly significant ( $P < 0.001$ ). While the seromucoid results do not confirm those obtained on human subjects, the neuraminic acid results do, which suggests that this acid plays an important role in Pb poisoning.

- 990** Camerada, P., Congiu, M., and Leo, P. (Univ. Cagliari, Italy): L'acido neuraminico nel tessuto nervoso di ratti intossicati con Pb. (NEURAMINIC ACID IN THE



NERVOUS TISSUES OF RATS INTOXICATED WITH Pb.) Bollettino della Società Italiana di Biologia Sperimentale 38, No. 20:1029-39, 1962.

The hypothesis that neuraminic acid possesses Pb-binding properties was tested by determining the acid in the brains of 9 rats (av 380 g weight) given Pb acetate equivalent to 5 mg Pb/100 g ip. Ten rats served as controls. The mean content (mg/100 ml of tissue) of neuraminic acid for treated and untreated animals was, respectively, 111.5 and 126.2. The difference was statistically significant ( $P < 0.01$ ). The authors conclude that this reduction agrees with previous results obtained in blood of human subjects. It is suggested that neuraminic acid combines with Pb and is either eliminated from the organism or becomes indeterminate by the methods used.

- 991 Catsch, A. (Nuclear Energy Res. Center, Karlsruhe, Germany): (INFLUENCE OF CHELATE-FORMING COMPOUNDS ON THE REACTIONS OF LEAD IN RATS.) *Arzneimittelforsch.* 12:924-30, 1962.

The influence of various chelate-forming compounds on the distribution of radio-Pb in the organism was studied in rats. 2:2'-Bis-(di-(carboxymethyl)-amino)-diethyldisulfide and 2-mercaptoethyliminodiacetic acid showed the most potent activity, resulting in reduced deposition of radio-Pb. The 2 compounds were found superior in effect to all other substances including EDTA. (From Nuclear Science Abstracts 17:Abstract No. 13893, 1963)

- 992 Cherednichenko, L.K. (Inst. Hygiene Occup. Diseases, Leningrad, USSR): Vliyaniye svintsovoi intoksikatsii na razvitiye eksperimental'nogo ateroskleroza. (THE EFFECT OF LEAD POISONING ON DEVELOPMENT OF EXPERIMENTAL ATHEROSCLEROSIS.) *Gigiena i Sanitariya* 27:18-21 (Mar.), 1962.

Atherosclerosis was produced in 75 male rabbits (2-2.5 kg weight) by administration of 0.6 g cholesterol in their daily feed for 3-1/2 mo. Pb poisoning was achieved by daily administration (presumably orally) over 2-1/2 mo of 0.025 g Pb acetate/kg with 3-4-wk intervals. The progress of poisoning was followed by counts of basophilic red cells and reticulocytes. The experimental animals were divided into 4 groups: (1) received only cholesterol; (2) cholesterol and Pb; (3) only Pb; (4) no treatment. The extent of atherosclerosis was estimated from the amount of lipids deposited in the blood vessels. The findings showed that during experimental atherosclerosis, Pb poisoning tended to increase hypercholesterolemia; it acted on blood pressure by increasing hypertensive reactions. It also accelerated the development of the atherosclerotic process by causing a considerable increase of the total amount of lipids in the aortic wall. (15 references)

- 993 Cremer, J.E. (Med. Res. Council Lab., Carshalton, England): TETRAETHYL LEAD TOXICITY IN RATS. *Nature* 195:607-8 (Aug.), 1962.

Daily intraperitoneal injections of 10 mg/kg TEL (in propanol and water) into 200-g-male rats caused the death of 3 out of 4 rats on the 4th

day of injection. The surviving rat showed pronounced excitation and body tremors. Analysis of brain slices of rats killed 2 hr after receiving 3 daily injections of TEL showed that oxidation of glucose was profoundly inhibited although the uptake of  $^{14}\text{C}$ -glucose was not affected. The following amounts of triethyl lead (TEL) ( $\mu\text{g/g}$ ) were found in tissues: brain 19.5; kidney 22; liver 36; blood 103. The amount of TEL present in the brain was sufficient to obscure any effects due to TEL alone.

Discrepancies between the results obtained by the author and by A. Vardanis (1961) in regard to the rate of  $\text{O}_2$  consumption by brain slices are discussed.

- 994 De Franciscis, P., and Boccalatte, F. (Univ. Naples, Italy): LEAD ACETATE AND DEVELOPMENT OF CHICK EMBRYO. *Nature* 193: 989-90 (Mar. 10), 1962.

When, after 8 days of incubation, 10, 20, and 30 mg Pb acetate were injected into the yolk sacs of 3 groups of 40 eggs respectively from White Leghorn fowls, the mortality rate of the embryos was directly proportional to the dosage used, reaching 100% at 30 mg. In the groups treated with 10 and 20 mg Pb acetate there was practically no difference in growth-retarding effect or incidence of malformations. A notable decrease in body weight occurred in the living embryos of the eggs that survived; mean body weights in relation to dose of Pb acetate given were, respectively: 12.40 g, 10 mg; 12.60 g, 20 mg; 19.25, controls.

- 995 Dhar, D.C. (Central Drug Research Inst., Lucknow, India): STUDIES ON ANAEMIA: PART VII. NUCLEIC ACID METABOLISM OF BONE MARROW, SPLEEN AND LIVER DURING EXPERIMENTAL LEAD ANAEMIA. *Journal of Scientific and Industrial Research* 21C, No. 1:7-9, 1962.

Anemia was produced in albino adult male rats (140-160 g weight) by intravenous injection of Pb acetate (6 mg/100 g body weight) for 8 days. Determination of the ribonucleic acid phosphorus (RNAP) and desoxyribonucleic acid phosphorus (DNAP) revealed that the content of RNAP and DNAP in bone marrow and spleen increased considerably in the anemic rats. The DNAP content of the liver was also enhanced in the anemic rats but there was little change in RNAP content. RNAP values in normal and anemic rats, respectively, were: bone marrow: 77.66 mg/100 g, 89.86; spleen: 69.33, 80.01; liver: 71.05, 68.30. DNAP values were: bone marrow: 64.87, 99.12; spleen: 82.05, 118.06; liver: 25.45, 37.73. (17 references)

- 996 Fukutsuji, S. (Kyoto Prefect. Med. Univ., Japan): (LEAD POISONING. I. LEAD QUANTITY EXCRETED INTO THE PAROTID AND SUBMAXILLARY-SUBLINGUAL SALIVAS AND THE FUNCTION OF THESE GLANDS.) *Kyoto Furitsu Ika Daigaku Zasshi* 70:31-46, 1962.

The function of the salivary secretion and the quantity of excreta were studied in 2 groups of Pb-poisoned dogs with permanent fistula. One group received 6 mg Pb/kg, intravenously, and the other group received, subcutaneously, 3 mg Pb/kg 10 times on alternate days. For 20 days following

the Pb administration, parotid and submaxillary-sublingual salivas were collected at intervals by taste stimulation with tartaric acid. In acute poisoning the secretion rate decreased 5 hr after administration, and dropped to a great extent in the 1st day and then gradually returned to normal. In chronic poisoning, the secretion rate decreased on the 10th day after the 1st administration and showed a marked decrease on the 18 or 19th day. In poisoning, the concentration of  $\text{Na}^+$  and  $\text{Cl}^-$  decreased with secretion rate, while that of  $\text{K}^+$  showed no significant change. The viscosity of the parotid saliva decreased slightly, but that of submaxillary-sublingual saliva showed a marked rise at the beginning and then fell correspondingly with secretion rate. The specific gravity of parotid saliva decreased with poisoning, but that of submaxillary-sublingual saliva showed no definite correlation. In acute poisoning, 10-15  $\mu\text{g}$  Pb/ml was found in the parotid saliva 1 hr after administration, while 0.5-2.5  $\mu\text{g}/\text{ml}$  was found in submaxillary-sublingual saliva. In chronic poisoning, the amount of Pb increased in parotid and decreased in submaxillary-sublingual salivas with poisoning. In mixed saliva no significant difference was observed in Pb content between normal and poisoning. (From Chemical Abstracts 58:1844, 1963)

- 997** Fukutsuji, S. (Kyoto Prefect Med. Univ., Japan): (LEAD POISONING. II. METHOD FOR COLLECTING PAROTID AND SUBMAXILLARY-SUBLINGUAL SALIVA OF DOG AND SECRETORY FUNCTION OF SALIVARY GLAND OF THE DOG POISONED WITH LEAD.) Kyoto Furitsu Ika Daigaku Zasshi 70:47-55, 1962.

Saliva was stimulated by pilocarpine in adult dogs after intravenous administration of 6 mg Pb/kg body weight. The total amount of saliva secreted after Pb administration was lower compared with the normal. Submaxillary-sublingual saliva showed a marked increase in viscosity and specific gravity while the specific gravity of parotid saliva was decreased. The Pb concentration in normal parotid saliva varied in direct proportion to the secretion rate while after Pb administration it varied inversely with the secretion rate. (From Chemical Abstracts 58:10649, 1963)

- 998** Gajdos, A., Gajdos-Török, M., and Danieli, G. (Med. Clin., Hôtel-Dieu, Paris, France): TREATMENT BY ADENOSINE-5-MONOPHOSPHORIC ACID OF EXPERIMENTAL SATURNISM IN RABBITS. Nature 193:183-4 (Jan. 13), 1962.

Eight of 16 rabbits, poisoned by a single im injection of 100 mg/kg of Pb acetate, were treated with a daily im dose of 100 mg of adenosine-5-monophosphoric acid (AMA), starting the day following intoxication, for 25 days. After the 2nd day of treatment, urinary excretion of ALA, porphobilinogen and coproporphyrin diminished; uroporphyrin appeared in decreased amounts only toward the 20th day. No effect was noticed on the serum-level of ALA or free protoporphyrin contents of erythrocytes while a clearly beneficial effect was observed on Pb anemia. The bone marrow, studied on the 18th day in 4 rabbits treated with AMA showed an erythropoietic hyperplasia, absent in the controls, and a normal curve of maturation of erythroblasts.

- 999** Gasparini, P. (Univ. Padua, Italy): Studio istioautoradiografico sulla localizzazione del plombo radioattivo nel tessuto osseo. (AUTORADIOGRAPHIC STUDY OF THE LOCALIZATION OF RADIOACTIVE LEAD IN BONE.) Acta Isotopica 2, No. 1:91-9, 1962.

A study of the localization of  $^{210}\text{Pb}$  in the bones of dogs revealed that the highest uptake was in the primitive osteones while in the ripe osteones no or only a small amount of radioactivity was observed. External and internal limitant laminae usually did not take up Pb except in one case in which the most internal lamina of the internal limitant showed an intense radioactivity. (From Nuclear Science 17:Abstract No. 27016, 1963)

- 1000** Gherardi, M., and Salvi, G. (Univ. Parma, Italy): Tossicità sperimentale del piombo tetrametile e del cloruro di piombo trimetile. (TOXICITY OF TETRAMETHYLLEAD AND TRIMETHYLLEAD CHLORIDE.) Folia Medica (Naples) 45:1254-62 (Dec.), 1962.

Repurified TML in 95% alcohol in doses varying from 0.30-5.0 mg or 13.6-227.5 mg/kg was injected sc in 8 groups of 6 adult Swiss albino mice each. Six groups of 5 mice each were injected with trimethyllead (TrML) chloride in physiologic solution in doses of 0.10-0.80 mg or 4.5-36.5 mg/kg. In addition, 12 mice were injected with 1 mg TML in order to follow the distribution of Pb in the brain, liver and kidney upon sacrifice at 12, 24, 48, and 72 hr after injection. (Bambach and Burkey's dithizone method was used.)

With TML doses of 0.30-0.60 mg no signs of poisoning were seen. With 1 mg and higher, the typical signs appeared after a latent period of 30-40 hr, and death was preceded by convulsions. The  $\text{LD}_{50}$  of TML was 36.4 mg/kg (considerably lower than was found by Buck and Kumro (1930) in rats). The Pb recovered from mice after 12, 24, 48, and 72 hr was as follows, in  $\mu\text{g}$ : brain, 3, 7, 7.5, 24.5; liver, 30, 24, 15.6, 16.5; kidney, 11, 7.5, 10, 8.25. No difference was observed in the effects of poisoning by the 2 compounds. While the initial effects were similar to those produced by acute TEL or TrEL poisoning, the further development of the clinical pattern was characterized by the appearance of a paresis of the hind legs. TML appeared almost as toxic as TEL while TrML chloride was much more toxic and its latent period shorter (15-25 hr). The  $\text{LD}_{50}$  of TrML was 7 mg/kg, lower than was earlier calculated by the authors. They conclude that the toxicity of TML is mainly due to the production of water-soluble TrML salts during its metabolism.

- 1001** Hauschild, F. (Univ. Leipzig, Germany): PHARMACOLOGY OF PEST-CONTROL AGENTS. Ernahrungsforschung 7:457-64, 1962.

Acute and chronic rat toxicity data for Pb arsenate and other pesticides are given. (From Chemical Abstracts 58:1867, 1963)

- 1002** Hemingway, R.G., Brown, N.A., and Inglis, J.S.S. (Univ. Glasgow, Scotland): THE EFFECTS OF CALCIUM CARBONATE, LEAD ACETATE AND COPPER SUPPLEMENTS ON BLOOD AND LIVER COPPER CONCENTRATIONS OF YOUNG SHEEP. Research in Veterinary Science 3, No. 4:348-

56, 1962.

The experiments were undertaken because of conflicting reports on the relationship of Pb to swayback disease in sheep and because of lack of information concerning effects of supplementary Cu on blood and liver levels of normal sheep at pasture. Forty sheep, 5 mo old, average initial weight of 80 lb were divided at random into 5 groups of 8. They were allowed to free-graze on herbage containing 17.3 ppm Cu (dry matter). They had been reared on a farm with no history of swayback and were assumed to be free of Cu deficiency. Group 1 received a daily drench of 35 g Ca carbonate, representing on the basis of Cu content of herbage, 0.35%, an additional 1.40-1.75% Ca; Group 2, 100 mg Pb acetate/day drench supplying ~100 ppm of the total dry matter; the herbage contained 15 ppm Pb; Group 3, a single injection of Cu glycine at the start, supplying 45 mg Cu; Group 4 a drench of 0.5 g CuSO<sub>4</sub>·5H<sub>2</sub>O every 14 days; Group 5, control with no treatment. Seven weeks after the start of the experiment 4 sheep of each group were killed and the remainder slaughtered 13 wk after the start. Blood samples were taken at the start and every 14 days thereafter. Cu was determined on all the blood and liver samples, Pb was determined in the blood, liver and kidney of the control group and Group 2. Fe was determined in all liver samples. Cu was determined by the Brown and Hemingway method, Pb by modification of the dithizone method of Baxter and Allcroft (1950), Fe by method of Bothwell and Mallett (1955).

As summarized, the results showed that the drenching with 100 mg Pb/day reduced both blood and liver Cu concentrations of young sheep when given for periods of 7-13 wk. Ca carbonate (35 g/day for the same period) did not reduce liver Cu contents but slightly depressed blood Cu concentrations. Of a single injection of Cu glycine 58% was stored in the liver. Cu sulfate (0.5 g every 14 days) significantly increased liver Cu contents, but only 2.4% of this additional Cu was stored in the liver. Cu glycine given parenterally was more effective than drenching with Cu sulfate.

There was a good correlation between liver Cu values and blood Cu concentrations at the time of slaughter when the liver Cu contents were <50 ppm in the dry matter.

- 1003 Kilham, L., Low, R.J., Conti, S.F., and Dallenbach, F.D. (Dartmouth Med. School, Hanover, N.H.): INTRANUCLEAR INCLUSIONS AND NEOPLASMS IN THE KIDNEYS OF WILD RATS. Journal of the National Cancer Institute 29:863-5 (Nov.), 1962.

Nuclear inclusions were found in kidneys of nearly all of 62 seemingly healthy, adult wild rats captured on refuse dumps in Hanover, New Hampshire, whereas 10 juvenile or younger rats of the same locality had none. Adult albino rats (36) raised under laboratory conditions had no renal inclusions. The nuclear inclusions appeared to be associated with the development of renal neoplasms ranging from circumscribed tumors to invasive, metastasizing carcinoma, and resembled those induced in control albino rats which were fed 1% solutions of Pb acetate and later Pb subacetate in drinking water. Assays of tissues of the wild rats showed abnormal content of Pb, suggesting

chronic Pb poisoning. The source of the Pb was not determined, but rats living and feeding on burning refuse dumps are exposed constantly to Pb-containing fumes.

- 1004 Konikova, G.S. (Leningrad Res. Inst. Occup. Hyg. Occup. Dis., USSR): CHOLESTEROL METABOLISM IN EXPERIMENTAL LEAD POISONING. Byulleten Eksperimental'noi Biologii i Meditsiny 54, No. 11:65-7, 1962; English Translation: Bulletin of Experimental Biology and Medicine 53/54:1246-8, 1962-63.

The total and protein-bound cholesterol, as well as the stability of the bond, were investigated in the following groups of rabbits: (1) 5 were fed daily 0.6 g cholesterol for 14 wk; (2) 5 received daily 0.026 g/kg Pb acetate by stomach tube route, for 1 mo, and again for 15 days after a 3-day interruption; (3) 6 were administered both compounds; (4) 10 served as controls. Rabbits receiving Pb acetate alone exhibited reduced stability of protein-cholesterol bond, and a slight tendency to a rise in the total cholesterol. Total unbound and loosely bound cholesterol were higher in rabbits receiving cholesterol + Pb acetate than in those on cholesterol alone. The author concludes that loss of stability of protein-cholesterol bonds appears as the 1st stage of Pb intoxication.

- 1005 Kośmider, S. (Silesian Med. Acad., Zabrze, Poland): Wpływ jonów ołowiu na aktywność fosfatazy zasadowej surowicy krwi w ostrym doświadczalnym zatruciu oraz in vitro. (EFFECT OF LEAD IONS ON THE ACTIVITY OF SERUM ALKALINE PHOSPHATASE IN EXPERIMENTAL ACUTE POISONING AND IN VITRO.) Polskie Archiwum Medycyny Wewnętrznej 32:1253-6, 1962.

Experiments with rabbits showed that in acute experimental Pb poisoning the fall of alkaline phosphatase activity in the blood serum depended on the dose of intravenously administered Pb (acetate). In vitro studies revealed that Pb has a direct effect on the alkaline phosphatase complex in the serum. The Pb ions depress alkaline phosphatase activity probably by inactivating the sulfhydryl, amino, and carboxyl groups in the protein part of the phosphatase.

- 1006 Lyubetskii, Kh.Z., Shraiber, L.B., Kazakov, K.S., Adamyan, R.I., and Abramova, L.I. (Uzbek Res. Inst. Sanitation, Hyg., Occup. Dis., Tashkent, USSR): Vliyanie Etilendiamintetraakusnoi kisloty i vitaminov B<sub>1</sub> i B<sub>12</sub> na techenie svintsovoi intoksikatsii (eksperimental'nye issledovaniya). (EFFECT OF ETHYLENEDIAMINETETRAACETIC ACID AND OF VITAMIN B<sub>1</sub> AND B<sub>12</sub> ON THE COURSE OF LEAD POISONING. (EXPERIMENTAL STUDIES.)) Gigiena Truda i Professional'nye Zabolovaniya 6:45-6 (Dec.), 1962.

Acute and chronic Pb poisoning was induced in rabbits by Pb acetate, given either sc or iv in doses of 10 or 5 mg/kg, respectively. The results of 7 series of experiments with 21 rabbits showed that the administration of EDTA after manifest signs of Pb poisoning, was reversed by EDTA; remission was more rapid in combination with vitamin B<sub>1</sub> and B<sub>12</sub>.

Pb, given in 1-3 iv doses of 10 mg/kg, caused a decrease in hemoglobin, total protein and albumin and globulin fractions, but  $\delta$ -globulin was raised. Blood cholinesterase and catalase activities were also decreased. At 3-4 doses acute cachexia and death followed. EDTA, administered iv and sc in doses of 150 mg/kg twice daily, produced no toxic signs after 30 days of treatment. After pretreatment with 5 mg Pb/kg/day, sc, for 10-15 days, treatment with EDTA reversed the harmful effects of Pb in 10 days. Results were the same when 0.1 ml/kg of vitamins B<sub>1</sub> and B<sub>12</sub> in 0.5% solution were added. When Fe, Cu, and Co were added to EDTA, no greater improvement was obtained than by EDTA alone.

- 1007 Magnanelli, P., Zecca, I., d'Avino, R., Andreucci, G., and Salera, U. (Univ. Rome, Italy): La dinamica del ferro nelle frazioni ferroprotidiche midollari in condizioni patologiche. IV. Intossicazione da piombo. (THE DYNAMICS OF IRON IN THE FERROPROTEIN FRACTIONS OF BONE MARROW IN PATHOLOGICAL CONDITIONS. IV. LEAD INTOXICATION.) Bollettino della Società Italiana di Biologia Sperimentale 38, No. 7:334-7, 1962.

Rabbits, average weight 2.2 kg, were poisoned by feeding daily for 2 mo an aqueous solution of 200 mg Pb acetate with their morning ration. At the end of 2 mo the rabbits were injected iv with 30  $\mu$ Ci <sup>59</sup>FeCl<sub>3</sub> and killed 30 min, 3 hr or 24 hr later. For in-vitro studies, bone marrow pieces were placed in isotonic solution of pH 7.2 and reacted with 2.5 mg Pb acetate. After 1 hr's incubation at 37°, 10  $\mu$ Ci <sup>59</sup>FeCl<sub>3</sub> was added and the incubation continued for 3 hr. Hemoglobin showed almost no radioactivity in vitro. In the in vivo experiment, in comparison with the normal values, all fractions (ferritin and unidentified) showed a significantly elevated radioactivity at hr 1/2, while at hr 24 the values were much lower except for the precipitate which remained somewhat elevated. The increase of radioactivity in the precipitate and the faster electrophoretic fraction is explained by a lack of utilization of Fe in hemoglobin synthesis.

- 1008 Makashev, K.K. (Kazakh Acad. Sci., USSR): Vliyanie kal'tsievoy i dvunatrievoy soli etilendiamintetrauksusnoi kisloty na vsasyvanie, nakoplenie i vyvedenie svintsa iz organizma pri svintsovoi intoksikatsii. (EFFECT OF CALCIUM AND DISODIUM SALTS OF ETHYLENEDIAMINETETRAACETIC ACID ON LEAD ABSORPTION, ACCUMULATION, AND EXCRETION FROM THE SYSTEM AFTER LEAD INTOXICATION.) Trudy Instituta Kraevoy Patologii, Akademiiya Nauk Kazakhskoi SSR 10:180-9, 1962.

The preparations used in these experiments were CaNa<sub>2</sub>EDTA (CaNaE) and Na<sub>2</sub>H<sub>2</sub>EDTA (NaHE). White rats (200-300 g weight) were divided into 3 groups to receive the following orally: (1) 18 controls, <sup>210</sup>Pb; (2) 10, <sup>210</sup>Pb + CaNaE; (3) 10, <sup>210</sup>Pb + NaHE. All animals were first subjected to Pb intoxication by the administration of 1 ml 2.5% solution of Pb acetate/kg/day for 4-5 mo, until signs of poisoning developed. <sup>210</sup>Pb was then administered at 2000 counts/g tissue. Groups 2 and 3, after this admin-

istration received by stomach tube 1 ml 10% solutions/kg of CaNaE and NaHE, respectively, over a period of 30 days. The elimination of <sup>210</sup>Pb was followed daily in urine and feces and the radioactivity of 10 organs and tissues was measured on days 5, 15 and 30 of the experiment. The results showed that both EDTA salts decreased Pb absorption in the digestive tract, and increased the excretion of Pb, primarily in the feces, but NaHE was approximately twice as effective as CaNaE. The accumulation of <sup>210</sup>Pb in organs of rats given NaHE was significantly smaller than in controls, and the latter caused higher accumulation of Pb in bones than CaNaE.

- 1009 Makashev, K.K., and Akhmedova, A.S. (Kazakh Acad. Sci., USSR): Vliyanie CaNa<sub>2</sub> EDTA i kortizona na raspredelenie fosfora i kal'tsiya v organakh i tkanyakh i vydelenie ikh iz organizma pri svintsovoi intoksikatsii. (THE EFFECT OF ETHYLENEDIAMINETETRAACETATE (EDTA) AND CORTISONE ON THE DISTRIBUTION OF PHOSPHORUS AND CALCIUM IN ORGANS AND TISSUES AND THEIR EXCRETION FROM THE SYSTEM AFTER LEAD INTOXICATION.) Trudy Instituta Kraevoy Patologii, Akademiiya Nauk Kazakhskoi SSR 10:190-7, 1962.

Three groups of white rats (250-300 g weight) were used: 16 were given 1 ml/kg of a 2.5% solution of Pb acetate daily for 4-5 mo. The other 2 groups of 16 each were treated as above and received cortisone or CaNa<sub>2</sub>EDTA. After symptoms of Pb intoxication appeared, the animals were given once 1000 counts/g tissue of <sup>32</sup>P and <sup>45</sup>Ca and then daily intramuscular injections of 10-25 mg cortisone or oral doses of CaNa<sub>2</sub>EDTA. Cortisone caused an increase of excreted P while Ca excretion was unaffected, and an increase of accumulation of <sup>32</sup>P and <sup>45</sup>Ca in the bone tissue. CaNa<sub>2</sub>EDTA decreased <sup>32</sup>P and <sup>45</sup>Ca accumulation in bone tissue and blood and increased their urinary excretion. CaNa<sub>2</sub>EDTA was more effective than cortisone for excretion of Pb from the system.

- 1010 Minden, H. (German Central Inst. Ind. Med., Berlin-Lichtenberg): Die Beteiligung des Gefäßsystems bei der Bleivergiftung. (THE PARTICIPATION OF THE VASCULAR SYSTEM IN LEAD INTOXICATION.) Archiv für Gewerbesch-pathologie und Gewerbehygiene 19, No. 6: 581-8, 1962.

Fifteen rabbits were injected over a period of 1 yr with intravenous doses of 0.3% Pb acetate. Doses and frequency of injection were adjusted to the hematologic findings in such a way that the animals showed clear signs of Pb exposure but no distinct symptoms of Pb intoxication. Six of the experimental animals died during the test and the remaining ones, which were injected with doses of Pb acetate reaching a total of 352-1273 mg showed a Pb accumulation of 486-1470  $\mu$ g% in the liver and 570-1388  $\mu$ g% in the kidney. Loss in body weight ranged from maxima of 220-1370 g. Histologic examination included the liver, kidney, heart, muscle, aorta, brain, and some sections of the adrenal and lung. The most pronounced changes were seen in the kidneys; however, the intensity varied with the animals. One that had received the low-

est dose, showed highest Pb values in liver and kidney. Histologic examination showed pathological changes in the kidney and heart, including kidney cell enlargement, cell-wall thickening, damage of the glomeruli, myocardial cell infiltration, and hypertrophy of the intima. Cholesterol values determined in some instances and phosphatides in serum were within normal limits. (15 references)

- 1011 Mokranjac, M.S., Radmić, S., and Soldatović, D. (Univ. Belgrade, Yugoslavia): Delovanje vitamina c kao antidota pri trovanju letalnim dozama olova. (ACTION OF VITAMIN C AS AN ANTIDOTE IN INTOXICATIONS BY LETHAL DOSES OF LEAD.) Acta Pharmaceutica Jugoslavica 12, No. 1:3-6, 1962.

Guinea pigs were poisoned by intraperitoneal administration of Pb acetate solutions (120 mg Pb/kg body weight on the 1st day, 60 mg/kg on the 5th and 8th day). According to the experience of other authors, these doses always proved to be lethal. Control guinea pigs received only the Pb acetate solution while the experimental animals were given simultaneously daily doses of 0.1 and 0.2 g vitamin C. All controls died within the first 12 days. The mortality in the experimental group was greatly diminished: 50% of the guinea pigs died by the 14th day while the other 50% survived and completely recovered. These results confirm the efficacy of vitamin C as an antidote to lethal doses of Pb. (From authors' French summary)

- 1012 Nurmaganbetov, E.K. (Kazakh Acad. Sci., USSR): Raspredelenie lipidov i ketosteroidov v kory nadpochechnikov pri svintsovoi intoksikatsii. (DISTRIBUTION OF LIPIDS AND KETO STEROIDS IN THE ADRENAL CORTEX IN THE COURSE OF LEAD INTOXICATION.) Trudy Instituta Kraevoi Patologii, Akademiya Nauk Kazakhskoi SSR 10:121-7, 1962.

Two groups of rabbits (12 and 10 respectively) received a dose of 1 ml/kg/24 hr of 5% or 2% solution of Pb acetate, respectively, over a period of 2.5-3 or 7-8 mo; 5 in each group served as controls. The hemoglobin level decreased to 15-25%, the number of erythrocytes to  $2 \times 10^6/\text{mm}^3$ . The weight of the adrenal glands in the 5%, 2%, and control groups was 300-400, 300-830 and 250-350 mg, respectively. After the acute intoxication hypertrophy and hyperplasia of the cells, rise of functional activity and decrease of ketosteroids and lipids was found. Chronic intoxication caused necrotic cell changes, a considerable decrease of steroids and lipids and failure of secretion activity.

- 1013 Nurmaganbetov, E.K. (Acad. Sci. Kazakh SSR): Funktsional'noe sostoyanie kory nadpochechnikov pri ostrom svintsovom otravlenii. (CHANGES IN THE ADRENAL CORTEX IN ACUTE LEAD POISONING.) Vestnik Akademii Nauk Kazakhskoi SSR 18, No. 1:88-95, 1962.

Experiments were performed with 17 rabbits (2.5-3.0 kg weight), 6 of which received 1 mg/kg of a 5% Pb acetate solution for 2-1/2 mo; 6 others received the same oral dose for 3-1/2 mo; 5 served as controls. Sections of the adrenal glands were

examined histologically. In the early stages of poisoning, hypertrophy and hyperplasia of the fascicular zone were observed, and adenomatous cells (functionally active) were found in the glomerular zone. Lipid staining and ketosteroid determination suggested that there was increased secretory activity. The later stages of poisoning produced extensive necrosis, with depletion of lipid and ketosteroids.

- 1014 Odynets, R.N.: (METHODS OF DETERMINATION OF TRACE-ELEMENT REQUIREMENTS IN DOMESTIC ANIMALS.) Mikroelementi v Zhivotnovodstve i Rastenievodstve, Akad. Nauk. Kirg. SSR 1962, No. 1:47-53.

Requirements of such trace elements as Co, I, Zn, Mn, Cu, Sr, Be, Ba, Mo, Pb, in water and pasture by domestic animals are discussed. Increased as well as decreased intake results in impaired health. The balance of some elements during an experimental period of 6-12 mo was determined from their content in water and feed ingested and in excreted feces. Weight, fertility, production of milk and flesh and health of the animals were investigated. The organs of dead animals were examined histologically. (From Chemical Abstracts 59:5559, 1963)

- 1015 Orlando, E., and Matassoni, G. (Univ. Bologna, Italy): Comportamento della piombemia nell'intossicazione acuta sperimentale. (BLOOD LEVEL OF LEAD DURING ACUTE EXPERIMENTAL INTOXICATION.) Folia Medica (Naples) 45:1270-80 (Dec.), 1962.

The Pb level in the blood was determined in 9 rabbits at 1, 5, 20, 40, and 60 days after a single sc injection of 200 mg Pb acetate. On the average, the Pb concentration in the rabbits rapidly increased to 10 times its normal value in control animals; then after a temporary decrease, it slowly increased to a peak 30 times the normal value over a period of 40 days. Iv administration of 200 mg/kg of  $\text{CaNa}_2\text{EDTA}$  to a 2nd group of 6 rabbits, 5 days following similar Pb intoxication, resulted in an initial rapid increase, followed by a rapid decrease of the Pb content in the blood so that the control value was reached only 20 days after intoxication. In a 3rd group of 6 rabbits, similarly poisoned, the concentration of ALA in the serum was determined. The values obtained corresponded exactly with those in the 1st group. From these results it appears that  $\text{CaNa}_2\text{EDTA}$  produces an efficient elimination of Pb from blood. A close relation between Pb in the blood and metabolic changes resulting in increased levels of ALA in the blood and urine was confirmed. (From authors' summary; 15 references)

- 1016 Pigulevskaya, M.L. (Kazakh Acad. Sci., USSR): K voprosu pnevmokonioza na svintsovo-baritovykh rudnikakh Kazakhstana. (PNEUMOCONIOSIS IN LEAD-BARITE MINES OF KAZAKHSTAN.) Trudy Instituta Kraevoi Patologii, Akademiya Nauk Kazakhskoi SSR 10:13-5, 1962.

The free silica content was determined in 12 ore samples and found to range from 0.66-0.22%; Ba content was >5%, while in the Pb-Zn layer, Ba was present only in traces, 0.01%. Intratracheal ad-

ministration of the dust to albino rats produced a lung disease typical of fibrosis.

- 1017 Reuber, M.D., and Schmieler, G.C. (Harvard Med. School, Boston, Mass.): EDETATE KIDNEY LESIONS IN RATS. *Archives of Environmental Health* 5:430-6 (Nov.), 1962. Sprague-Dawley male rats, each weighing ~200 g, were injected intraperitoneally, daily, with 500 mg/kg Pb edetate or 250-500 mg/kg Na or Ca edetate, up to 21 days, and sacrificed at different time intervals. Na edetate was the most toxic of the drugs; in 400- and 500-mg doses it produced severe hydropic degeneration of the proximal convoluted tubules of the kidney in all rats. The administration of 500 mg Ca edetate to the rats caused only minimal changes in the kidney even though the dose employed was much larger than that used to treat Pb intoxication in man. Pb edetate was found to be also only mildly nephrotoxic to rats. The degeneration in this group was followed by regeneration of cells lining the proximal convoluted tubules.

Since the kidney changes produced in rats by Ca or Pb edetate were hardly comparable to the nephrosis in human cases of Pb intoxication, it would seem that some other factor may be necessary for these compounds to cause acute renal failure. (23 references)

- 1018 Rotta, C., Parigi, A., Brusca, A., and Margaglia, F. (Univ. Turin, Italy): Importanza della percentuale di piombo nelle leghe Pb-Sn sul suo assorbimento. Nota I. Dati sperimentali. (THE EFFECT OF THE LEAD CONTENT OF LEAD-TIN ALLOYS ON THEIR ABSORPTION. I. EXPERIMENTAL DATA.) *Lavoro Umano* 14, No. 12:736-48, 1962.

This study was performed in the aim of lowering the Pb poisoning risk in workers employed in the filing of Pb-Sn alloys. In-vitro tests on the solubility in HCl (pH 1.2) at 37° of Pb-Sn alloys, reduced to dust such as might be generated by high-speed abrasive wheels commonly used in the repair of automobile bodies, revealed that ~17% of the Pb dissolved from a 97% Pb alloy and only 3.6 and 2.2%, respectively, from a 75% or 50% alloy. Oral absorption in vivo was studied in dogs by introducing dust filings into animals with the Heidenhain pouch. Pb analysis of blood from the femoral artery showed a 57% reduction in absorption with a change from the 97% to the 75% alloy and a 46% reduction when going from the 75% to the 50% Pb alloy. The results were similar when the dogs were fed the various alloys mixed with meat. In tracheal intubation, absorption from 75% Pb alloy dust was ~50% that found from the 97% Pb alloy. (18 references)

- 1019 Ryazanov, V.A.: INVESTIGATIONS IN THE FIELD OF LIMITS OF ALLOWABLE CONCENTRATIONS OF ATMOSPHERIC POLLUTANTS DURING 1958-1959. In Ryazanov, V.A., ed.: *Limits of Allowable Concentrations of Atmospheric Pollutants*, Book 5, translated by B.S. Levine, Washington, US Department of Commerce, Office of Technical Services, 1962, pp. 1-18.

Experimental studies conducted by M.I. Gusev and

O.P. Shalamberidze on the comparative toxicity of Pb sulfide and Pb oxide, and on the MAC for Pb compounds in the air are reviewed. The presently adopted limit in the USSR of allowable Pb concentrations in air of 0.7 µg/m<sup>3</sup>/24 hr is considered to be adequately founded. However, since Pb oxide is ~5 times as toxic as Pb sulfide (calculated for Pb), Gusev recommends that a MAC of 1.7 µg/m<sup>3</sup> for Pb as Pb sulfide be established.

- 1020 Schroeder, H.A., Vinton, W.H., Jr., and Balassa, J.J. (Darmouth Med. School, Hanover, N.H.; Brattleboro Retreat, Vt.): EFFECT OF CHROMIUM, CADMIUM AND LEAD ON SERUM CHOLESTEROL OF RATS. *Proceedings of the Society for Experimental Biology and Medicine* 109:859-60 (Apr.), 1962.

Three groups of 20 male Long-Evans rats, maintained on a controlled diet and environment as to trace metals, were given 5 ppm Pb acetate, Cd chloride, or Cr acetate in their drinking water for 10-20 mo. One group of 20 rats served as controls. The mean level of serum cholesterol in the Pb-fed group was 71.3 mg/100 ml (p <0.01) as compared to 101.7 in the controls. The average level of hepatic cholesterol in the Pb-fed group measured in pairs of animals matched for age was (mg/100 g wet tissue) 325 as compared to 335 in the controls. Pb concentrations in the liver were 0-0.33 µg/g in the controls, 0-0.49 in the Cd-fed and 2.0-3.1 in the Pb-fed groups. In conclusion Pb and Cd appeared to lower serum cholesterol levels significantly; Cr was without demonstrable effect. Hepatic levels were apparently unchanged.

- 1021 Selye, H., Tuchweber, B., and Gabbiani, G. (Univ. Montreal, Canada): CALCINOSIS INDUCED BY LEAD ACETATE. *Journal of Pharmacology and Experimental Therapeutics* 138:131-8 (Oct.), 1962.

Among many others, PbCl<sub>2</sub> is mentioned as a "direct calcifier," capable of producing calcification at the site of injection without sensitization. Though most of them are highly toxic and thus unsuitable for iv administration, at high dose levels, it was observed that rats tolerate Pb acetate iv in amounts which produce heavy Ca deposits in certain internal organs. Female Holtzman albino rats, weighing 90-110 g, were used in a 6-day experiment. Visceral and topical calcinosis were produced by iv injections of 5 mg Pb acetate in a 1.0 ml aqueous solution twice with a 5-hr interval; for the 1st, as much as 10 mg/injection was used in repeat experiments; for the topical, injection was followed by trauma. Mortality was 30% or higher, but in all rats calcified masses were found at the portal vein, pancreas, spleen, cecum near the ileocecal valve and along mucosa folds in adjacent parts of the colon. Topical calcinosis was only achieved when trauma was applied immediately after the 2nd injection. Cutaneous calcinosis was produced by 1 iv injection of 7.5 mg Pb acetate followed by trauma, and local calcinosis, by 7.5 mg iv, with subsequent sc injection of blood removed from the jugular vein into the same group, into a 2nd group 1 hr later, and into a 3rd group, 1 day later. For control, skin on the contralateral flank was crushed.

This calcinosis is attributed to extravasation

of blood and plasma. Topical application of mechanical trauma or chemical irritants, Polymyxin, etc, immediately following a single iv injection of Pb acetate induces local calcinosis presumably again as a consequence of extravasation of Pb-containing fluid from the circulation.

The reported experiments show that a high enough Pb concentration in blood can be built up to induce Ca deposition in the portal territory. Presumably Pb acetate causes minute hemorrhages here. Local trauma induces topical calcinosis when the metal concentration in the blood is still very high; both spontaneous calcifications and those purposely induced by trauma after iv Pb acetate injections are the result of tissue imbibition with extravasated whole blood or serum. It remains questionable whether Pb itself or some calcifiable substrate produced under influence of Pb gives rise to calcinosis.

- 1022 Semenov, D.I., and Tregubenko, I.P. (Inst. Biol., Sverdlovsk, USSR): (MOBILIZATION OF  $Ce^{144}$  AND  $Pb^{210}$  FROM TISSUE OF THE ORGANISM BY LATE APPLICATION OF DIETHYLENETRIAMINOPENTAACETATE.) *Biokhimiya* 27:317-21, 1962.

Diethylenetriaminopentaacetate as a Na salt and a Ca complex were tested for their capacity to mobilize  $^{144}Ce$  and  $^{210}Pb$  in male and female rats which had been injected intravenously with  $^{144}CeCl_3$  and  $^{210}Pb$  nitrate. Na-diethylenetriaminopentaacetate was slightly more effective in male rats and less effective in female rats than the Ca-diethylenetriaminopentaacetate.  $^{210}Pb$  mobilization by both forms of diethylenetriaminopentaacetate was less efficient than that of  $^{144}Ce$ . (From Chemical Abstracts 57:2809, 1962)

- 1023 Shlopak, T.V. (Stanislavsk Med. Inst., USSR): Nekotorye osobennosti khimizma khrustalika v norme i patologii. (Soobshchenie 1-e. Soderzhanie ryada khimicheskikh elementov v prozrachnykh khrustalikakh zhivotnykh i cheloveka). (CERTAIN CHARACTERISTICS OF CRYSTALLINE LENS CHEMISTRY, NORMAL AND PATHOLOGIC. (I. THE CONTENT OF A SERIES OF CHEMICAL ELEMENTS IN THE TRANSPARENT CRYSTALLINE LENS OF ANIMALS AND MAN.)) *Oftal'mologicheskii Zhurnal* 17, No. 5:273-6, 1962.

Eye lenses of fish, frogs, birds, and mammals were analyzed spectrographically and colorimetrically for Pb and other trace elements; the material consisted of 552 animal and 160 human specimens. Aside from a relationship with age, one between the content of trace elements and the disturbance of enzymic activity and metabolism in relation to cataract was also noted. (No quantitative information is given for Pb.)

- 1024 Skripnichenko, Z.M., and Zholnerovich, L.S. (V.P. Filatov Ukrainian Res. Inst. Eye Dis., USSR): Aktivnost kholinesterazy i regulyatsiya oftal'motonusa u krolikov pri TES intoksikatsii. (CHOLINESTERASE ACTIVITY AND INTRAOCULAR TENSION IN TETRAETHYLLEAD-POISONED RABBITS.) *Oftal'mologicheskii Zhurnal* 17, No. 8:484-90, 1962.

After establishing the norms of cholinesterase

(ChE) activity in the blood, one of 2 groups of 1-yr-old rabbits (2.5-3.0 kg) received TEL solutions (ethyl fluid) in fish oil in sc doses of 0.02 mg/kg body weight every 3 days. ChE activity was determined after 5, 10, 15, 20, 30 injections, by the method of Zubkova and Playdich-Neminska (1945). Controls (17) showed ChE activity of av 45.5, and the test animals (16) before injection,  $42.0 \pm 0.9$ . On the basis of these tests, extending over 30-60 days, only slight fluctuations were observed; and intraocular pressure in either eye did not exceed 24.0 mm. TEL poisoning depressed the activity of blood serum ChE and affected seriously the ophthalmotonal regulation. After 10-15 injections of TEL, ChE activity was reduced by 27-40%. Intraocular pressure increased to 32-34 mm and there were greater differences between maximum and minimum tension and more greater fluctuations than in normal animals. No functional connection was found between ChE activity and the degree of intraophthalmic pressure regulation. ChE activity returned to normal within 1 mo after TEL injections were discontinued while ophthalmotonal regulation was disturbed even 2 mo after TEL administration had been discontinued. (30 references)

- 1025 Sortino, G., and Rasa, R. (Univ. Catania, Sicily): (EFFECT OF EXPERIMENTAL INTOXICATION BY LEAD ACETATE ON THE ORAL MUCOSA OF THE RAT.) *Gazz. Sanit.* 33, No. 10-11: 605-8, 1962.

Rats poisoned with Pb acetate developed only a small gingival edge, but histologic examination of the oral mucosa showed marked congestion and lymphocytic infiltration in almost all cases. The Pb is probably fixed to the tissues as a colloidal Pb phosphate. (From Chemical Abstracts 59:13255, 1963)

- 1026 Sortino, G., and Terranova, P. (Univ. Degli Studi, Catania, Italy): (ACTION OF VITAMIN B COMPLEX ON VARIOUS SECTIONS OF THE ORAL MUCOSA OF RATS INTOXICATED WITH LEAD ACETATE.) *Gazz. Sanit.* 33:418-9, 1962.

In young rats receiving 2 cc of a 1.5% solution of Pb acetate gastrically, injection of a vitamin B preparation intramuscularly protected the buccal mucosa against the chronic inflammation resulting from the Pb acetate alone. (From Chemical Abstracts 58:7285, 1963)

- 1027 Sroczynski, J. (Silesian Med. Acad., Zabrze, Poland): Badania nad mechanizmem niedokrwistości ołowiczej. (STUDIES ON THE MECHANISM OF ANEMIA IN LEAD POISONING.) *Polskie Archiwum Medycyny Wewnętrznej* 32, No. 7:673-81, 1962.

Two groups of rabbits were poisoned by intravenous injections with alkaline Pb acetate. Acute Pb poisoning was produced in one group and chronic poisoning in the second one. Cytochemical examination of erythrocytes was performed to determine the chemical composition of the granulations occurring in Pb poisoning. It was found that the mechanism of Pb-induced anemia depends on the hemolytic processes and the inhibition of Fe incorporation into the porphyrin molecule, both of which exist simultaneously, and eventually lead to a decrease of

hemoglobin. In the anemia of acute Pb poisoning, the hemolytic processes predominate while in chronic Pb poisoning the impairment of Fe incorporation is the main factor. Pb induces not only hemolysis of mature erythrocytes but damages also the erythroblasts by inhibiting hemoglobin production and probably by inactivating mitochondrial ribonucleases. (From author's English summary; 20 references)

- 1028 Suzutani, T., and Taira, H. (Wakayama Med. Coll., Japan): BIOCHEMICAL BEHAVIOR OF LEAD. I. LEAD CONTENT IN BLOOD OF RABBIT ADMINISTERED WITH LEAD. Wakayama Medical Reports 7:29-36 (Mar.), 1962.

Male mature rabbits, weighing 1.9-2.3 kg, were divided into groups of 4 animals each and fed a diet in which the daily Pb content was always below 92 µg which is the lowest amount of Pb determinable by polarography. A solution of 0.55 g Pb acetate/100 ml was administered to the animals sc, iv or orally, at the rate of 6 or 3 mg Pb/kg body weight. Blood samples taken from the ear vein were analyzed by the method of Suzutani, which is described in detail and in which Pb is completely liberated from the proteins, then determined polarographically. The error of the method is within 5%. The Pb level in 10 of 38 normal rabbits was <20 µg/100 ml; 82% of those having a Pb concentration >20 µg/100 ml, had <50 µg/100 ml; the highest concentration found was 87 µg/100 ml. Daily analysis of the Pb concentration in the blood of 4 normal rabbits revealed that (1) the greatest daily variation in an individual rabbit was 26 µg/100 ml and (2) that every rabbit had a blood Pb concentration characteristic for this individual. Data of the Pb content in blood of rabbits over a period of 60 days after oral or sc administration of a single dose of 6 mg Pb/kg are presented in graphs. The 2 curves obtained are almost identical; the Pb level begins to decrease on the 2nd day after administration; on the 4th or 5th day a slight transient rise occurs which is followed by a continuous drop to nearly normal levels by the 10th-25th day and to complete recovery of the normal level on the 45th day. Other graphs demonstrate data obtained after repeated oral, sc and iv administration of Pb. When 3 mg Pb/kg was administered once in 3 days for 30 days, the patterns of the Pb content in blood were almost the same, regardless of route: Pb began to increase very acutely toward a peak on days 9-10, fell to a minimum on days 15-18 and then started another acute rise. When 3 mg Pb/kg was administered orally once every other day for 20 days, a peak was reached on the 4th day which was followed by a decrease to day 20. The periodical increase and decrease of the blood Pb after repeated Pb administration over a period of time was explained as follows: In the initial stage of poisoning, the tissues cannot absorb the whole amount of Pb entering the blood circulation, and consequently, a remarkable increase of the blood Pb level occurs. As the Pb-combining power of the tissues increases, they absorb more Pb than enters the circulation and the blood Pb level decreases. However, the Pb-combining power of the tissues reaches a threshold after which the blood Pb level rises again.

- 1029 Todd, J.R.: A KNACKERY SURVEY OF LEAD POI-

SONING INCIDENCE IN CATTLE IN NORTHERN IRELAND. Vet. Record 74:116-8, 1962.

A survey of the Pb content of the cortical tissue of kidneys of animals at a knackery receiving carcasses from all over Northern Ireland, showed Pb poisoning to be responsible for deaths of 1.7% of adult cattle and for 4.5% of calves. (From Veterinary Bulletin 32:Abstr. No. 2024, 1962)

- 1030 Tregubenko, I.P., Podgornaya, I.V., Postovskii, I.Ya., and Semenov, D.I. (Biophys. Lab., Inst. Chem., Ural Acad. Sci., Sverdlovsk, USSR): Uskorenie vydeleniya ittriya, tseriya i svintsa iz organizma pri pomoshchi uramildiatsetata, 1,2-diamintsiklogeksantetraatsetata i polietilenpoliaminopoliatsetata. (ACCELERATION OF THE EXCRETION FROM THE ORGANISM OF YTTRIUM, CERIUM AND LEAD WITH THE AID OF URAMIL DIACETATE, 1,2-DIAMINECYCLOHEXANETETRAACETATE AND POLYETHYLENEPOLYAMINOPOLYACETATE.) Radiobiologiya 2:200-6, 1962.

As determined in rats, polyethylene polyamine polyacetate (PEPAPA) had a marked effect on the deposition in tissues and on the elimination from the organism of <sup>144</sup>Ce and <sup>210</sup>Pb, greater than that of all complexons tested to date. On <sup>91</sup>Yb this complexon had the same effect as uramildiacetate (UDA) but greater than diaminocyclohexanetetraacetate (DCHTA). When used long after radioisotope treatment, PEPAPA increased the rate of elimination of Yb, Ce and Pb to a considerably higher degree than UDA and DCHTA. UDA was very effective when administered early but was ineffective on the elimination of Yb, Ce, and Pb from the organism if administered at a later time.

- 1031 Van Esch, G.J., Van Genderen, H., and Vink, H.H. (Natl. Inst. Pub. Health, Utrecht, Netherlands): THE INDUCTION OF RENAL TUMOURS BY FEEDING OF BASIC LEAD ACETATE TO RATS. British Journal of Cancer 16:289-97 (June), 1962.

Two groups of Wistar rats (24-30 each) were given from weanling age, a diet containing 0.1 (Group 1) and 1% (Group 2) basic Pb acetate, for 29 and 24 mo, respectively. The rate of growth was lower in both groups as compared to that of their respective controls, and the life span of group 2 was shortened. Blood tests performed in the 2 groups after 14 and 37 wk of feeding, respectively, showed the presence of anemia, increase in number of leukocytes, and basophilic stippling in Group 2, while Group 1 showed normal blood values. Renal tumors were observed after 1 yr in the 1% group (in 13 of 24 rats) and after 1.5 yr in the 0.1% group (in 11 of 32) occurring in equal number among males and females. Carcinomas were found in 3 rats of Group 1. Histologic examination showed an enlarged kidney which was granular to cystic in appearance, chronic interstitial nephritis, deposits of Pb salts, epithelial cells with enlarged nuclei containing inclusion bodies. The mean concentrations of Pb and Fe in the kidneys after 14-21 days of feeding Pb acetate and of coproporphyrin in urine after 14 days of feeding, were, respectively: 75 and 71 µg/g and 19 µg/24 hr in Group 1, and 192 and 55 µg/g and 38 µg/24 hr in Group 2. Observations made on virus activation by the Pb-contain-



ing food and on the radioactivity of the Pb preparation did not support the possibility of attributing the carcinogenic effect to one of these factors.

In the discussion, the authors compared the dose level used in the experiments with amounts of human exposure considered to be poisonous. As the caloric value of the food was 3700 K cal/kg, a man ingesting 3000 K cal of the same food would ingest 0.81 kg, or 810 mg of Pb acetate, or 550 mg Pb/day, which is far in excess of doses tolerated by man. This could explain the fact that in chronic poisoning, renal tumors have not been seen, and that the occurrence of other symptoms would limit the dose or duration of exposure to levels that are insufficient for tumor production.

- 1032 Von Studnitz, W., and Haeger-Aronsen, B. (Univ. Lund, Malmö, Sweden): URINARY EXCRETION OF AMINO ACIDS IN LEAD-POISONED RABBITS. *Acta Pharmacologica et Toxicologica* 19:36-42, 1962.

$\alpha$ -Amino N and glycine were determined in the urine of 10 adult rabbits. Seven of these rabbits (4 males, 3 females) weighing 2.5-3.5 kg, then received a sc injection of 125 mg of 4% Pb acetate/kg. The rate of creatinine excretion in the urine ranged from 52-98 mg%, mean 71 mg%, never exceeding the upper normal limit. The excretion of glycine and ALA increased 3-10 times during the 1-4th days, declined towards normal during the following week and then increased again slowly. The initial ascent of the curves of excretion was attributed to a prerenal disorder, and the 2nd rise was ascribed to tubular injury which decreased the reabsorption of amino acids. The excretion of serine fell initially, but rose again on the 20-25th days after the administration of Pb. It is suggested that the decreased excretion of serine combined with the increased excretion of ALA in acute Pb poisoning may be explained by a blockage of ALA transaminase. No conspicuous changes were seen in the excretions of lysine, alanine, glutamic acid or tyrosine in the acute stage of the poisoning. (18 references)

- 1033 Wanov, X., Prodanov, P., Chelibonova, K., and Bozhkov, S.: (LEAD CONTENT OF HAIR FROM CATTLE, SHEEP AND HUMAN BEINGS IN AREAS WHERE HUMAN NEPHRITIS IS ENDEMIC.) *Izv. Inst. Pat. Zhivotni (Sofia)* 9:275-83, 1962.

(This reference was given erroneously in Veterinary Bulletin 33:Abstract No. 2130, 1963. The first author's name is Ivanov, K. See Abstract No. 2415.)

- 1034 Watrach, A.M., and Vatter, A.E., Jr. (Univ. Illinois, Urbana; Univ. Colorado, Denver): THE NATURE OF INCLUSION BODIES IN LEAD POISONING. In *Electron Microscopy*, Vol. 2, New York, Academic Press, 1962, pp. VV-11.

A study was made of the ultrastructural and chemical characteristics of inclusion bodies found in the liver of pigs fed with Pb acetate. Acidophilic nuclear inclusion bodies were found in the liver and kidney, and they contain a small amount of DNA

and large amounts of protein with a high content of sulfhydryl groups. Electron microscopic studies showed that the essential unit of the bodies was osmiophilic fibrils which are densely packed in the larger bodies. Numerous ferritin granules were dispersed throughout the bodies, and small chromatin aggregates were present at the edges of the bodies. (From Nuclear Science Abstracts 16: Abstract No. 31421, 1962)

- 1035 Zel'tser, M.E. (Kazakh Acad. Sci., USSR): K voprosu o funktsional'nom sostoyanii shchitovidnoi zhelezy pri saturnizme. (THE FUNCTIONAL STATE OF THYROID GLAND IN LEAD POISONING.) *Trudy Instituta Kraevoi Patologii, Akademiiya Nauk Kazakhskoi SSR* 10:116-20, 1962.

Two groups of rats were given 1 ml/kg/24 hr of 2 or 5% solution of Pb acetate, respectively, over a period of 2.5-3 mo. Then 0.5-0.59  $\mu$ Ci of  $^{131}$ I was administered subcutaneously.  $^{131}$ I absorption in the thyroid gland and thyroid hormone formation and secretion into blood was slowed down. There was a relation between the intensity of these changes and the doses of Pb administered.

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- 1036 Aldanazarov, A.T., Aitbaev, T.Kh., and Kutyrkina, N.A. (Acad. Sci. Kazak SSR): Ob izmeneniyakh belkovogo sostava syvorotki krovi pri svintsovom otravlenii v eksperimente. (CHANGES IN THE PROTEIN COMPOSITION OF THE BLOOD SERUM IN EXPERIMENTAL LEAD POISONING.) *Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Meditsiny Nauk* 2: 48-53, 1963.

Following analysis of the serum proteins of 30 dogs (10-28 kg weight), the animals received orally Pb acetate as a 1.5% solution on alternate days for 6 mo and as a 2.5% solution for 2 additional mo, both in a volume of 2 ml. Determination of total protein (refractometric method) and of the fractions (paper electrophoresis) was performed after 2, 4, 6, 7, and 8 mo. The results showed that there was no great change in the total protein of the serum. The albumin concentrations decreased somewhat, but the  $\gamma$ -globulin fraction decreased significantly and the  $\alpha$ - and  $\beta$ -globulins significantly increased. These changes paralleled the severity of the poisoning.

- 1037 Anonymous: EFFECT OF "ABNORMAL" TRACE METALS ON SURVIVAL OF MICE AND RATS. *Nutrition Reviews* 21:340-1 (Nov.), 1963.

This review concerns the work by Tipton (1960) on accumulation of trace metals in man with age, and of Schroeder et al (1962, 1963) with mice and rats, reporting shortened survival of male mice and both male and female rats administered Cd and Pb in amounts sufficient to cause tissue levels similar to those of adult man.

The reviewer wonders why only male mice were affected. Since no significant differences were observed in survival between the various groups of female mice, he deems it desirable to know if these male mice are particularly susceptible to degenerative disease(s) and whether this explains the increased mortality caused by Pb and Cd in this

group. The increased mortality in both male and female rats was explained by the peculiar occurrence of hypertension. The mechanism of it, however, was not explained though the reviewer believes it could be related to renal damage since chronic Cd poisoning causes renal tubular damage in man.

The review closes with the statement that although the relationship of the accumulation of metals to disease in man is speculative, tissue levels similar to those of adult man have been shown to be associated with reduced survival in mice and rats. Autopsy findings in these animals should reveal whether small amounts of Cd or other "abnormal" trace metals accentuate chronic disease or cause the pathologic changes that result from excessive amounts of the same metals. These studies of the effects of "abnormal" trace metals in animals may eventually lead to a better understanding of disease in man.

- 1038 Arkhipova, O.G., Medved, T.Ya., Rudomino, M.V., and Kabachnik, M.I. (Inst. of Occup. Hyg. and Prof. Dis., Moscow, USSR): Vliyanie dvunatrievoy soli etilendiaminobisizopropilfosfinovoy kisloty na vyvedenie svintsya i techenie svintsovoy intoksikatsii v eksperimente. (EFFECT OF DISODIUM ETHYLENEDIAMINE-BIS-ISOPROPYLPHOSPHINATE ON LEAD EXCRETION.) Gigiena Truda i Professional'nye Zabolovaniya 7, No. 12:33-7, 1963.

The disodium salt of ethylenediamine-bis-isopropylphosphoric acid (phosphicin), used by the authors as a complexing agent in intoxications by heavy metals and rare earth elements, proved to be nontoxic when used in single and repeated dosage. Its minimum lethal dose was 6 g/kg, while that of Ca disodium ethylenediaminetetraacetate (EDTA) was 3 g/kg. Repeated administration of phosphicin in doses of 1.5-0.5 g/kg produced no demonstrable changes in animals.

In vitro experiments showed it to form stable nonionizable complexes with Pb.

The action of phosphicin in subacute Pb poisoning was investigated on 40 white mice, divided into 4 groups of 10 mice each, with one serving as control, the other 3 groups receiving 250 mg/kg Pb nitrate; of these, one group was treated with 1500 mg phosphicin/kg orally, and another, intraperitoneally. By the 5th day, 8 mice of Group 2 (receiving Pb only) were dead, while the phosphicin-treated mice remained alive. Upon necropsy, fatty degeneration of the liver and intestinal spasm were seen in the mice of Group 2; the other mice showed no changes when sacrificed.

Chronic intoxication was induced in white rats by oral administration of 1 ml of 4% solution of Pb acetate daily for 2 mo. Two wk thereafter the rats were divided into 4 groups of 10 each, the first of which served as control; of the other groups, one received for 12 days orally 1 ml of 5% solution of phosphicin daily, and another, intraperitoneally; Group 4, the same dosage of EDTA. The results showed that elimination of Pb by both chelating agents was about the same. However, most of the Pb after phosphicin was eliminated in the feces whereas after EDTA, most of the Pb appeared in the urine.

In the next series, Pb (as nitrate, at 45 mg/kg) and the chelates (either EDTA at 0.5 ml 10% solution, or phosphicin at 1 ml 5% solution) were administered daily orally, at the same time as Pb to guinea pigs for 3 wk. Severe intoxication was obtained in the untreated animals, with increased number of stippled cells, reticulocytosis, decreased hemoglobin. In the EDTA group not much change was seen, but in the phosphicin-treated animals the effects of Pb were less pronounced. By the end of the experiment, the phosphicin-treated animals had eliminated twice as much Pb as the controls mainly in the feces; EDTA caused greater elimination in the urine, particularly in the 1st wk. Phosphicin also prevented the deposition of Pb in bones, for after treatment, the Pb level in bone was almost the same as in the control animals.

It is concluded that phosphicin is an effective therapeutic agent in Pb poisoning, which can be used both orally and parenterally.

- 1039 Aronson, A.L. (Univ. Minnesota, Minneapolis): FACTORS DETERMINING THE EFFICIENCY AND DEGREE OF LEAD MOBILIZATION FROM SOFT TISSUE BY A CHELATING AGENT. Dissertation, University of Minnesota, 1963 (Diss. No. 63-7905), University Microfilms, Inc., Ann Arbor, Mich., 141 pp.

The ability of calcium ethylenediaminetetraacetate (CaEDTA) to mobilize Pb from the soft tissues in rats and calves was studied. Calves were given Pb orally in divided doses sufficient to elevate the Pb concentration in the erythrocytes to a range of 1-2.5 µg/cc within 5 days after the last dose of Pb. Rats were given a single iv injection containing 7 mg Pb (as the citrate)/kg and 50 µc of Ra D/dose; the infusion was administered rapidly in 5 sec or slowly over a period of 12 min. Four rats were fed Pb at a dose of 500 mg/kg.

Comparison of the Pb distribution after the different ways of administration showed that at the rapid iv administration the liver contained more Pb than the kidney, whereas after oral and slow iv infusion the Pb distribution in liver and kidney was similar, with the kidney containing the larger proportion. Concentrations of EDTA and disappearance curves in the plasma were determined following rapid or 6-hr iv infusion of EDTA in both rats and calves. The effect of CaEDTA infusions on urinary Pb excretion in calves 5 days following the last Pb dose was determined. Also, the effect of both rapid and continuous infusion of CaEDTA, 4 days after Pb administration, on the residual Pb concentration in kidney, liver, brain, total soft tissue and bone was measured in rats that had been sacrificed 3 days following CaEDTA treatment.

In parallel experiments the ability of CaEDTA to unbind Pb from tissues in vitro, using livers and kidneys of rats, was studied. Pb could be removed more readily by CaEDTA from subcellular fractions of kidney and liver than from whole cells, the latter requiring a continuous exchange of the fluid surrounding the cells. Correlations between in-vivo and in-vitro data indicated that the molar ratio EDTA/Pb was far less important than the turnover of an extracellular fluid containing the chelating agent. It is postulated that the turnover of extracellular fluid effects removal of Pb

from cells by creating a constant removal of the PbEDTA chelate from the chelation sites.

- 1040 Bienvenu, P., Nofre, C., and Cier, A. (Lyon, France): Toxicité générale comparée des ions métalliques. Relation avec la classification périodique. (COMPARATIVE GENERAL TOXICITY OF METAL IONS. RELATION TO THE PERIODIC SYSTEM.) Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences 256:1043-4 (Jan.), 1963.

Swiss albino mice received ip injections of an aqueous solution of Pb acetate. The LD<sub>50</sub>, when death occurred within 30 days (expressed as LD<sub>50</sub>/30), of the bivalent Pb ion was calculated statistically as  $0.370 \pm 0.010$  mg/kg body weight; its relative toxicity, compared to the LD<sub>50</sub>/30 of numerous other metal ions, with that of Na ion taken as 1, was 120.3.

- 1041 Boyadzhiev, V. (Med. Inst. Sofia, Bulgaria): Predpazno khranene pri eksperimentalno olovno otravyane. (PREVENTIVE NUTRITION IN EXPERIMENTAL LEAD POISONING.) Nauchni Trudove na Visshiya Meditsinski Institut, Sofia 42:169-88, 1963.

In previous papers the author pointed out the role of protective diets in the evolution of Pb poisoning. By a method described in these articles he investigated the effect of some protein and fat-containing diets on the conditioned reflexes and hematologic indices in Pb poisoning.

In this paper the changes in weight, Pb concentration and histopathologic alterations in the organs were followed after administration of 4 kinds of diets (high and low protein and high and low fat) to animals (species are not indicated) with chronic intoxication by Pb nitrate.

The changes of the conditioned reflex activity, the hematologic criteria, the weight, the biochemical and histopathologic findings showed, in conformity with the observations of other authors, that the toxic direct and neuroreflex effect of Pb was very strong. It caused alterations which could not be prevented by changing the functional state of the cerebral cortex by means of a given nutritional regimen. However, the food ratios could influence the character and the degree of the alterations of the above criteria. Poisoning is most serious in animals fed a protein-poor diet, followed by a diet rich in fats. Animals fed a high protein diet showed the mildest clinical picture.

The author recommends that workers exposed to Pb be placed on a diet rich in proteins and poor in fats. (From author's summary)

- 1042 Brugnone, F., and Galzigna, L. (Univ. Padua, Italy): Effetto del piridossal fosfato sull'inibizione della porfirinuria indotta dall'acido adenosin-mono-fosforico in vivo e in vitro. (EFFECT OF PYRIDOXAL PHOSPHATE ON THE INHIBITION OF PORPHYRINURIA INDUCED BY ADENOSINE-MONOPHOSPHORIC ACID IN VIVO AND IN VITRO.) Lavoro Umano 15, No. 11:502-7, 1963.

The possibility of a deficiency of phosphorylated derivatives of adenine, such as adenosine monophosphoric acid (AMP), in porphyria has been con-

sidered. As such a deficiency could lead to inadequate synthesis of some essential metabolites or to the accumulation of intermediate toxic metabolites, the authors explored the reversal of this condition by pyridoxal phosphate in porphyria induced by Pb.

For the in-vitro experiments, blood collected from rabbits which had been intoxicated with neutral Pb acetate, was incubated with 5  $\mu$ M of AMP, adenosine-diphosphoric acid (ADP), adenosine-triphosphoric acid (ATP), or pyridoxal phosphate (PLP). For the in-vivo experiments, 12 male rabbits, weighing 2-3 kg, were given 1st a subcutaneous injection of 50 mg neutral Pb acetate and then 4 intravenous injections of 7.5 mg each on 4 successive days in order to induce first an acute, then a more moderate state of intoxication by Pb. The experimental animals were divided into 3 groups of 4 rabbits each. Group 1 was treated from the beginning of the intoxication with intramuscular injections of 30 mg AMP alternating with 10 mg PLP. Administration of AMP was discontinued after 20 days while that of PLP was continued for 10 more days. Group 2 was treated intravenously with 30 mg AMP on alternate days for 30 days, and Group 3 received no treatment. At regular intervals, estimations were made of hemoglobin content, red blood cell counts, hematocrit, and urinary  $\delta$ -aminolevulinic acid (ALA), porphobilinogen and coproporphyrin.

In vitro, both ATP and ADP increased the production of free erythrocytic protoporphyrin by 160%; PLP by itself caused an increase of 40%, while AMP produced a 24% inhibition and AMP plus PLP a 72% inhibition.

In the in-vivo experiments, none of the animals died. Urinary elimination of ALA, porphobilinogen and coproporphyrin decreased in the experimental rabbits. The decrease of urinary ALA and porphobilinogen was more pronounced in the animals treated with AMP plus PLP than in those treated with AMP alone. ALA in the blood followed the same pattern as urinary ALA, though to a lesser degree. Free erythrocytic protoporphyrin increased slightly upon treatment with AMP and rapidly upon treatment with AMP plus PLP, but returned rapidly to its normal values. Treatment with AMP plus PLP also increased the values of hemoglobin, hematocrit and red cell counts.

The authors conclude that, both in vitro and in vivo, PLP enhances the effect of AMP on the metabolism of porphyrins in Pb-poisoned rabbits and exerts a favorable influence on the blood picture.

- 1043 Brykalski, D., and Depczyk, D. (Inst. Med. Pracy, Lodz, Poland): Wpływ EDTA, BAETA i DTPA na retencje Pb-210 w ustroju myszy. (EFFECT OF EDTA, BAETA AND DTPA ON THE RETENTION OF Pb-210 IN MICE.) Medycyna Pracy 14, No. 6:439-47, 1963.

The effect of early and late administration of ethylenediaminetetraacetate (EDTA), bis(2-(bis(carboxymethyl)amino)ethyl) ether (BAETA) and diethylenetriaminepentaacetic acid (DTPA) on the distribution and retention of Pb in the organism was studied in 58 white mice. The animals were given a single intravenous injection of <sup>210</sup>Pb. The chelates were administered intraperitoneally as follows: (1) single injection simultaneously with

Pb; (2) repeated injections with 2-day intervals starting 24 hr after the Pb administration; (3) repeated daily injections starting 5 days after Pb administration. All 3 chelates decreased the  $^{210}\text{Pb}$  content in the organism of the mice significantly. Their effectiveness was in the order of DTPA > EDTA > BAETA. These results agree with those obtained by Tregubenko (1961) on rats.

- 1044 Brykalski, D., and Wronowa, B. (Inst. Med. Pracy, Lodz, Poland): Wpływ doustnie podanego EDTA na wchłanianie i wydalanie z ustroju ołowiu wprowadzonego tą samą drogą. (THE EFFECT OF ORAL ADMINISTRATION OF EDTA ON THE ABSORPTION AND ELIMINATION OF LEAD ADMINISTERED IN THE SAME MANNER.) *Medycyna Pracy* 14, No. 4:313-20, 1963.

Seventeen albino rats were given a single oral dose of  $^{210}\text{Pb}$ . One group of these rats then received an aqueous solution of ethylenediaminetetraacetate (EDTA), the remainder serving as controls. All animals were killed 48 hr after the administration of  $^{210}\text{Pb}$  and the radioactivity was determined in some of the organs. The results showed that the  $^{210}\text{Pb}$  content was smaller in the organs of those animals that had been given EDTA, than in the controls, amounting to 45% in the liver, 26% in the kidney and 21% in the bones. At the same time,  $^{210}\text{Pb}$  excretion in the urine of the EDTA rats increased, exceeding that of the controls fivefold within 48 hr. The experiments demonstrated that the animals receiving EDTA absorbed 2-3 times as much  $^{210}\text{Pb}$  as the control group. However, the rate of  $^{210}\text{Pb}$  excretion increased more than the rate of absorption so that the  $^{210}\text{Pb}$  content in the body became smaller. (From authors' English summary)

- 1045 Camba, R., Dianzani, M.A., and Montaldo, S. (Univ. Cagliari, Italy): Lesioni mitocondriali e lisosomiali nell'intossicazione sperimentale da piombo nel ratto. (LESIONS OF THE MITOCHONDRIA AND THE LYSOSOMES IN RATS FOLLOWING EXPERIMENTAL LEAD INTOXICATION.) *Rassegna Medica Sarda* 65: 591-600 (Sept.-Oct.), 1963.

The enzymatic activity of mitochondria and lysosomes in the liver was studied in Wistar albino rats, weighing 120-130 g each, which were poisoned by oral administration or inhalation of Pb acetate for 3 mo. Group 1 was given by stomach tube a daily dose of 0.4 ml of a 10% solution of neutral Pb acetate, Group 2 was subjected, daily for 30 min, to an aerosol formed by 2 ml of a 10% solution of Pb acetate. The aerosol treatment simulates best the conditions of occupational chronic Pb poisoning in man. The animals were sacrificed 24 hr after the last treatment. Homogenates were prepared for determination of oxidative phosphorylation, activities of adenosinetriphosphatase (ATPase),  $\beta$ -glucuronidase and cathepsin, and of enzyme N (to express activity). The liver of each animal was examined histologically.

In the orally poisoned rats, the ratio of phosphorus to oxygen decreased significantly as early as in the first 48 hr and the liver was greatly enlarged. The rats poisoned by Pb aerosol reached this stage only after 2-4 wk of exposure. In these aerosol-treated animals, there was also a

relative decrease of dinitrophenol (DNP)-stimulated ATPase and an absolute decrease of the ratio of DNP-activated to magnesium-activated ATPase, while the activity of ATPase in the absence of the activators was increased. On the other hand, ATPase activity both in the absence and presence of activators was markedly below normal in the orally poisoned rats. The action of cathepsin and  $\beta$ -glucuronidase was studied only in the aerosol-treated rats. The activity of cathepsin in the absence of Triton X-100 was definitely increased but there was no difference of  $\beta$ -glucuronidase activity in normal or treated rats. This behavior points to the existence of a change in permeability of the membrane of lysosomes.

The results of the experiments indicate that the effects of Pb as aerosol are much less severe than those of orally administered Pb. The mechanism and the implication of the changes are discussed.

- 1046 Castellino, N. (Univ. Naples, Italy): Acquisizioni recenti en toxicologie industrielle au moyen de radio-isotopes. Contribution à l'étude du métabolisme du Pb 210. (RECENT STUDIES IN INDUSTRIAL TOXICOLOGY BY MEANS OF RADIOISOTOPES. CONTRIBUTION TO THE STUDY OF THE METABOLISM OF Pb 210.) *Internationales Archiv für Gewerbepathologie und Gewerbehygiene* 20:237-52 (Aug.), 1963.

Rats received intravenous injections of  $^{210}\text{Pb}$  acetate containing 100  $\mu\text{g}$   $^{210}\text{Pb}$ /animal. The animals were kept in metabolism cages and then sacrificed at certain time intervals. About 96% of the injected Pb was retained in the cellular elements of the blood and 4% was found in the plasma. The plasma Pb was carried rapidly to the tissues, the highest concentrations appearing in the kidneys, liver and bones. The Pb concentration in the blood and the tissues decreased first rapidly and then more gradually with exception of the bones where it increased slowly during the first few hours and then decreased slowly. Pb was excreted in the feces and urine. During 14 days of observation, 51.6% of the injected dose was excreted, 35.74% in the feces and 15.90% in the urine. Fecal and urinary excretion started very soon, reached a maximum between 12-48 hr after injection and then decreased asymptotically.

- 1047 Castellino, N., and Colicchio, G. (Univ. Naples, Italy): Ricerche sperimentali sulla tossicità di una miscela antidetonante al piombo tetrametil. (EXPERIMENTAL STUDIES OF THE TOXICITY OF AN ANTI-KNOCK MIXTURE CONTAINING TETRAMETHYLLEAD.) *Folia Medica* 46, No. 9:715-33, 1963.

See Abstract No. 1117.

- 1048 Castellino, N., Colicchio, G., and Piccoli, P. (Univ. Naples, Italy): Studio della funzione epatica nell'intossicazione sperimentale con una miscela antidetonante al piombo tetrametil. (LIVER FUNCTION IN EXPERIMENTAL INTOXICATION WITH AN ANTI-KNOCK MIXTURE CONTAINING TETRAMETHYLLEAD.) *Folia Medica* (Naples) 46:825-34 (Oct.), 1963.

Two groups of male rabbits, weighing 2.1-2.9 kg each, were subcutaneously injected daily, 5 times/

wk, with an antiknock mixture containing 33.7% tetramethyllead (TML), 10.8% ethylenedibromide, 19.9% ethylenedichloride and 35.6% toluene, dye and impurities. Group 1 (9 rabbits) was given 15 mg/kg body weight of the mixture dissolved in aqueous alcohol; Group 2, 5 mg/kg. Four rabbits, serving as controls, were injected with 0.18 cc/kg of an aqueous alcohol solution. The content in the blood of proteins, lipoproteins and lipids, total cholesterol and cholesterol esters was determined before the start of the experiment, after 10 injections in Group 1 and after 30, 60, 90, 120, 150, 180 injections in Group 2 and the controls. The liver was histologically examined at death or at the end of the treatment. The slight changes occurring in Group 1 after 10 injections of 15 mg/kg each were not significant statistically. As previously reported, after 12-18 injections of 15 mg/kg the animals revealed severe nervous signs followed by death due to damage of the brain. Rabbits of Group 2, treated with 5 mg/kg, also did not show any statistically significant changes up to 90 injections. One animal died after 96 treatments, showing a marked increase of  $\gamma$ -globulin and congestion and hemorrhages in the liver. After 120 injections, decreases of albumin and  $\alpha_1$ -globulin and increases of  $\alpha_2$ -,  $\beta$ - and  $\gamma$ -globulin were noted in some animals; these changes also were not significant statistically. Similar changes developed after 150 and 180 treatments; one animal died after 162 injections with degenerative hepatic lesions and signs of fatty liver.

From the results the authors conclude that the antiknock mixture containing TML does not exert any toxic action on the liver.

- 1049 Castellino, N., Colicchio, G., and Rossi, A. (Univ. Naples, Italy): Studio della funzione renale nella intossicazione sperimentale con una miscela antidetonante al piombo tetrametile. (RENAL FUNCTION IN EXPERIMENTAL INTOXICATION WITH AN ANTI-KNOCK MIXTURE CONTAINING TETRAMETHYLLEAD.) *Folia Medica* 46:850-7 (Oct.), 1963.

Two groups of male rabbits were poisoned by subcutaneous injection of an antiknock mixture containing 33.7% tetramethyllead (TML), 10.8% ethylenedibromide, 19.9% ethylenedichloride and 35.6% toluene. Group 1 of 9 rabbits, weighing 2.1-2.9 kg each, received 15 mg/kg/day/rabbit of the mixture dissolved in aqueous ethyl alcohol, for 5 days/wk. Group 2 of 10 animals, weighing 2.3-2.9 kg each, were given 5 mg/kg/day/rabbit, for 5 days/wk. A group of 4 rabbits of the same weight, serving as controls, were injected with aqueous ethyl alcohol. Time of survival, toxic symptomatology and renal function were studied; at the time of death or at the end of the treatment the kidneys were histologically investigated. Glomerular filtration was determined by means of the clearance of endogenous creatinine, and the renal plasma flow and the maximal tubular excretion capacity, by the clearance of sodium para-aminohippurate. All tests were carried out before and after the start of injections (10 in Group 1, and 60, 90, 150, and 180 injections in Group 2). There were no statistically significant alterations of the renal function in Group 1. After 12-18 injections, motor irritability and tremors be-

gan, followed by spastic paralysis of the front and hind limbs and finally death. Histologically, the kidneys showed some congestion in the rabbits in Group 2. Two rabbits died at the 96th and 162nd injection, respectively. This group showed statistically significant alterations of the renal function and slight histological changes of the kidneys; however, none of the animals of this group displayed a neurotoxic syndrome. The authors conclude the experimental results did not demonstrate any significant alterations of the renal function as being caused by the TML-containing mixture.

- 1050 Castellino, N., Colicchio, G., and Rossi, A. (Univ. Naples, Italy): Comportamento della crasi ematica nell'intossicazione sperimentale con una miscela antidetonante al piombo tetrametile. (THE BLOOD PICTURE IN EXPERIMENTAL INTOXICATION WITH AN ANTI-KNOCK MIXTURE OF TETRAMETHYLLEAD.) *Folia Medica* 46:980-6 (Nov.), 1963.

An antiknock mixture containing 33.7 vol % tetramethyllead (TML) was injected subcutaneously to 2 groups of male rabbits. Group 1 of 9 rabbits, weighing 2.1-2.9 kg, received daily 15 mg/kg of the mixture dissolved in aqueous ethyl alcohol, on 5 days/wk; Group 2, 10 rabbits of 2.3-2.9 kg weight, received 5 mg/kg/day. Four control rabbits, weighing 2.3-2.9 kg, were injected with aqueous ethyl alcohol. Blood counts were done at the beginning and after 10 injections in Group 1 and after 30, 60, 90, 120, 150, 180 injections in Group 2 and the controls. The data obtained for red and white blood cells, hemoglobin, cellular volume, Fe content, granulocytes, lymphocytes and monocytes were tabulated. Myelograms, taken at the beginning and at death or end of treatment, showed no significant alterations in Group 1; however, after 12-18 doses the animals died with neurotoxic manifestations. In Group 2, after 90 injections, a statistically significant decrease of the red cells and hemoglobin was noted. The level of Fe in the blood did not vary significantly and variations in the leukocyte count were within physiological limits. After 120 injections, the cellular volume was significantly decreased and the blood Fe significantly increased. Examination of the bone marrow at the beginning and end of the treatment revealed no variations in the rhythm of proliferation and maturation of erythroblasts and granuloblasts. The occurrence of a hypochromic, hypersideremic anemia was attributed to the action of toluene and Pb which formed in the metabolic decomposition of TML.

- 1051 Castellino, N., Rossi, A., and Mole, R. (Inst. Ind. Med. Naples Univ., Italy): TOXICITY OF TETRAMETHYL LEAD SOLUTIONS TO MICE AND RABBITS. *British Journal of Industrial Medicine* 20:63-5 (Jan.), 1963.

Swiss albino mice (19-23 g weight) were administered TML sc in doses ranging from 20-1200 mg/kg; others were exposed to inhalation of air containing 1.2-40 g TML/m<sup>3</sup>; 2 groups of 4 rabbits each received sc injections of 400 or 800 mg/kg. Mice showed no signs of poisoning at sc doses <300 mg/kg; at higher doses, hyperexcitability and muscular quivering was noted. Inhalation of concentrations of 36-40 g/m<sup>3</sup> caused

severe drowsiness; lower concentrations produced only excitation. LD<sub>50</sub>'s during the 1st 6 hr, 3 and 10 days were 1173, 224, and 31.11 mg/kg respectively; by inhalation, the LC<sub>50</sub>'s were 40.8 and 8.51 g/m<sup>3</sup> on days 1 and 10, respectively. Rabbits at the lower dose died in 3-6 days; those on 800 mg, in 18-24 hr. It was concluded that TML has a low toxicity. The toxicities of ethylenes dibromide and dichloride, and of toluene were also determined.

- 1052 Cier, A., Tine, J., and Nofre, C. (Research Center Army, Lyons, France): Étude comparée chez la souris des effets radioprotecteurs de quelques cations. (COMPARATIVE STUDY IN THE MOUSE OF THE RADIOPROTECTIVE EFFECTS OF SOME CATIONS.) Comptes Rendus des Séances de la Société de Biologie 157, No. 8-9:1596-9, 1963.

The potential radioprotective and radiosensitizing effect of 42 cations (among them Pb) and 12 of their chelates with ethylenediaminetetraacetic acid was studied, using male Swiss albino mice, weighing  $21 \pm 2$  grams. The mice were exposed to 343 rads of gamma radiation 15-20 min after intraperitoneal injection with 0.5 m<sup>3</sup> of a solution of Pb acetate in such a concentration that the injected dose was equal to one fifth of the LD<sub>50</sub> for 30 days (0.074 mg Pb/kg). The radioprotective effect of Pb, as determined by Gart's technique, was found to be 0, none of the mice surviving 30 days.

- 1053 Davis, R.K., Horton, A.W., Larson, E.E., and Stemmer, K.L. (Univ. Cincinnati, O.): INHALATION OF TETRAMETHYLLEAD AND TETRAETHYLLEAD. A COMPARISON OF THE EFFECTS IN RATS AND DOGS. Archives of Environmental Health 6:473-9 (Apr.), 1963.

The experimental design, maintenance of the determined concentrations of the alkyls in the chambers and the analytical techniques used, the source and handling of animals are described in detail. In the preexposure period, the blood and urine of the animals were sampled for the determination of base Pb values. The concentrations to which the animals were exposed are shown in tables together with mortality, interval between exposure and death, and metabolic data.

Groups of 10 rats each (5 male, 5 female), exposed to 63, 49, 22, and 12 mg TML/m<sup>3</sup> for 10, 18, 35, and 150 x 7 hr, respectively, showed a mortality of 9, 9, 8, and 4; of similar groups exposed to 46, 22, and 12 mg TEL/m<sup>3</sup> for 5, 14, and 150 x 7 hr, 8, 9, and 0 died. The average interval between last exposure and death was 0.25-40 days (40 days being the longest period when some of the survivors were killed for further examination).

Exposure of dogs (a single dog/exposure, initial weight 5.4-13.2 kg) was to 44, 23, 12, 12, 4, and 4 mg TML/m<sup>3</sup> for 8, 9, 15, 14, 107, and 84 x 7 hr, with an average survival time of 1, 0, 1, 2, 0, and 0 days; exposure to 42, 22, 12, and 12 mg TEL/m<sup>3</sup> for 7, 30, 29, and 24 x 7 hr resulted in death at 0.25, 0, 3, and 0 days after last exposure.

The first signs in rats were irritable behavior increasing through combativeness to convulsions. When the experiment was discontinued before or at this stage, the rats recovered completely in 3-4 wk. In dogs, tremors and muscle twitching de-

veloped gradually. At the peak of hyperactivity, a chorea-type picture developed, followed by convulsions and death. The overall results indicated that both TML and TEL proved to be more toxic for dogs than for rats, TEL being somewhat more toxic for rats than TML, while TML was considerably more toxic for dogs than TEL. Urinary Pb concentrations were higher with TEL than with TML and regardless of the compound, they were higher in rats than in dogs. In discussing the metabolism of TML and TEL, the authors point to the results of some tissue analyses performed to help explain the species differences in response: the highest concentrations of Pb from the inhalation of TML were found in lungs, liver, and kidney (rats, 13, 10, and 8 mg/g, and 3, 3, 3 from TEL; dogs, 0.2, 2, and 1 from TML, and 0.2, 3, and 1 from TEL). The rats died with about the same level of Pb in their brains (1 mg/100 g) regardless of the compound inhaled (in dogs, 0.7 from TML and 0.2 from TEL). They also note that concentrations of Pb in these tissues in fatal TEL intoxication in man were not remarkably different from those of dogs exposed to both compounds. In addition, the concentrations of Pb in the kidney and urine of rats exposed to TML as compared to those inhaling TEL, suggest that the metabolites of TML may accumulate or be retained in the kidney reminiscent of the behavior of certain compounds of Hg.

The authors point out that the early illness and death of the dogs subjected to inhalation of TML is a warning that low urinary Pb levels in workers exposed to this compound may not, in themselves, give assurance as to their safety. The occurrence of any suggestive symptom in a workman so exposed should be the signal for the termination of his exposure to TML for a time.

- 1054 Dooley, A.E. (Texaco Inc., New York, N.Y.): TOXICITY OF PETROLEUM PRODUCT ADDITIVES. Archives of Environmental Health 6:324-8 (Mar.), 1963.

Toxicity data for the more commonly used additives in the petroleum industry are given. The oral toxicity of Pb naphthenate is in the order of 3.5-5.1 g/kg. Repeated application to the skin of rabbits showed that some skin absorption occurs. The calculated median lethal time for daily doses of Pb naphthenate containing 24% Pb, when applied daily to rabbits under impervious sleeves for 90 days was 55 days for 1 ml/kg/day, 40 days for 2 ml/kg/day, and 22 days for 4 ml/kg/day. Anemia was observed in the 1- and 2 ml/kg groups; basophilic stippling was absent. Death was usually due to pneumonia. Pb-containing fish oils and Pb soaps have physiological properties of the same order as those of Pb naphthenate.

- 1055 Gajdos, A., Dantchev, D., and Bénard, H. (Hotel Dieu, Paris, France): Action de l'acide adénosine-5'-monophosphorique sur la survie des globules rouges chez le lapin intoxiqué par le plomb ou la phénylhydrazine. (ACTION OF ADENOSINE-5'-MONOPHOSPHORIC ACID ON THE SURVIVAL OF ERYTHROCYTES IN RABBITS POISONED WITH LEAD OR WITH PHENYLHYDRAZINE.) Revue Française d'Études Cliniques et Biologiques 8:62-6 (Jan.), 1963.

Anemia in experimental Pb poisoning was studied in adult rabbits weighing 3 kg each. Red blood cell survival was measured with  $^{51}\text{Cr}$ . Pb was given 15 days after administration of  $^{51}\text{Cr}$ , as follows:

(1) 6 rabbits received an im injection of 100 mg/kg Pb acetate to produce a mild intoxication; (2) 6 rabbits received daily injections of the same dose for 4 days for a more severe intoxication; (3) 3 of each of these 2 groups of 6 rabbits were treated with daily im injections of 50 mg AMP, the remainder were left untreated. Phenylhydrazine intoxication (5, 10 and 15 mg/kg injected subcutaneously with AMP treatment as above) was produced for comparison of red blood cell survival in both types of intoxication.

In Group 1, the 3 rabbits treated with AMP had a red cell survival of 60 days, in the 3 not treated with AMP, 57 days (both normal for the rabbit). The curve of radioactivity in the AMP-treated animals was normal, but that of the untreated rabbits fell sharply. This evidenced slight but definite hemolysis. In the 3 untreated rabbits of Group 2, red blood cell survival was reduced to 40 days and the radioactivity curve for the erythrocytes fell sharply. The curve for the AMP-treated animals showed some deviation, but the erythrocytes had a normal 60-day survival time.

Similar results were obtained in the experiment with phenylhydrazine. The authors conclude that the antihemolytic action of AMP is quite general. After discussing the biochemical mechanism of AMP, they propose further studies of this property especially as AMP may affect certain hemolytic anemias in the human.

- 1056 Gajdos, A., and Gajdos-Török (Med. Clinic, Hôtel-Dieu, Paris, France): Action des nucléosides et des nucléotides adényliques sur la biosynthèse des porphyrines. (ACTION OF NUCLEOSIDES AND ADENINE NUCLEOTIDES ON THE BIOSYNTHESIS OF PORPHYRINS.) Bulletin de la Société de Chimie Biologique 45:1227-46, 1963.

The authors review the title subject, mainly on the basis of their experiments in vivo and in vitro, by first considering the inhibitory effect of adenosine mono-, di-, and triphosphates on porphyria induced by hexachlorobenzene, Pb, and other substances; then, the biochemical localization of the inhibitory effect of adenylic nucleosides and nucleotides on the biosynthesis of porphyrins; mechanism of inhibitory action of adenylic nucleosides and nucleotides on porphyrin synthesis; the regulatory role of adenylic nucleosides and nucleotides in the in vivo biosynthesis of porphyrins. Their conclusion is that a physiologic equilibrium takes place between the synthesis of porphyrins and the synthesis, or turnover, of adenylic nucleosides and nucleotides. (25 references)

- 1057 Gajdos, A., and Gajdos-Török, M. (Hotel Dieu, Paris, France): EFFECT OF ADENOSINE-5'-MONOPHOSPHORIC ACID AND INOSINE ON PORPHYRIN METABOLISM, ANEMIA AND RED CELL SURVIVAL IN LEAD POISONING OF RABBITS. In Haemoglobin Metabolism, Lisbon, Portugal, 1963. Proceedings of the Congress of the European Society of Haematology 9,

No. 2:875-84, 1963.

See Abstract No. 1132

- 1058 Haase, H.B. (Coll. Med. Ribeirão Preto, São Paulo, Brazil): Tempo de trânsito gastrointestinal em ratos. Padronização de um método. (RATE OF GASTROINTESTINAL TRANSIT IN RATS. STANDARDIZATION OF A METHOD.) Hospital 64:737-56 (Sept.), 1963.

The importance of the determination gastrointestinal transit time in laboratory animals is justified and stressed. The X-ray method was initially tried but considered inefficient for several reasons. The author describes a procedure in which a small radio-opaque solid spheric body (Pb spherule) is introduced with liquid food directly into the esophagus and stomach of albino rats.

- 1059 Iskakova, R.G. (Acad. Sci. Kazakh SSR): K izmeneniyu pochechnogo krovotoka pri khronicheskoi svintsovoi intoksikatsii. (Eksperimental'noe issledovanie.) (CHANGES IN RENAL BLOOD FLOW IN CHRONIC LEAD POISONING. (EXPERIMENTAL STUDY.)) Izvestiya Akademii Nauk Kazakhskoi SSR 1963, No. 2:58-61.

Dogs were subjected to Pavlov-Orbel's operation (displacement of ureter to the skin) and to chronic Pb poisoning by the administration of 1.5% solution of Pb acetate at 1 ml/kg every other day for 1 yr. Renal blood flow was followed according to Ratner's method by injecting phenol-red im. Phenol-red content in the blood increased, while in the urine it decreased. The coefficient of phenol-red clearance decreased. The author concludes that in Pb poisoning the renal blood flow is retarded.

- 1060 Iskakova, R.G. (Acad. Sci. Kazakh SSR): K izmeneniyu fil'tratsionno-reabsorbtionnoi funktsii pochek pri saturnizme. (Eksperimental'noe issledovanie.) (CHANGES IN THE FILTRATION-REABSORPTION FUNCTION OF KIDNEYS IN LEAD POISONING. (EXPERIMENTAL STUDY.)) Izvestiya Akademii Nauk Kazakhskoi SSR 1963, No. 2:62-7.

Experiments were performed with 16 male dogs that were subjected to Pavlov's technique of surgical displacement of the ureter to the skin for the study of normal and pathologic kidney function. The test animals were poisoned by administration of 1.5% Pb acetate solution at 1 ml/kg daily doses for 1 yr. The results showed that in chronic Pb poisoning the content of creatinine in blood increased. At the height of poisoning (6-8 mo), glomerular filtration decreased in most of the test animals. At the same time, tubular reabsorption was decreased. The author concludes that disorders of kidney function are caused by vascular-tubular deficiency and nephrosclerosis. (16 references)

- 1061 Jonderko, G., and Sroczyński, J. (Silesian Clinic for Internal Dis., Zabrze, Poland): Zachowanie się poziomu zredukowanego glutationu we krwi w przewlekłej doświadczalnej ołowicy u królików. (BEHAVIOR OF REDUCED GLUTATHIONE CONCENTRA-

ION IN BLOOD IN EXPERIMENTAL LEAD POISONING IN RABBITS.) *Postepy Higieny i Medycyny Doswiadczalnej* 17:615-8 (Sept.-Oct.), 1963.

The findings in 10 rabbits poisoned with 4 mg/kg iv Pb acetate every 7 days for 6 mo, confirmed that the glutathione content of the blood was decreased.

- 1062** Jonek, J., Kosmider, S., and Grzybek, H. (Silesian School of Med., Zabrze, Poland): HISTOCHEMICAL STUDIES ON ALKALINE PHOSPHATASE, ACID PHOSPHATASE, ADENOSINETRIPHOSPHATASE AND DIAPHORASE IN STRIATED MUSCLES AND HEART MUSCLE IN EXPERIMENTAL ACUTE LEAD POISONING. *Archivum Immunologiae et Therapiae Experimentalis* 11, No. 4:652-63, 1963.

The experiments reported were designed to elucidate the mechanism of disorders of some of the intracellular processes in the muscle caused by Pb ions. Five adult female chinchilla rabbits, weighing ~2000 g each, were given daily intravenous injections of 6 mg of Pb acetate/kg body weight for 12 days; 3 rabbits were kept as controls. Histochemical tests were performed for alkaline and acid phosphatase by the method of Gomori, for adenosinetriphosphatase (ATP-ase) by the method of Wachstein and Meisel, and for diaphorase (DPNH) by the method of Novikoff. The results showed that in the Pb-treated animals the activity of ATP-ase, DPNH and alkaline phosphatase was diminished in the skeletal and heart muscle while that of acid phosphatase was increased. The activities of ATP-ase and alkaline phosphatase in the walls of small blood vessels were distinctly diminished. As the author interprets the results, the active transport of phosphates from the blood to the muscle fibers becomes impaired. In the skeletal muscle the activity of ATP-ase, DPNH and alkaline phosphatase was diminished less and that of acid phosphatase was increased more than in the heart muscle; this was due to the incessant action of the latter, making it more liable to Pb. Increased activity of acid phosphatase reflected degenerative changes in the sarcoplasm. The changes in the striated muscle fibers, because of greater blood flow there, may explain why in Pb poisoning atrophy develops earliest in the most active muscles. A direct action of Pb on the muscle is thus confirmed.

- 1063** Khlebnikova, M.I. (Novosibirsk Inst. Hyg., USSR): DUST FROM THE PRODUCTION OF TIN. In Izrael'son, Z.I., ed: *Toksikologiya Redkikh Metallov*. (Toxicology of the Rare Metals.) Moscow, Gosudarstvennoe Izdatel'stvo Meditsinskoi Literatury, 1963, pp. 278-88. Translated by Y. Halperin, edited by E. Lieber. U.S. Department of Commerce, Clearinghouse for Federal Scientific and Technical Information, 1967, pp. 192-9.

Dust (a) settled near Sn smelting units, the disperse phase of the condensation aerosol formed during the release of Sn metal or slag (b), SnO<sub>2</sub> dust (c), or SiO<sub>2</sub> dust (d) were introduced into the lungs of white rats and rabbits. The percentage content of (a) was 34.8 Sn, 21.6 total SiO<sub>2</sub>

(4.2 free SiO<sub>2</sub>), 7.04 Al<sub>2</sub>O<sub>3</sub>, 13.9 Fe<sub>2</sub>O<sub>3</sub>, 4.28 CaO, 3.43 MgO, 1.00 Pb, 0.07 Mn, and 0.02 As; (b), 31-61 Sn (mostly SnO<sub>2</sub>), 0.72-3.96 free SiO<sub>2</sub>, and 0.5-0.8 Fe<sub>2</sub>O<sub>3</sub>. The internal organs of rats were examined within 3.0-10 mo, those of rabbits within 6-12 mo and within 1.5-2 yr. The effects were confined to the lungs; these are described and illustrated in microphotographs. On the basis of the findings, tentatively the MPC in the air of Sn dust containing other components can be set at 5-6 mg/m<sup>3</sup>, ie, it may be higher than that of SiO<sub>2</sub>, but should be lower than that of relatively non-irritant metals like Ti.

- 1064** Kinoshita, Y., and Muraoka, K. (Nissan Chem. Ind., Ltd., Tokyo, Japan): TOXICITY OF POLY (VINYL CHLORIDE) (PVC) FILM. *Shokuhin Eiseigaku Zasshi* 4:78-85, 1963.

The extractability of metals contained as stabilizers in polyvinylchloride (PVC) films was measured by dipping in various solutions. The LD<sub>50</sub> values of the stabilizers used for the processing of PVC film were determined by acute toxicity tests on animals and the safety limits of films stabilized by various stabilizer systems were calculated. The safety limit of the PVC films stabilized by various stabilizer systems were calculated. The extractability of metals in H<sub>2</sub>O aqueous 6% HCl, 50% ethyl alcohol, 3% lactic acid, soybean oil, 3% acetic acid, and 3% Na chloride solutions were as follows: Ca-Zn complex < Pb stearate < Cd-Ba complex. For Pb stearate it was found to be 5 mg/m<sup>2</sup>. (From Chemical Abstracts 59:9232, 1963)

- 1065** Kosmider, S., Grabski, J., and Stradowski, J. (Silesian School of Med., Zabrze, Poland): PLASMA SODIUM, CALCIUM AND POTASSIUM LEVELS IN RABBITS DURING EXPERIMENTAL ACUTE LEAD POISONING. *Archivum Immunologiae et Therapiae Experimentalis* 11:303-6, 1963.

Twenty rabbits of mixed breeds, weighing 1500-2700 g, maintained on a normal diet, were divided into 2 groups. The 10 rabbits of the 1st group received daily injections into the marginal ear vein of 6 mg Pb acetate/kg body weight, and the 10 rabbits of the 2nd group doses of 10 mg/kg. The degree of poisoning was assessed on the basis of erythrocyte counts, percentages of erythrocytes showing basophilic stippling, hemoglobin levels and body weight. Plasma electrolyte levels were determined before poisoning and in the 1st group 12 days and in the 2nd group 8 days after the start of the injections, by using the technique of the photometric assays. Poisoning with massive doses of Pb resulted in decreases in hemoglobin levels to 40-60% and erythrocyte counts to 3-3.5 millions. The proportion of erythrocytes with basophilic stippling reached 70/thousand; the animals lost weight. Mean levels of electrolytes found in the plasma of rabbits before poisoning, 12 days after injection of 6 mg Pb acetate/kg/day and 8 days after injection of 10 mg Pb acetate/kg/day, respectively, were, in mg %: Na, 372, 342, 351; K, 20.5, 22.6, 23.5; Ca, 11.2, 10.9, 13.8. The conclusion was drawn that high concentrations of Pb ions in the living body lead to disturbances in the electrolyte balance. The drop in Na levels may be the consequence of disordered renal filtra-



tion or reabsorption and loss of fluids. The elevated serum K levels may be explained by the loss of K ions from body cells in acute Pb poisoning, a phenomenon which has also been observed by other investigators. The serum Ca levels showed significant changes only at the 10 mg/kg Pb acetate dose. Probably, high Pb concentrations deposited in the bones displace part of the Ca ions, leading to raised serum Ca levels.

- 1066** Lothe, K., and Falbe-Hansen, I. (Finsen Inst., Copenhagen, Denmark): INCORPORATION OF  $^{59}\text{Fe}$  INTO ERYTHROCYTE NONHAEM IRON AND HAEMOGLOBIN IN ANAEMIC AND LEAD-POISONED RABBITS. *Clinical Science* 24:47-54 (Feb.), 1963.

Female rabbits were injected iv with 5 ml of a solution of neutral Pb acetate containing 2 mg Pb/ml; 1 hr later the animals received  $\sim 10 \mu\text{Ci}$  of  $^{59}\text{Fe}$  iv. The radioactivity of nonhem Fe and hemoglobin Fe in these rabbits was compared electrophoretically with that of anemic rabbits. In the Pb-poisoned rabbits there was an accumulation of radioactivity in the nonhem Fe while no radioactivity was found in the fast moving anodic fraction. This suggests that the accumulation may be due to a blocking in the Fe transfer from ferritin to this fraction or it may be the result of hyperhemolysis leading to a loss of nonhem Fe during the preparation of "ghosts" (red cells with a very small content of hemoglobin). (20 references)

- 1067** McLaughlin, J., Jr., Marliac, J.-P., Verrett, M.J., Mutchler, M.K., and Fitzhugh, O.G. (U.S. Food and Drug Admin., Washington, D.C.): THE INJECTION OF CHEMICALS INTO THE YOLK SAC OF FERTILE EGGS PRIOR TO INCUBATION AS A TOXICITY TEST. *Toxicology and Applied Pharmacology* 5, No. 6:760-71, 1963.

A technique is described for the evaluation of chemical toxicity and teratogenic effect by injection of the test compound into the yolk sac of fertile eggs prior to incubation. The method has been applied to >100 compounds over a 3-yr period. Nontoxic chemicals injected at an appropriate level allowed the embryo to develop and hatch normally, whereas toxic compounds produced effects at dose levels comparable to those producing effects in feeding experiments with animals. The technique often supplied information not shown by conventional methods. Pb acetate was among the chemicals that showed a high order of toxicity and/or teratogenic effects. Injections of 0.05 ml of 10% aqueous solution prevented hatching; a 2% solution (in same volume) produced hydrocephalus in embryos that failed to hatch; 0.5% solution prevented hatching of 80%. (18 references)

- 1068** Magistretti, M., Zurlo, N., Scollo, F., and Pacillo, D. (Univ. Milan, Italy): Tossicità comparata del piombo tetraetile e del piombo tetra-metile. (A COMPARATIVE STUDY OF THE TOXICITY OF TETRAETHYLLEAD AND TETRAMETHYLLEAD.) *Medicina del Lavoro* 54:486-95 (June-July), 1963. TEL and TML toluene (80.33% TML + 19.67% toluene), respectively, was administered to Sprague-Dawley

rats (av weight 250 g) iv, ip or orally;  $\text{LD}_{50}$ 's were, in mg/kg, as follows: TEL, iv, 14.40; ip, 15.05; oral, 35.00. TML, iv, 88.20; ip, 90.15; oral, 105. Toluene, iv, 1960. The data obtained demonstrated that iv or ip administered TEL is 2-4 times more toxic than TML, and orally administered TEL 2-3 times more toxic than TML. In subacute intoxication, when rats were treated with sc doses of TEL (30 and 65 mg/kg) or TML (65 and 150 mg/kg), 100% mortality was reached more rapidly with TEL than with TML. The distribution of Pb, 6 and 24 hr after ip injection of nonlethal doses, was similar for TEL and TML, respectively, in  $\mu\text{g/g}$  for the 2 time periods: blood, 19 and 44, 41 and 122; liver, 21 and 20, 22 and 25; brain, 0.8 and 1.0, 4.0 and 6.0; spleen, 6 and 7, 25 and 26. No significant histologic alterations were noted after iv (15 mg/kg), ip (15 mg/kg) or oral (40 mg/kg) doses of TEL or TML (100, 100, 110 mg/kg, respectively). Some congestion was observed in the lungs, kidneys, brain and liver, and hemorrhages in the lungs and brain. Effects on the cardiovascular system were studied in male rabbits after iv administration of TEL and TML. At doses of 30-50 mg/kg the toxic effects, as expressed in the EKG and blood pressure, were more marked in the case of TEL than in that of TML, while at 200 mg/kg the effects of TEL and TML were similar.

Since TML is more volatile than TEL, the concentration of Pb in the air was determined at service stations where alternately gasoline containing added TEL or added TML was distributed. The data obtained (4 samples over 7-9 hr showed with TML 4.1-8.6  $\mu\text{g}/\text{m}^3$ , and with TEL, 3.9-16.5; control zone, 2.3-5.8  $\mu\text{g}/\text{m}^3$ ) did not reveal any appreciable differences. Urinary Pb of 10 workers in a refinery, loading tank trucks with TML gasoline ranged from 35-85  $\mu\text{g}/\text{l}$ ; thus, normal. The conclusion was drawn that there is no reason to consider gasoline containing TML to be more toxic than gasoline containing TEL. (46 references)

- 1069** Mambeeva, A.A. (Inst. Reg. Pathol., Acad. Sci. Kazakh SSR, Alma-Ata, Kazakh USSR): Motorno-evakuatornaya funktsiya pishchev-aritel'nogo trakta pri eksperimental'noi svinstsovoi intoksikatsii. (MOTOR-EVACUATORY FUNCTION OF THE DIGESTIVE TRACT DURING EXPERIMENTAL LEAD INTOXICATION. *Byulleten Eksperimental'noi Biologii i Meditsiny* 55, No. 4:41-4, 1963.

Acute, subacute and chronic Pb intoxication was induced in 8 dogs by feeding 1%, 2%, or 3% Pb acetate in milk at a dose of 1 mg/kg body weight. The state of the motor-evacuatory function of the digestive tract was studied by X rays. Pb poisoning depressed the motor-evacuatory function. The earliest changes manifested themselves in a delay of primary evacuation from the stomach. Evacuation of food from the small intestine was also delayed. (From author's English summary)

- 1070** Marshall, S.P., Hayward, F.W., and Meagher, W.R. (Florida Agric. Exp. Sta., Gainesville): EFFECTS OF FEEDING ARSENIC AND LEAD UPON THEIR SECRETION IN MILK. *Journal of Dairy Science* 46:580-1 (June), 1963. Eight lactating Jersey cows, weighing 820-1040 lb,

were assigned to 4 groups of 2 animals each and either grazed on millet pasture or fed chopped millet forage; in both cases, a concentrate mixture was added. As and Pb as Pb arsenate were incorporated into the concentrate and fed daily to the cows, for 126 days in mg/100 lb body weight as follows: Group 1, 0.00; Group 2, 1.17 and 3.23; Group 3, 2.34 and 6.47; Group 4, 4.68 and 12.95, respectively. Milk samples were taken 5 days before and at the start of the experiment and 1, 3, 14 days and subsequently at 14-day intervals thereafter. In all milk samples analyzed, including those from control cows, concentrations of As and Pb were <0.05 mg/l.

- 1071 Mokranjac, M.S., and Soldatović, D. (Univ. Belgrade, Yugoslavia): Promene sadržaja gvožđa, bakra i kobalta u krvi životinja izloženih hroničnoj intoksikaciji olovom. (CHANGES IN THE CONTENT OF IRON, COPPER AND COBALT IN THE BLOOD OF ANIMALS WITH CHRONIC LEAD INTOXICATION.) Acta Pharmaceutica Jugoslavica 13, No. 1:43-50, 1963.

Lambs were poisoned by feeding them, with their daily diet, 25 mg Pb as nitrate. The content of Fe, Cu, and Co in the blood was determined every 4 days. The results of the study showed that the Fe and Cu levels decreased as the Pb concentration increased, reaching a minimum of 8-10 mg and 22-26 µg/100 ml blood, respectively, at a Pb concentration of ~200 µg/100 ml. Further elevation of the Pb concentration did not produce any more decreases of either Fe or Cu. The Co level decreased until the Pb concentration in the blood reached 170-180 µg/100 ml; no Co could be detected at higher Pb concentrations. The Fe, Cu, and Co concentration in the blood of control lambs was, respectively, 25-28 mg, 42-50 µg, and 1.5-2 µg. Thus, chronic Pb intoxication reduces the Fe and Cu levels in the blood by ~50%. The mechanism of the displacement of Fe, Cu, and Co by Pb is not known. The physiological implications of the changes of the metal equilibrium on the process of hematopoiesis are pointed out.

- 1072 Mrozikiewicz, A., and Widy, W. (Med. Acad., Poznań, Poland): THE INFLUENCE OF SALTS OF SOME HEAVY METALS ON OCCURRENCE OF PIGMENTARY CHANGES IN THE HAIR OF ANIMALS FED BY POISONED MOTHERS. Bulletin de la Société des Amis des Sciences et des Lettres de Poznań, Series C, 12:71-3, 1963.

After previous experiments (1960) had shown that the offspring of female rats poisoned with Tl developed dark brown or black pigmentary deposits at the root of growing hair, the authors investigated whether similar pigmentary changes occurred in young nursing mothers poisoned with salts of Bi, Hg, U, Au, or Pb. White rats, weighing 180-260 g and feeding 3 young ones each, were used. Groups of 4 females each were poisoned by 1 of the above salts administered once in close to lethal doses when the young were 4-10 days old; in the case of Pb, the acetate was administered sc. Bi and U caused pronounced changes, while Hg, Au, and Pb caused only slightly visible and indistinct alterations. The author believes that darkening of the roots will also occur in the hair of poisoned human mothers and in that of children fed by her.

- 1073 Müller, H.A., and von Ramin, D. (Univ. Würzburg, West Germany): Morphologie und Morphogenese der durch Schwermetalle (Pb, Bi) hervorgerufenen Kerneinschlüsse in den Hauptstückepithelien der Rattenniere. (MORPHOLOGY AND MORPHOGENESIS OF THE NUCLEAR INCLUSIONS INDUCED BY HEAVY METALS (Pb, Bi) IN THE PROXIMAL TUBULAR EPITHELIUM OF THE RAT KIDNEY.) Beiträge zur Pathologischen Anatomie und zur Allgemeinen Pathologie 128, No. 3:445-67, 1963.

Eighteen white rats, 1.5-2 mo old, were given a 1% solution of Pb acetate ad lib instead of drinking water. Some of the rats were sacrificed after 0.5, 1, 2, 3, 4.5, 8.5, and 9 mo. One rat died spontaneously after 14 mo of Pb administration. In a 2nd series, rats received the Pb acetate solution for 3, 8 or 10 mo, and subsequently were given normal drinking water for 1, 2, 4 and 10 wk before sacrifice. In each case, the occurrence of corpuscular nuclear inclusions containing protein was observed in the cells of the convoluted portions of the proximal tubules of the kidney. The inclusions developed from cloudy intranuclear precipitates and at times finally filled the whole nucleus. The changes in the straight part differed from those occurring in the convoluted part by polymorphism of the nuclear structure and by a different appearance of inclusion. The development of renal tumors during chronic Pb intoxication was confirmed. The most frequent site of their origin was the corticomedullary border.

- 1074 Nofre, C., Clément, J.M., and Cier, A. (Dept. Public Health, Lyons, France): Toxicité comparée de quelques ions métalliques et de leur chélate à l'acide éthylènediaminetétracétique. (COMPARATIVE TOXICITY OF SOME METALLIC IONS AND THEIR ETHYLENE-DIAMINETETRAACETIC ACID CHELATES.) Pathologie-Biologie 11:853-65 (Aug.-Sept.), 1963.

The toxicity of 13 metallic ions (Al, Cd, Ca, Cr, Co, Cu, bi- and trivalent Fe, Mn, Hg, Ni, Pb, Zn) and of their chelates (1:1) with ethylenediaminetetraacetic acid (EDTA) was studied in 3000 male albino Swiss mice, ~2 mo old and weighing  $20 \pm 2$  g. The mice were injected intraperitoneally with identical volumes (0.40 ml/20 g body weight). The criterion of toxicity was the dose which proved lethal in 50% of the cases by 30 days ( $LD_{50/30}$ ). The  $LD_{50/30}$  of the mouse for bivalent Pb (as Pb acetate) was, in mg/kg body weight,  $76.6 \pm 2.0$ , for EDTA alone  $297.6 \pm 14.8$ , and for the Pb-EDTA chelate  $642.3 \pm 14.5$ . Comparison of the values obtained for the 13 metallic ions shows that a linear relation exists between the degree of detoxication and the stability of the chelate, and that the toxicity of the chelate is a function of the toxicity of the metallic ion. The results obtained by the authors were compared with experimental and clinical data cited in the literature.

- 1075 Pecora, L., Molé, R., Balletta, A., Daniele, E., and Pesaresi, C. (Univ. Naples, Italy): Azione dell'ac. adenosin-5-monofosforico e dell'inosina sul metabolismo porfirinico nel saturnismo sperimentale. (ACTION OF ADENOSINE-5-MONOPHOSPHATE AND

INOSINE ON THE PORPHYRIN METABOLISM IN EXPERIMENTAL SATURNISM.) *Folia Medica (Naples)* 46, No. 5:349-60, 1963.

In a study of the effect of Pb on the metabolism of porphyrins 20 rabbits were poisoned by gastric administration with 2 cc of a 20% solution of Pb acetate/day. Two other groups of 12 rabbits each were treated in the same manner and subsequently daily with 100 mg adenosine-5-monophosphate (AMP) intramuscularly and 100 mg inosine intravenously, respectively. In all animals, determinations of the urinary  $\delta$ -aminolevulinic acid (ALA), porphobilinogen, uroporphyrin and coproporphyrin, and of protoporphyrin in the blood were made every 4 days for the first 12 days and thereafter every 8 days for a total of 28 days. The results are shown in tables. In the nontreated group, ALA increased for 8-12 days, then dropped slightly and after that increased again; porphobilinogen followed a similar course at a lesser degree; uroporphyrins were initially absent but occurred after 8 days and then increased progressively and protoporphyrins increased throughout the experimental period. In the treated animals the increase of ALA and coproporphyrin during the first period of intoxication was smaller and the increase of porphobilinogen greater. These phenomena were more pronounced with inosine than with AMP. While the results of these tests confirm those of other authors that AMP and inosine exert an effective action on porphyrin metabolism, they are considered to be still too incomplete to permit an exact interpretation of the mechanism of their action.

- 1076 Pernis, B., Vigliani, E.C., de Petris, S., Beard, R., and Karlsbad, G. (Univ. Milan, Italy): THE ULTRASTRUCTURE OF RED CELLS IN EXPERIMENTAL LEAD-POISONING. In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, vol. II, pp. 798-802.

See Pernis, B., de Petris, S., Beard, R.R., and Karlsbad, G.: *Medicina del Lavoro* 55:81-101 (Feb.), 1964.

- 1077 Pigulevskaya, M.L.: Deistvie pyli svintsovo-baritovogo i svintsovo-tsinkovogo rudnikov na legkie zhivotnykh v eksperimente. (AN EXPERIMENTAL STUDY OF THE ACTION OF DUST FROM LEAD-BARYTA AND LEAD-ZINC MINES ON THE LUNGS OF ANIMALS.) *Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Meditsiny Nauk* 3:30-7, 1963.

Eighty rats in 4 series of experiments were exposed intratracheally once to dust from Pb and baryta concentrates. Dusts from both Pb-baryta and Pb-Zn mines caused proliferation of the connective tissue in the lungs of the rats but marked fibrosis did not occur within 12 mo. (From *Referativnyi Zhurnal Otd. Vypusk Farmakol. Toksikol.* 1964, No. 21:499; *Biological Abstracts* 46:Abstract No. 52645, 1965)

- 1078 Puhac, I., Hrgovic, N., Stankovic, M., and Popovic, S. (Inst. Hyg., Belgrade, Yugoslavia): Laboratorijska ispitivanja mogućnosti primene olovnikh jedin'en'a kao

ratitsidnog sredstva putem sman'ivan'a reproduksionikh sposobnosti patsova. (LABORATORY INVESTIGATION OF THE POSSIBILITY OF EMPLOYING LEAD COMPOUNDS AS RATICIDES BY DECREASING THE REPRODUCTIVE CAPABILITY OF RATS.) *Acta Veterinaria (Belgrade)* 13, No. 1:3-9, 1963.

Eight groups of 40 male and female rats each, 4-6 mo old, were fed 80-8000 mg Pb nitrate/100 g of their rations for 30 days; a 9th group served as controls. Every other day, 3 male rats were killed and their organs were examined for pathologic and histologic changes, and the amount of Pb deposited in the testes was determined. The results showed that the amount of Pb deposited was not proportional to the amount of Pb ingested. The Pb content of the testes in the experimental rats ranged from 0.0021-0.0188 mg% compared with 0.0013-0.0776 mg% in the controls. None of the animals showed pathologic changes, while histologic changes occurred when the intake of Pb nitrate exceeded 800 mg/100 g food. The intensity of the changes was influenced by the amount of Pb taken into the organism. After 30 days of feeding of Pb nitrate, the rats were paired with untreated females. No reproduction took place for 45 days. The same phenomenon was observed when the treated males were paired with treated females.

- 1079 Rombola, G., and Magnanelli, P. (Natl. Inst. Assurance Against Ind. Accidents, Rome, Italy): Sulla patogenesi dell'anemia saturnina. (THE PATHOGENESIS OF ANEMIA IN LEAD INTOXICATION.) *Medicina del Lavoro* 54:106-17 (Feb.), 1963.

The movement of Fe in the Fe-protein fractions of the bone marrow was studied in vivo and in vitro. Rabbits received orally 200 mg Pb acetate for 2 mo, then were sacrificed following an intravenous administration of 50  $\mu$ Ci  $^{59}\text{FeCl}_3$ . Bone marrow of normal rabbits was incubated with  $10^{-4}\text{M}$  Pb acetate for 1 hr, and following addition of 10  $\mu$ Ci  $^{59}\text{FeCl}_3$  for 3 more hr. The determination of the radioactivity of the single fractions as a function of time, especially in the case of the stromal fraction and of Hb, showed that the synthesis of Hb was inhibited in vitro but considerably accelerated in vivo. Both in vitro and in vivo there was a marked accumulation of Fe in the stromal fraction. This was explained by assuming that this accumulation is not in fact related to the synthesis of Hb or that in addition to these hyperfunctioning cells in a state of greatly accelerated maturation there is another quota of cells incapable of completing Hb synthesis in which, therefore, the stromal Fe remains. (57 references)

- 1080 Rosati, G. (Italy): Action des médicaments du système nerveux sur la syndrome toxique de plomb-tetraethyl (PbT). (ACTION OF DRUGS FOR THE NERVOUS SYSTEM ON THE TOXIC SYNDROME OF TETRAETHYLLEAD.) In 2nd International Pharmacological Meeting, Prague, 1962. *Biochemical Pharmacology* 12 (Suppl.): 157-8 (Abstracts of Papers), 1963.

Rats and white mice, administered tetraethyllead (TEL), develop a syndrome of hyperkinesia, characterized by trembling, increased fear and aggres-

siveness. The syndrome lasts for several hours and is terminated by the death of the animal. White mice, subcutaneously injected with TEL dissolved in absolute alcohol, were used to determine which drugs might have an influence on the effects of TEL. Preliminary tests showed that male mice were more sensitive to TEL than females; the LD<sub>50</sub> for males was 39.8 mg/kg. Pretreatment with iproniazid did not influence the toxic syndrome while reserpine prolonged the time lapse between injection of TEL and the occurrence of the characteristic phenomena. Atropine, thiopental and perphenazine had no influence at all on the trembling; procainolol and mephensin caused complete disappearance of the trembling and hydroxyzine increased it. The possibility of using the toxic syndrome of TEL for the screening of drugs acting on the nervous system, is discussed.

- 1081** Schroeder, H.A., Vinton, W.H., Jr., and Balassa, J.J. (Dartmouth Med. School, Hanover, N.H.): EFFECT OF CHROMIUM, CADMIUM AND OTHER TRACE METALS ON THE GROWTH AND SURVIVAL OF MICE. *Journal of Nutrition* 80:39-47 (May), 1963.

In order to study the effects on growth and survival of 5 "abnormal" trace metals, groups of 100 or more weanling white mice, housed in acrylic plastic cages with stainless steel covers, in quarters removed from airborne contamination and maintained on a diet of rye, corn oil and dried skim milk, containing small amounts of Cr, Ti, Cd, Pb (0.19 µg/g) and Ni, were given drinking water containing 5 ppm of 1 of these metals. This concentration was used to reproduce insofar as possible the tissue concentrations found in man. Cr inhibited mortality and increased growth. Divalent Pb (used as the acetate) had no marked effect on growth, mature weights nor mortalities up to 18 mo of age, but after that significantly increased death rates in males. Pb concentrations in the kidneys and the liver of mice given Pb were comparable (0.67-3.3 µg/g of wet weight of liver) to those of adult man (0.5-3.2 µg/g of liver); those of controls were lower (0.05-0.71 µg/g of liver). It is concluded that Cr resembled an "essential" trace element, whereas Cd and Pb exhibited an innate toxicity.

- 1082** Schroeder, H.A., Vinton, W.H., Jr., and Balassa, J.J. (Dartmouth Med. School, Hanover, N.H.): EFFECTS OF CHROMIUM, CADMIUM AND LEAD ON GROWTH AND SURVIVAL OF RATS. *Journal of Nutrition* 80:48-54 (May), 1963.

Extending the experiments with mice as described in the preceding article, groups of >100 male and female hooded rats were each given, beginning at 28 days of age, 5 ppm of Cd, trivalent Cr or Pb (as acetate) in drinking water; the Pb content of their diet was 0.19 µg/g. Rats given Pb grew normally but their survival rate at 21 mo was considerably reduced when their tissue Pb concentrations were approximately similar to those of adult human beings (0.7-1.5 µg/g wet kidney weight of rats fed Pb (0.3-0.8 µg/g in controls) vs 0.28-2.53 µg/g of kidney of man). Rats with low tissue Pb and Cr levels and those given Cr had very low mortalities under the conditions of the experiment.

- 1083** Selye, H., Gabbiani, G., and Tuchweber, B. (Univ. Montreal, Canada): (AN EXPERIMENTAL MODEL OF OSTEOMYELOSCLEROSIS.) *Acta Haematologica* 29:51-62, 1963.

Research on the etiology and pathogenesis of osteomyelosclerosis in man has been handicapped by the impossibility of reproducing typical osteomyelosclerosis in laboratory animals. The object of the present communication is to show that, in the rat, repeated intravenous administration of Pb acetate at certain intervals reliably induces an osteomyelosclerosis which is structurally similar to that seen in man.

Female Holtzman rats, having a mean initial weight of either 100 or 200 g, were lightly anesthetized and injected slowly into the jugular vein with 5 mg/100 g body weight of Pb acetate in 1 ml distilled water. Great care was taken not to spill any Pb acetate to avoid local calcification. After the injection, the skin incision was closed with a stitch or a clip. The procedure was repeated on the 3rd and 5th day to produce mild osteomyelosclerosis, and on the 3rd, 5th and 7th day for the development of maximal lesions. The animals were killed on the 12th day after the 1st injection at which time osteomyelosclerosis was evident even macroscopically. Although the rats appeared normal after recovery from each injection, they had lost about 10% of their body weight toward the end of the observation period and occasionally showed signs of jaundice and anemia. The bones presented the classic picture of osteomyelosclerosis with the entire marrow cavity filled out by spongy bone. Apart from the skeletal lesions, the only noteworthy effects were calcification and enlargement of the spleen and liver, which are stated to be characteristic of severe intoxication by intravenously administered Pb compounds.

- 1084** Selye, H., Gabbiani, G., and Tuchweber, B. (Univ. Montreal, Canada): FACTORS INFLUENCING TOPICAL CALCINOSIS INDUCED BY TRAUMA FOLLOWING INTRAVENOUS INJECTION OF LEAD ACETATE. *Archives Internationales de Pharmacodynamie et de Thérapie* 145:254-63 (Sept.), 1963.

A study was carried out whether a direct calcifier such as Pb acetate produces calcification unconditionally wherever it comes in contact with the tissues, or whether this effect depends upon systemic conditioning factors such as drugs, etc. Female albino rats were given each a single intravenous injection of 7.5 mg neutral Pb acetate, Pb(C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>)<sub>2</sub> · 3H<sub>2</sub>O in aqueous solution and immediately after the injection topical trauma, required to induce local calcinosis, was applied by compressing the root of the right external ear with a curved hemostat for 20 sec. In addition, the influence of various agents on this form of hematogenic direct calcinosis was tested. It was found that subcutaneous injections of formaldehyde, histamine liberators, serotonin creatinine sulfate, and desoxycorticosterone prevented the effect, whereas some local and systemic stressors, reserpine, cyproheptadine and triamcinolone failed to do so. It was assumed that the inhibitory agents may act by preventing the exudation of Pb through the capillary wall and not by interfering with the

action of Pb upon the connective tissue itself.

- 1085** Selye, H., Tuchweber, B., and Gabbiani, G. (Univ. Montreal, Canada): ROLE OF THE PARATHYROID IN THE PRODUCTION OF OSTEITIS FIBROSA AND SOFT TISSUE CALCIFICATION BY LEAD ACETATE. *Endocrinology* 72:782-6 (May), 1963.

Recent findings have suggested that the parathyroids are not indispensable in the production of typical osteitis fibrosa, the causes of which include heavy metal salts, among them Pb.

Six groups of 10 rats each, 90-110 g initial body weight, maintained on Purina Chow and tap water, were injected into the jugular vein with basic Pb acetate at a dose of 7.5 mg in 1 ml distilled water/rat. Group 1 served as controls, Group 2 was subjected to parathyroidectomy, Group 3 was injected subcutaneously with 500 µg of the histamine liberator 48/80, Group 4 was subjected to the treatments of Group 2 and 3 at 11 days' interval, Group 5 received subcutaneous injections of 5% NaCl solution, and Group 6 was subjected to parathyroidectomy and 11 days later to the NaCl injections. The Pb treatment in each case was given just before the infiltration with 48/80 or NaCl. All rats, which had been injected with NaCl or 48/80, developed massive cutaneous calcification with severe osteitis fibrosa, both in the presence and absence of the parathyroids. None of the animals showed any evident sign of acute Pb intoxication. Pb acetate alone in Groups 1 and 2 caused no cutaneous calcinosis, and histologically, just detectable traces of osteitis fibrosa in Group 1.

- 1086** Senczuk, W., and Zegarska, S.: (THE EFFECT OF PREVENTIVE TREATMENT WITH SULFIDE-CONTAINING MINERAL WATER ON CHANGES IN PARENCHYMATOUS ORGANS IN CASES OF PROTRACTED SATURNISM.) *Bulletin of the Institute of Marine Medicine in Gdansk* 14, No. 1-2:57-64, 1963.

To test the suggestion that mineral water containing sulfide might be effective in the treatment of Pb poisoning, rats were first experimentally poisoned with Pb, either orally or by inhalation for 6 mo. They then received artificially prepared - mineral water containing 3.9 or 7.8 mg hydrogen sulfide/kg. Control rats received ordinary drinking water. In animals poisoned orally, the liver contained 5.9 µg Pb/100 g when sulfide-containing water was given, compared with 11.4 µg Pb/100 g when plain water was given. In rats exposed to Pb by the respiratory route the corresponding values were 8.1 and 9.6, respectively. Histologic changes were shown in 16 photomicrographs. The authors conclude that in poisoned rats given the sulfide water, the pathologic changes in the parenchymatous organs were much smaller. Further studies are in progress. (From *Bulletin of Hygiene* 39:21, 1964)

- 1087** Shakhbazyan, G.Kh., and Savitskii, I.V. (Kiev Med. Inst., USSR): Kombinirovannoe deistvie tiolovykh yadov i vysokoi temperatury vosdushnoi sredy na organism. (EFFECT OF COMBINED ACTION ON ANIMALS OF SULFHYDRYL POISONS AND HIGH AMBIENT AIR TEMPERATURE.) *Vestnik Akademii Nauk SSSR* 18, No. 2:38-42,

## 1963

Three series of experiments were performed to determine the effect of high temperature on the action of Pb and Hg. Altogether, 35 rats were used as controls, and in the exposure experiments, 45 rats and 22 rabbits. Criteria of poisoning were the blood picture, protein fractions (by electrophoresis and chromatography), thermoregulatory balance, etc., and serum SH as an early sign of disorder. In the 1st series, rabbits were exposed for 4 hr/day over 10 or 50 days to 0.0001 mg Pb/l air at usual temperature. No signs of intoxication were seen, but certain functional changes were evident, ie, decrease of serum SH groups which by the 10th day amounted to 30.9%; some changes in the proteins were also seen. In the 2nd experiment, rabbits were exposed for 10 days to 39-40° temperature, and rats for 30 days to 40°. Respiratory rate rose rapidly in the 1st days to 180-240/min, irritation of the upper respiratory tract and adynamia were observed. With longer stay in the chamber, the manifestations became less marked. Functional changes were not noted, only an increase in SH groups, and some loss in weight of the animals. Neither changes were significant.

In the 3rd series, combined exposure to Pb at 0.00004 mg/l and 39-40° temperature resulted in much greater effect than did separate exposures. Under these conditions the animals found it significantly more difficult to tolerate heat; respiration rose to 280-300/min, the liver SH groups of the rats decreased by 26% vs 11.4% at ordinary temperature; serum SH also was affected.

In the experiments with Hg, exposure to high concentrations (0.00010-0.00012 mg/l) at high temperature produced as marked an effect as at ordinary temperature; however, low concentrations (0.00004 mg/l) which at ordinary temperature produced no effect, were extremely toxic at high temperature. The authors conclude that the potentiating effect of the combination of toxic substances and high temperature dictates the need for differential hygienic standards in relation to environmental temperature.

- 1088** Shraiber, L.B., and Mosevich, P.N. (Uzbek Sci. Res. Inst. Sanit., Hyg., Occup. Dis., USSR): Ob isbiratel'nom porazhenii ot del'-nykh perifericheskikh nervov ruk pri svin-tsovoi intoksikatsii. (SELECTIVE DISORDERS OF REMOTE PERIPHERAL NERVES OF THE HAND IN LEAD POISONING.) *Meditinskii Zhurnal Uzbekistana* (Tashkent) 7:35-9 (July), 1963.

The authors had noted that workers exposed for a long time (5-10 yr) to Pb present even in minimal concentrations (0.02-0.05 µg/l air (expressed in original as 100,000th mg)) are not infrequently affected by Pb polyneuritis which develops slowly and involves mainly the sensory nerves. For this reason they undertook experiments with 6 dogs which they subjected to chronic poisoning by Pb nitrate (white Pb (dose and route not indicated)). They found that in dogs, paralysis of the hind legs occurs first, and in the more advance stages of poisoning, the fore legs are involved; thus, functional involvement of the extremities differs in dogs and in man. Chronaximetric and histologic findings showed that the radial nerve is affected first, followed by the ulnar, and the median is least af-

fects. This was confirmed by the demonstration of the deposition of Pb in these nerves. In an attempt to demonstrate deposition of Pb in human nerves, preparations from autopsy cases of individuals who had suffered accidental deaths, showed no Pb. When Pb was added to these specimens and allowed to remain for up to 10 days, a differential affinity for Pb was observed, with the radial nerve having the greatest, and the median the least. The authors consider this as confirmation of the typical forms of sensory polyneuritis seen by them in workers. They state also that other factors may hasten the process, such as excessive muscular strain.

- 1089** Soldatović, D., and Petrović, Č. (Univ. Belgrade, Yugoslavia): Uticaj olova na aktivnost fermenta-holinesterazu i katalazu-kod životinja trovanih malim količinama olova. (INFLUENCE OF LEAD ON ENZYME ACTIVITY - CHOLINESTERASE AND CATALASE - IN ANIMALS POISONED WITH SMALL AMOUNTS OF LEAD.) Arhiva za Farmaciju 13, No. 4:253-8, 1963.

Sheep were poisoned with daily doses of 25 mg Pb as Pb nitrate administered with the feed. Cholinesterase activity as measured by the change in color of bromothymol blue within a given time (Davis-Nicholls' method), decreased from a normal of 46-50 min to 100 min when the Pb concentration in the blood reached 280-320 µg%. In contrast to the inhibitory influence of Pb on cholinesterase, catalase activity increased as the Pb level in the blood increased and reached a maximum of 10-11 units/ml of plasma at a blood Pb content of 230-250 µg%, compared to 3.8-5.8 units in control animals. (From authors' French summary)

- 1090** Sporn, A., and Schöbesch, O. (Inst. Hyg., Bucharest, Romania): Influența asupra organismului animal a administrației concomitente a unor substanțe chimice care impurifică sau se adaugă la alimente. (EFFECT OF SIMULTANEOUS ADMINISTRATION OF FOOD ADDITIVES AND FOOD CONTAMINANTS TO ANIMALS.) Igiena 12, No. 4:315-25, 1963.

When rats were fed a diet containing a mixture of maximum permissible amounts of 15 compounds (4 coloring agents, 1 flavoring agent, 1 antioxidant, 3 preservatives, 2 insecticides, and 4 contaminants (Pb, Cu, Sn and As), signs of intoxication, such as a decrease of adrenal vitamin C and liver protein developed. Addition of 0.1 mg Pb nitrate, 100 mg Cu sulfate, 200 mg Sn chloride and 0.05 mg As trichloride to 1 kg of diet induced toxic symptoms; however, a mixture of 3 of the above compounds caused no toxicity.

- 1091** Springman, F., Bingham, E., and Stemmer, K.L. (Lloyd Brothers, Inc.; Univ. Cincinnati, O.): THE ACUTE EFFECTS OF LEAD ALKYLs. ORAL ADMINISTRATION OF TETRAMETHYLLEAD, TETRAETHYLLEAD, TRIMETHYLLEAD CHLORIDE, TRIETHYLLEAD CHLORIDE, AND DIETHYLLEAD DI-CHLORIDE TO RATS. Archives of Environmental Health 6:469-72 (Apr.), 1963.

Among the title compounds, it is known that triethyllead (TrEL) is a major metabolic product of TEL, and there is evidence that trimethyllead

(TrML) forms in the body from TML. Although not yet demonstrated, it is possible that the dialkyls are also formed in vivo. In this report, earlier work is extended by showing body weight changes after administration of these compounds and by describing briefly the pathologic findings.

Cesarean-derived rats (Charles River strain) weighing ~290 g were administered the compounds in a single dose by stomach tube in separate groups of rats, nearly equal in numbers of male and female. Survivors were killed ~1 mo after administration. TML and TEL (99.8 and 98.8%, respectively), were administered as a 5% and a 1% solution, respectively, in peanut oil at 24-280 mg/kg and 10-55 mg/kg; TrML, and TrEL chlorides and diethyllead dichloride (DiEL) as a 1% solution in water at 36-280, 10-55, and 55-180 mg/kg, respectively.

The data on mortality, survival time, and onset of tremors showed that all compounds acted similarly, and except for TrEL which killed all rats within 3 days, survival ranged from a few hours to 1 or 2 wk, depending upon dosage. All compounds produced loss in weight (10-15%) that reached its maximum at ~1 wk, except for TML where weight loss continued into the 2nd wk. This response was also dependent on dose. TEL, TrEL and TrML were about equally toxic at comparable doses and several times more so than TML and DiEL. Signs of illness by TML, TEL and the tri-alkyls were similar and typical of those usually observed; DiEL produced no hypersensitivity, tremors, convulsions, or lack of coordination, only increasing weakness and death. Pathologic changes (brain, kidney, lung) varied in intensity and extent and were those of a nonspecific acute intoxication. These were summarized by Davis, et al (Abstr. No. 1053).

The authors' conclusions are that although limited in scope, the observations point to the fairly rapid conversion of TEL to TrEL; in part, the toxic effect is that of the Pb content, but the total structure seems to exact a modifying influence. The lesser neurologic effect of DiEL may be due to the probability that the divalent ion would be bonded more securely to the polar sites on proteins than monovalent or nonionic forms and thus not readily available to neurons; also its low solubility in lipids would prevent its being taken up as rapidly as TrEL into the nervous system. As to TrML, while similar to TrEL in producing toxic response and mortality, it differed from it by longer intervals between administration of lethal dosage and death. It is inferred that some factor retards the building up of an effective concentration in the susceptible areas of the nervous system.

- 1092** Sroczyński, J. (Silesian Clinic Int. Dis. Zabrze, Poland): Układ krwiotwórczy królików w przewlekłym zatruciu ołowiem. (THE HEMATOPOIETIC SYSTEM OF RABBITS IN CHRONIC LEAD POISONING.) Postępy Higieny i Medycyny Doświadczalnej 17:585-94 (Sept.-Oct.), 1963.

Twelve rabbits were poisoned by iv injections of 0.9% Pb acetate solution in doses of 4 mg/kg every 7 days over 7 mo. The changes observed in the blood picture throughout this period are shown in 6 graphs. The author concludes that the anemia developing in Pb poisoning is both hemolytic and

achrestic. (18 references)

- 1093** Sroczyński, J., and Jonderko, G. (Clinic of Internal Diseases, Zabrze, Poland): Katalaza krwinek czerwonych w przewlekłej ołowicy królików. (ERYTHROCYTIC CATALASE IN CHRONIC PLUMBISM IN RABBITS.) *Postępy Higieny i Medycyny Doswiadczałnej* 17:609-14 (Sept.-Oct.), 1963.

Chronic Pb poisoning was established in 11 rabbits of both sexes by intravenous injections of 4 mg Pb acetate/kg, 7 days a wk over a period of 6 mo. Catalase activity in the erythrocytes was determined by Jolles' method as modified by Gepner-Woźniewska before the injections had begun and after signs of intoxication, such as anemia and the presence of stippled erythrocytes, were observed.

The results showed a definite increase in catalase activity ranging up to 170% above those found before exposure, although the constancy of progress of the activity reported by Gajdos and Gajdos-Török (1958) was not observed. Therefore, it was not possible to correlate the increase with the manifestations of the poisoning. The effect of hemolysis on catalase activity was also investigated on the blood of poisoned rabbits and of humans as controls. The results, however, were inconclusive.

In discussing the mechanisms involved in the increase of blood catalase activity the authors consider it unlikely that a possible liver injury in Pb poisoning could be held responsible. In experimentally induced injury of the liver, which is the site of synthesis of catalase, they had observed a decrease in activity of this enzyme.

- 1094** Sroczyński, J., and Piekarski, B. (Silesian Clinic Int. Dis., Zabrze, Poland): Obraz białek surowicy krwi królików w przewlekłym zatruciu ołowiem. (SERUM PROTEIN PICTURE IN RABBITS WITH CHRONIC LEAD POISONING.) *Postępy Higieny i Medycyny Doswiadczałnej* 17:603-8 (Sept.-Oct.), 1963.

The electrophoretic serum protein patterns were examined in 10 rabbits subjected to chronic Pb poisoning (4 mg Pb acetate solution/kg iv every 7 days for 7 mo) and compared with histologic changes in the liver and kidney.

- 1095** Starcich, R., Chizzola, A., and Rastelli, G. (Univ. Parma, Italy): La reazione stromale fibrosclerotica provocata nel midollo osseo da somministrazione endovenosa di acetato di piombo. (THE FIBROSCLEROTIC STROMAL REACTION INDUCED IN THE BONE MARROW BY INTRAVENOUS ADMINISTRATION OF LEAD ACETATE.) *Rivista di Anatomia Patologica e di Oncologia* 24:1247-54 (Dec.), 1963.

Selye et al reported in 1963 that osteomyelosclerosis could be induced in the rat by Pb acetate. Starcich and his associates wished to investigate this action and its mechanism in another species in order to clarify the anemia occurring in Pb poisoning.

Fifteen rabbits were injected intravenously on alternate days with a daily dose of 5-2.5 mg/kg body weight of Pb acetate in a 1% aqueous solution.

The higher doses caused acute intoxication, with death after a few treatments. For the purpose of this experiment, it was deemed best to administer the lower doses for 2 cycles of 15 days each, separated by an interval of 130 days. Animals were killed following the 1st and 2nd cycle. A constant increase of the circulating nucleated cells up to 50,000/mm<sup>3</sup> was noted. Leukocytes reached a maximum after 5 days and then returned slowly to the normal level. Shortly after the increase of leukocytes, great numbers of erythroblasts were emitted into the circulation, while leukocytes decreased. Hemoglobin and the number of erythrocytes decreased; hypochromia and basophilia developed. Values tended to normalize during the 2nd wk of treatment. The histologic changes of the parenchyma of the bone marrow were mainly of aplastic type, followed by stromal reactions in the form of hyperplasia of the reticular fibers. None of these alterations were reversible.

In discussing the findings, the authors point out that the process observed is similar to the secondary myelosclerosis produced experimentally by several organic compounds and drugs.

- 1096** Tarmas, J. (Silesian Inst. Anatomy, Zabrze, Poland): Wpływ dożylnie podawanego octanu ołowiu na zwoje rdzeniowe królików. (EFFECT OF INTRAVENOUS LEAD ACETATE ON THE SPINAL GANGLIA IN RABBITS.) *Postępy Higieny i Medycyny Doswiadczałnej* 17:771-6 (Nov.-Dec.), 1963.

The title subject was investigated on rabbits injected iv Pb acetate in doses of 4 mg/kg according to a schedule given in a table. The findings are described and shown in 2 microphotographs. (36 references)

- 1097** Tikhonov, N.N., and Semenova, V.A. (Acad. Sci. Kazakh SSR): Soderzhanie mediatorov v krovi pri svintosovoi intoksikatsii. Soobshchenie I. (O soderzhanii adrenalina v dinamike otravleniya svintsom v eksperimente.) (CONTENT OF MEDIATORS IN THE BLOOD DURING LEAD POISONING. I. CONTENT OF ADRENALINE IN THE DYNAMICS OF EXPERIMENTAL LEAD POISONING.) *Izvestiya Akademii Nauk Kazakhskoi SSR* 1963, No. 2:42-7.

When dogs (medium weight) were given orally 1 ml of either a 5% or 2.5% solution of Pb acetate/kg/day, the adrenaline content rose from a normal av 0.275 µg/ml to an av 0.430 by the 25th-30th day, then dropped to 0.08 by the 170th-180th day. This phenomenon was attributed to changes in the metabolism of vitamins and proteins. (20 references)

- 1098** Vincent, J. (Lovanium Univ., Leopoldville, Congo): MICROSCOPIC ASPECTS OF MINERAL METABOLISM IN BONE TISSUE WITH SPECIAL REFERENCE TO CALCIUM, LEAD AND ZINC. *Clinical Orthopaedics* 26:161-75, 1963.

The skeleton is involved in general metabolic interactions and is recognized as the key tissue in various vital controls. Histochemical, micro-radiographic and autoradiographic observation of the deposition in the bone tissue of several elements, among them Pb, as a new approach to a better understanding of bone physiology, is described.

When Pb was used as a substitute for Ca, and fed to dogs for 3 days, it proved to be useful in the study of adult bone remodeling. Pb yielded valuable estimates of the growth rate of osteons and demonstrated that remodeling activity is much more active in the metaphysis than in the epiphysis.

- 1099 Wagenaar, G. (Univ. Utrecht, Holland): Een geval van chronische loodvergiftiging bij kalveren. (CHRONIC LEAD POISONING IN CALVES.) Tijdschrift voor Diergeneeskunde 88, No. 13:826-34, 1963.

Four calves on a farm died after a sickness of ~6 wk; another calf had died the year before under the same symptoms. Necropsy of 3 of these animals showed chronic interstitial nephritis and uremic endocarditis of the left auricle. When the last calf died, the possibility of poisoning was considered. The liver of this calf was found to contain 2 mg Pb/kg, the cortex of the kidney 25 mg/kg. The liver of the calf that had died previously contained 49.7 mg Pb/kg. Meanwhile it was learned that the farmer had put an old painted door in the calf shed and the calves constantly licked at this door. The paint of the door contained 18.6% Pb.

- 1100 Wieczorek, M., and Sroczyński, J. (Silesian Inst. Pathol. Anatomy, Zabrze, Poland): Badania anatomopatologiczne w doświadczalnym przewlekłym zatruciu ołowiem królików. (ANATOMICAL AND PATHOLOGIC STUDIES IN EXPERIMENTAL CHRONIC LEAD POISONING IN RABBITS.) Postępy Higieny i Medycyny Doswiadczalnej 17:595-601 (Sept.-Oct.), 1963.

Ten rabbits were subjected to chronic Pb poisoning by the iv injection of 4 mg/kg body weight daily for 4-7 mo. Histopathology was performed on the lung, liver, kidneys, adrenals, spleen, stomach and intestine. The changes are described and illustrated in 4 microphotographs. (12 references)

- 1101 Wilson, M.R., and Lewis, G. (Univ. Bristol, England): LEAD POISONING IN DOGS. Veterinary Record 75:787-91 (Aug. 3), 1963.

The literature on Pb poisoning in dogs is reviewed and 5 out of 14 field cases that had been submitted to the Department of Veterinary Medicine at the University of Bristol are described. All the animals were <11 mo old. The main signs were anorexia, vomiting, diarrhea or constipation, loss of weight and epileptiform convulsions; the nervous signs consisted of sudden paralysis with excessive salivation and clamping of the jaws. Two of the 5 cases ended in death. The source of Pb in most cases was paint. The clinical picture of Pb poisoning in the dog is not specific; other disease conditions have been shown to cause mobilization of Pb from the bones and to produce a concurrent Pb intoxication. In positive cases of Pb poisoning, treatment with calcium ethylenediamine-tetraacetate has been successful. (19 references)

- 1102 Yagi, R., Nishikawa, M., and Nakajima, M. (Tokyo Med. Dental Univ., Japan): DEPOSITION OF LEAD ACETATE AND TETRACYCLINE ON THE TEETH OF FUR SEAL. Sci. Rept. Whales

Res. Inst. 1963, No. 17:191-5.

Pb acetate was given to a female fur seal intramuscularly (5 mg/kg body weight). After ~23 wk of rearing in an aquarium, the Pb line was detected histochemically in the dentin tissue under ultraviolet light. This administration method may be used as a technique for age determination of the animal. (From Chemical Abstracts 59:10553, 1963)

- 1103 Zel'tser, M.E. (Acad. Sci., Kazak SSR): Raspredelenie ioda-131 v shchitovidnoi zheleze, plazme krovi i slyunnoi zheleze pri eksperimental'nom svintsovom otravlenii u kryss. (DISTRIBUTION OF IODINE-131 IN THE THYROID, BLOOD PLASMA, AND SALIVARY GLANDS IN EXPERIMENTAL LEAD POISONING IN RATS.) Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Meditsinskikh Nauk 1963, No. 1:66-70.

Male rats were poisoned with 2 and 5% Pb acetate solutions (1 ml/kg/day by gastric tube) over a period of 2.5-3 mo in order to produce typical chronic poisoning. At the end of this period they were injected with <sup>131</sup>I and the I uptake was followed 1, 24, and 48 hr after poisoning. The results showed that the thyroid absorbed less inorganic I, and that there was a slower synthesis of thyroid hormone. (15 references)

- 1104 Zel'tser, M.E. (Acad. Sci. Kazak SSR): Reaktsiya shchitovidnoi zhelezyi v nachal'noi stadii eksperimental'noi svintsovoi intoksikatsii. (REACTION OF THE THYROID IN THE INITIAL STAGES OF EXPERIMENTAL LEAD POISONING.) Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Meditsiny Nauk 1963, No. 2:54-7.

The I uptake by the thyroid gland was studied in male rats poisoned with 1 ml/kg of 2% Pb acetate solution/day for 20-25 days. This dosage was well tolerated and no significant changes occurred in the blood picture. At the end of this period, the rats received <sup>131</sup>I sc. In another series, in order to study the distribution of inorganic and organic fractions in the thyroid and plasma, trichloroacetic acid was used according to Taurog, Chaikoff and Feller's method. The results showed that a characteristic acceleration of thyroid function took place which was demonstrable principally by increased I uptake. The author concludes that activation of thyroid function must be considered as one of the pathogenic factors in incipient Pb poisoning. (14 references)

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- 1105 Aronson, A.L., and Hammond, P.B. (Univ. Minn., St. Paul): EFFECT OF TWO CHELATING AGENTS ON THE DISTRIBUTION AND EXCRETION OF LEAD. Journal of Pharmacology and Experimental Therapeutics 146:241-51 (Nov.), 1964.

The pattern of mobilization of Pb with regard to removal from selected organs and tissues of rats by chelating agents, the importance of the intensity and duration of exposure of tissues to ethylenediaminetetraacetate (EDTA) and dimercaptopropanol (BAL) was evaluated and their metal-mobiliz-



ing effects were compared. Male Sprague-Dawley rats, weighing 240-260 g, were used throughout the study. Pb was administered (solution of Pb citrate to which  $^{210}\text{Pb}$  had been added) by slow iv infusion in order to achieve a pattern of Pb distribution in the body that would be reasonably similar to that following oral intake which is the most common route in Pb poisoning of children and domestic animals. In a comparative experiment, infused Pb was distributed to kidney, liver and brain in amounts approximating those following oral administration, while the Pb deposition in spleen and lungs was appreciably greater than in oral administration. (The rats in this test had been killed 30 hr following oral and 24 hr following iv administration.) Distribution of Pb on the 1st, 4th and 7th days following infusion of 7 mg Pb/kg body weight was next studied in 9, 11 and 10 rats, respectively. In the soft tissues, the levels of Pb decreased with time while they concomitantly increased in the bones. A tabulation of daily excretion of Pb in urine and feces shows that until day 4, excretion via feces was more important than that via the urine.

The concentration of EDTA in the plasma water was determined in 6 rats under conditions of rapid iv injection and in 4 rats, given iv infusion over a 6-hr period. The dose of EDTA was in each case 1.073 mM/kg of body weight. EDTA concentration in the plasma water varied from 200-420 nM/ml during infusion, fell rapidly upon cessation of infusion, but concentrations of 10-12 nM EDTA persisted for as long as 18 hr following infusion. When therapy, using 1.073 mM EDTA/kg, was started on the 4th day following Pb administration and the rats killed on the 7th day, continuous iv infusion over 6 hr proved superior to rapid injection in mobilizing Pb from soft tissue; also this dose was superior to lower doses. Most mobilized Pb came from the kidney except in the case of slow infusion of 0.107 mM EDTA/kg, when EDTA acted almost exclusively on the muscle. Acceleration of urinary Pb excretion following treatment with EDTA was essentially completed in 24 hr, which is in contrast to man and cattle where urinary Pb excretion is enhanced for several days.

In the experiments with BAL, 0.573 mM/kg were used for rapid injection and 1.073 mM/kg for 6-hr infusion. These doses were toxic and caused convulsions in the rats, but none died. At equimolecular doses, BAL was superior to EDTA in mobilizing Pb from the body, but less effective than EDTA in removing Pb from nonosseous organs and tissues, such as kidney, muscle and brain. BAL enhanced both urinary and fecal excretion of Pb. Accelerated urinary Pb excretion was largely completed within 24 hr, the same as when EDTA was used.

When rats were treated with 1.073 mM EDTA/kg on the 1st day (early treatment) and sacrificed on the 4th day following Pb administration, less Pb was mobilized from soft tissue than by treatment with the same dose of EDTA on the 4th day (late treatment) following Pb administration. Significant reduction of Pb content only of brain and muscle resulted. Urinary Pb excretion was markedly increased and fecal Pb excretion decreased.

In summary, both intensity and duration of the chelating process influenced the mobilization of

Pb, notably the kidney and liver; intensity influenced more the removal from brain and from muscle; late treatment was more effective in mobilization of Pb; BAL was less effective than EDTA at equimolar doses in removal from soft tissues, but more so in mobilizing Pb from the body.

- 1106 Baetjer, A.M., and Horiguchi, S. (Johns Hopkins Univ., Baltimore, Md.): EFFECTS OF ENVIRONMENTAL TEMPERATURE AND DEHYDRATION ON LEAD POISONING IN LABORATORY ANIMALS. In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. II, pp. 795-7.

In a total of 12 experiments, mice were injected intravenously with 1 mg Pb/20 g mouse as nitrate to which 1  $\mu\text{Ci}$   $^{210}\text{Pb}$  was added. Half of the mice were kept at 35°C, the other half at 22°C, for 4, 24, or 48 hr. At the higher temperature, mice excreted less Pb in feces and urine than did those kept at normal temperature. The  $^{210}\text{Pb}$  concentration in the blood did not vary significantly at the 2 levels of temperature. At 4 hr, the Pb content in lungs, spleen, brain, heart and bladder plus testes was higher in the heat-exposed mice, that in kidney and liver was lower. By 24 hr, Pb in lungs, spleen and kidney was greater in the heat-exposed mice and by 48 hr, that in the liver also exceeded the levels in mice at normal temperature.

Intracellular fluid loss was produced in rats by replacing the drinking water with 2% Na chloride solution for 2 wk preceding and following intravenous injection of 1 mg Pb/100 g body weight as nitrate. Mortality from acute Pb poisoning was greater in the dehydrated than in the control rats and deaths continued over a longer time. The differences were statistically significant. Fatality was not related to weight loss. Before Pb injection, food consumption and fecal excretion were less, fluid intake and urine output greater in the dehydrated animals than in the controls. Immediately following Pb injection, fluid and food intake and feces and urine output decreased sharply in all rats but soon returned to the pre-injection pattern. The saline rats excreted less Pb in the urine and more Pb in the feces. Fecal Pb excretion reached a maximum during the 1st day after Pb injection in the normal rats and on the 3rd or 4th day in the dehydrated ones. Pb concentration was greater in the kidneys of saline rats but lower in their liver. Pb in the red cells, 14 days after injection, was higher in normal than in saline rats, that in plasma did not differ appreciably.

The experiments show that high temperature and dehydration may be important factors in Pb poisoning in man.

- 1107 Baldwin, R.W., Cunningham, G.J., and Pratt, D. (Univ. Nottingham, England): CARCINOGENIC ACTION OF MOTOR ENGINE OIL ADDITIVES. British Journal of Cancer 18:503-7 (Sept.), 1964.

Various components of a proprietary engine oil additive, consisting mainly of Pb naphthenate together with small amounts of chlorinated hydrocarbons, were assessed for carcinogenic activity.

The shaved skin of young adult male albino mice was painted once or twice weekly for up to 12 mo with the whole additive I or with one of its 3 components, ie base oil, additive concentrate and Pb naphthenate, or with a proprietary additive II used as an upper cylinder lubricant. The carcinogenic substances were contained almost exclusively in the base oil. Neither the whole additive formulation nor the Pb naphthenate fraction produced any significant carcinogenic response in the skin of the mouse. Skin papillomata were observed in only 2 of 59 mice (4%) following skin painting with Pb naphthenate, and only a single papilloma developed in mice treated with the additive concentrate. However, skin painting with the Pb naphthenate fraction induced marked kidney damage and tubular adenomata were observed in 4 mice while 1 had a renal carcinoma. Additive II also proved to be carcinogenic for the skin of the mouse.

- 1108 Bolanowska, W., Piotrowski, J., and Trojanowska, B. (Inst. Med. Pracy, Lodz, Poland): THE KINETICS OF DISTRIBUTION AND EXCRETION OF LEAD ( $Pb^{210}$ ) IN RATS. In: XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. II, pp. 420-2.

Thirty-four adult male albino rats, mean weight 260 g, received each, intravenously, a single dose of 200  $\mu$ g Pb, as Pb acetate solution labeled with 2  $\mu$ Ci  $^{210}Pb$ , calculated to be 1 mg Pb/kg. Pb excretion in feces and urine was observed for 98 days in 8 rats and distribution curves of Pb in the body were obtained for 12 different periods from 0.5 hr up to 98 days after the injection. The determination of Pb was based on the measurement of the  $\beta$ -radiation of the  $^{210}Bi$  which is in equilibrium with  $^{210}Pb$ . The distribution data obtained allowed the division of the organs into 3 basic compartments differing in Pb exchange rate: (1) the rapid exchange pool consisting of blood, heart, lungs, liver, kidneys, spleen and gastrointestinal tract, with a Pb content of 100% of the dose in the first moment to 7% after 1 wk after which time the Pb content in these organs remained constant; (2) the intermediate pool of muscles and skin with a Pb maximum of 11% of the dose after 1 day, dropping to 8% after 1 wk; (3) the slow exchange pool including the bones and whole tail with a maximum Pb content of 40% of the dose after 1 wk which decreased very slowly to ~30% in 3 mo. After 1 wk, 50% of the Pb introduced was excreted in urine and feces with ~4/5 of this amount in the feces. Since turnover of Pb in muscles and skin is very slow, this may explain why absorption of Pb given subcutaneously is very slow and incomplete, as later experiments showed. The excretion coefficient of these tissues against the rapid exchange pool is only ~0.01/hr. Whole of body processes of the Pb metabolism may be fairly well described by simple power functions, the coefficients of which are of the same order as those found for radioactive bone seekers. However, before practical application of these functions they must be proved by experimental repeated exposure in animals and in man under field conditions.

- 1109 Brugnone, F., Corsi, G.C., and Galzigna, L. (Univ. Padua, Italy): Carico di serotonina e di 5-idrossitriptofano in conigli intossicati da piombo tetraetile. (SERO-TONIN AND 5-HYDROXYTRYPTOPHAN LOADS IN RABBITS INTOXICATED WITH TETRAETHYLLEAD.) Medicina del Lavoro 55:184-7 (Mar.), 1964.

Since earlier experiments had shown that tetraethyllead (TEL) alters the urinary elimination of 5-hydroxyindoleacetic acid (HIAA), the principal metabolite of serotonin, the authors wished to continue the study of the mechanism of action of TEL by observing the behavior of this metabolite after loading animals with serotonin and 5-hydroxytryptophan (HTP).

Eight male rabbits, weighing 2-3 kg, received intramuscular injections of 50 mg/kg/day of TEL, dissolved in ethyl alcohol; controls were given only the alcohol. Both TEL-treated and control rabbits then received daily for 4 days 8 mg HTP and 20 mg serotonin. Daily determinations of HIAA in the urine showed excretion to remain unchanged in the TEL-poisoned rabbits treated with HTP, while it increased markedly in TEL-poisoned rabbits treated with serotonin and in controls treated with serotonin. The experiments confirmed the previous hypothesis that TEL inhibits the catabolism of HIAA in the brain and that HTP is the only hydroxyl metabolite of tryptophan which can pass the blood-brain barrier.

The experiments were continued while this paper was being printed. After injecting rabbits daily for 8 days with 15 mg HTP, a group of untreated rabbits serving as controls, oxalic acid and HIAA were determined in the urine. The results showed that 94% of the administered dose of HTP was eliminated or metabolized by a pathway other than that of HIAA. Excretion of oxalic acid did not increase significantly.

- 1110 Brugnone, F., Galzigna, L., and Corsi, G.C. (Univ. Padua, Italy): Contenuto di serotonina nei polmoni di conigli intossicati con piombo tetraetile. (CONTENT OF SEROTONIN IN THE LUNGS OF RABBITS INTOXICATED WITH TETRAETHYLLEAD.) Medicina del Lavoro, 55:411-13 (June-July), 1964.

The effect of tetraethyllead (TEL), of the solvent used, and of Pb as Pb acetate on the serotonin content in the lungs was studied in 36 male rabbits, weighing 2-3 kg each. Thirteen rabbits were treated intramuscularly as follows: 4 with TEL dissolved in ethanol, 2 with ethanol only, 3 with Pb acetate and 4 with Pb acetate plus ethanol. Ten rabbits were subjected to inhalation of TEL at a concentration of 1 mg/l of air, 4 of them for 1 hr/day for 2 days (acute poisoning) and 3 for 30 min on alternate days for 44 days (subacute poisoning). Seven animals were kept as controls and 3 each received 10 mg/kg/day of 1-benzyl-2-(5-methyl-3-isoxazolylcarbonyl) hydrazine (Marplan) for 20 days and 50 mg/kg/day of iproniazid (Marsilid), respectively. The 3 Marsilid-treated animals were sacrificed after 24, 48 and 72 hr, respectively; all other animals were killed before death from poisoning was imminent. The sensitivity of the method used for the determination of serotonin did not go beyond 4  $\mu$ g/g of fresh tissue, so that in some cases the levels were indica-

ted as being nondeterminable (nd). In acute poisoning with TEL by inhalation, serotonin was decreased to nd levels in 6 of the 7 cases studied and after intramuscular administration of TEL plus ethanol in all cases. In subacute poisoning with TEL by inhalation, it was nd in 1 of 3 instances. Treatment with ethanol or with Pb acetate plus ethanol had no particular effect; Pb acetate alone seemed to increase the serotonin level and Marplan and Marsilid produced no changes.

Two interpretations of the above findings were proposed: (1) the effect of TEL is not limited to the inhibition of monoamine oxidase; (2) the decrease of serotonin is due to a reaction not connected with monoamine oxidase. The author considers the first of these hypotheses as the more convincing one because TEL acts as a general poison rather than as a specific inhibitor.

- 1111 Brykalski, D., and Bolanowska, W. (Inst. Occup. Med., Lodz, Poland): Dalsze badania nad wpływem doustnie podanego EDTA na wchłanianie i wydalanie ołowiu. (FURTHER STUDIES ON THE EFFECT OF ORALLY ADMINISTERED EDTA ON LEAD ABSORPTION AND EXCRETION.) *Medycyna Pracy* 15, No. 3:133-8, 1964.

Each of a group of 16 albino rats were fed 300  $\mu$ g Pb ion labeled with  $^{210}\text{Pb}$ ; 8 of them were then given 5 mg ethylenediaminetetraacetate (EDTA) in aqueous solution in 5 portions over 2 days. Excreta and urine were collected separately for 48 hr, when the animals were killed. Total body retention of  $^{210}\text{Pb}$  was found to be similar in both groups, amounting to 0.095% of the administered dose in the EDTA-treated rats and 0.092% in the controls. Urinary  $^{210}\text{Pb}$  excretion for the 1st and 2nd day together was 4.296 and 0.806% of the dose in the 2 groups, respectively. The conclusion was drawn that EDTA increases Pb absorption from the alimentary tract, but this increased absorption is compensated by a relatively high excretion while the total body retention is not raised. (From authors' English summary).

- 1112 Camerada, P., Congiu, M., and Leo, P. (Univ. Cagliari, Italy): Comportamento del seromucoide e dell'acido sialico (sangue e tessuto nervoso) nell'intossicazione sperimentale da piombo nel ratto. (BEHAVIOR OF SEROMUCOID AND SIALIC ACID (BLOOD AND NERVOUS TISSUE) IN EXPERIMENTAL LEAD POISONING IN RATS.) *Rassegna Medica Sarda* 66:253-63 (Jan.-Dec.), 1964.

Previous studies by the author (1959) have shown that in individuals exposed to the risk of Pb poisoning a significant increase of seromucoid corresponding to a significant decrease of neuraminic acid in the blood occurs. He then sought to determine whether the same phenomenon occurs in experimental Pb poisoning and the nature of these constituents in the blood and nerve tissue.

Forty male albino Wistar rats, average weight 380 g, were divided at random into 4 groups of 10 each and given the following treatments: Group A served as controls; rats in Group B received a single intraperitoneal dose of 5 mg Pb/100 g body weight, as Pb acetate, to produce acute poisoning and were killed 8 hr later; rats of Group C re-

ceived intraperitoneal injections of 1 mg Pb/100 g body weight as Pb acetate on the 1st, 2nd, 4th and 5th day and were killed on the 6th day (1 rat died spontaneously on the 5th day); the animals in Group D were fed 2 mg Pb/day for 10 consecutive days and sacrificed on the 11th day. Neuraminic acid in blood and cerebral tissue was determined by the method of Hess et al (1957) and seromucoid in blood by the method of Hurga et al (1956). The neuraminic acid in blood and nerve behaved similarly in Groups B and D; the reduction of neuraminic acid in both these groups (means in plasma,  $67 \pm 14$  and  $100 \pm 12.12$  mg/100 ml; nerve,  $111.5 \pm 10.44$  and  $91.9 \pm 12.9$ ) was statistically significant with respect to the controls (plasma,  $111 \pm 23.66$ ; nerve,  $126.2 \pm 10.7$ ). Seromucoid decreased slightly in Group B and increased moderately in Group D ( $226 \pm 70$  and  $270 \pm 74$  vs  $243 \pm 32$ ), but both changes were not significant statistically. In Group C, neuraminic acid in plasma ( $124 \pm 10.33$ ) and nerve ( $124.66 \pm 17.7$ ) showed only slight changes, but seromucoid increased conspicuously and significantly to  $\sim 2$ -fold ( $498 \pm 95$ ) compared with controls ( $243 \pm 32$ ). The latter results were not attributed to Pb poisoning but to peritoneal inflammation observed in all animals of Group C, which always produces an increase of seromucoid in the blood.

Based on the results from Group B and D it was concluded that Pb introduced into the organism forms an organometallic complex which binds neuraminic acid to a chelate and that thereby Pb is prevented to develop its toxic effect. The findings are similar to those observed in man.

- 1113 Castellino, N., and Aloj, S. (Univ. Naples, Italy): KINETICS OF THE DISTRIBUTION AND EXCRETION OF LEAD IN THE RAT. *British Journal of Industrial Medicine* 21:308-14 (Oct.), 1964.

Wistar male rats, weighing 180-225 g, were given a single intravenous injection of 100  $\mu$ g Pb as Pb acetate and enough  $^{210}\text{Pb}$  to record about 10<sup>6</sup> counts/min. Groups of 5 rats were killed at intervals up to 14 days after injection. Two groups of 3 rats were given only 0.7  $\mu$ g Pb each; these rats were killed after 1 and 24 hr. The percentages of the injected  $^{210}\text{Pb}$  fixed and excreted as well as those recovered in fresh tissues and their variation with time were tabulated and the total  $^{210}\text{Pb}$  contents of whole organs were calculated. In the blood, 96% of the Pb was bound to the cellular elements and 4% was in the plasma; the ratio was constant during the whole period of observation.  $^{210}\text{Pb}$  was rapidly distributed in the tissues, the highest concentrations being in kidney, liver and bones. The kinetics of disappearance of  $^{210}\text{Pb}$  from the organs and tissues followed the pattern of first order reactions. The disappearance curves in the blood, plasma, hematic cells and some other tissues can be expressed as sums of exponential functions. In contrast, the removal of metal from the bone tissue occurred at a constant and extremely slow rate. Excretion by the feces and urine reached its maximum within 24 hr and decreased asymptotically thereafter. About 35.7%  $^{210}\text{Pb}$  was excreted in the feces and 15.9% in the urine.

- 1114 Castellino, N., and Aloj, S. (Univ. Naples, Italy): (DISTRIBUTION AND EXCRETION OF LEAD-210 ACETATE IN THE RAT.) *Folia Medica* (Naples) 47, No. 2:138-56, 1964. See preceding abstract.

- 1115 Castellino, N., and Aloj, S. (Univ. Naples, Italy): Azione del  $\text{CaNa}_2\text{EDTA}$  sulla cinetica della distribuzione ed escrezione dell'acetato di piombo ( $\text{Pb}^{210}$ ) nel ratto. (ACTION OF  $\text{CaNa}_2\text{EDTA}$  ON THE DISTRIBUTION AND EXCRETION OF LEAD ( $^{210}\text{Pb}$ ) IN THE RAT.) *Folia Medica* (Naples) 47:381-403 (April), 1964.

EDTA, given iv to rats injected 100  $\mu\text{g}$   $^{210}\text{Pb}$  iv, greatly increased urine excretion but reduced the fecal, with greatest effect occurring shortly after Pb injection. When given  $\geq 7$  days after Pb, the increase was negligible. Mobilization was from every tissue; Pb ions bound weakly to cells were removed rapidly while Pb fixed to intracellular constituents was removed slowly. Bone Pb was not mobilized. Of 500  $\mu\text{g}$  Pb/rat given orally,  $\sim 18\%$  was absorbed through intestine. Oral EDTA increased urinary Pb and reduced Pb retention. (Also in XIVth International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, vol. II, pp. 910-2; *British Journal of Industrial Medicine* 22:172-80 (July), 1965)

- 1116 Castellino, N., and Aloj, S. (Univ. Naples, Italy): Determinazione delle costanti di allontanamento del  $\text{Pb}^{210}$  dai differenti tessuti del ratto. (DETERMINATION OF THE ELIMINATION CONSTANTS OF  $\text{Pb}^{210}$  FROM VARIOUS RAT TISSUES.) *Folia Medica* 47:238-48 (Mar.), 1964.

Ten groups of 5 male Wistar rats each (av 190 g) were given iv 100  $\mu\text{g}$   $^{210}\text{Pb}$ /rat (as acetate) and were killed after 1, 12, 24, 72, 144, 192, 216, 264, 288, and 336 hr.  $^{210}\text{Pb}$  was found in all tissues. It diffused rapidly into extravascular and intracellular fluids and a few hr after injection was scarcely detectable in the plasma. From the findings, it is concluded that the bond of Pb with individual tissues is reversible but that its elimination occurs in different phases: 2 initial, of rapid elimination, followed by a slow phase in the blood, plasma, blood cells, lung and heart, and only 1 rapid and 1 slow in liver and kidney. Elimination from bone tissue was slow and constant with a biological decay time of  $\sim 70$  days. In interpreting results, the authors suggest that the rapid phases portray elimination of Pb in ionic form, present in the intracellular spaces or lightly bound to the cells, while the slow phase expresses the elimination of Pb transformed into an organic compound.

- 1117 Castellino, N., Colicchio, G., Grieco, B., Piccoli, P., and Rossi, A. (Univ. Naples, Italy): Toxicité d'un mélange antidetonant au plomb tétraméthyle. Recherches expérimentales et contrôle du risque de contamination chez des ouvriers exposés. (TOXICITY OF AN ANTIKNOCK MIXTURE CONTAINING TETRAMETHYLLEAD. EXPERIMENTAL STUDIES AND PREVENTION OF HAZARDS TO EXPOSED WORKERS.) *Archives des Maladies Profession-*

nelles de Medecine du Travail et de Sécurité Sociale 25:203-18 (Apr.-May), 1964.

A mixture of the following composition was used, in volume %: TML, 33.7; ethylene dibromide, 10.8; ethylene dichloride, 19.9; toluene, coloring matter, impurities, 35.6. Five groups of male rabbits were injected sc as follows: Group 1 (4 animals, av 2.375 kg), single dose of 400 mg/kg body weight of the mixture; Group 2 (9 rabbits, av weight 2.700 kg), 0.1 ml (corresponding to 50 mg)/kg of an alcoholic solution of the mixture, daily, 5 days/wk for a total of 4-15 injections; Group 3 (9 rabbits, av weight 2.450 kg), 0.10 ml (equal to 15 mg)/kg of an alcoholic aqueous (78:22) solution of the mixture, daily, 5 days/wk for a total of 12-18 administrations; Group 4 (10 animals, av weight 2.600 kg), 0.18 ml (equal to 5 mg)/kg of an alcoholic aqueous (63:37) solution of the mixture, daily, 5 days/wk for a total of 180 injections; Group 5, controls (4 rabbits, av weight 2.570 kg), 0.18 ml/kg of a mixture of alcohol and water (63:37). Survival time, weight changes and toxic signs before death were studied and data concerning hepatic and renal function and blood composition were tabulated.

The rabbits in Group 1 died within 5-12 days, those in Group 2, 1-2 days after injections were discontinued, having lost 16% of their body weight. All 4 experimental groups developed a comparable nervous syndrome but they did not show any statistically significant manifestations of hepatic, renal or hemopoietic alterations. The neurotoxic symptoms did not attenuate as the dose decreased from 400-15 mg/kg, but disappeared at doses of 5 mg/kg. On the other hand, animals treated with 5 mg/kg of the mixture showed a statistically significant hypochromic hypersideremic anemia and some variable changes in hepatic function.

In discussing the results, the authors consider the contribution of the individual constituents of the mixture to the neurotoxic manifestations, to be a synergistic action exerted by each. The fact that only neurotoxic effects were seen in all but the chronic intoxication (at 5 mg/kg) is attributed to the early deaths of the animals. The anemia seen in chronic exposure is attributed to the double action of toluene and TML.

In addition, the hazard of TML poisoning was studied over a period of 10 mo in 10 workers of a gasoline refinery in Southern Italy. All men were trained to wear masks and gloves during work and to observe hygienic precautions; the work place was suitably ventilated. Results of tests for the Pb content in blood and urine, azotemia, cholesterol, coproporphyrins, protoporphyrins, and hematoipoiesis in these subjects were tabulated. None of the men showed any evidence of intoxication which demonstrates that the hazard of intoxication by TML can be excluded by adequate precautionary measures.

- 1118 Chaika, P.A.: Profilakticheskaya rol' pektinov pri zatravke zhivotnykh aerolyami svintsya. (THE PROPHYLACTIC ROLE OF PECTINS WHEN ANIMALS ARE POISONED BY LEAD AEROSOLS.) In *Materialy XV Nauchnoi sessii Instituta Pitaniya Akademii meditsinskikh nauk SSSR*, 1964. Moscow 2:114,

1964. (From Referativnyi Zhurnal, Otd. Vypusk. Farmakol. Toksikol, 1964, No. 23: 54-467; Biological Abstracts 46:Abstr. No. 66352, 1965)
- 1119 Cimasoni, G., and Collet, R.A. (Univ. Geneva, Switzerland): INORGANIC PHOSPHORUS AND LEAD POISONING: AN EXPERIMENTAL STUDY USING  $P^{32}$ . *Helvetica Odontologica Acta* 8: 142-7 (Oct.), 1964.
- A study was carried out on rats in order to establish whether inorganic P is removed from bone in the presence of Pb, and in a preliminary investigation, a method for labeling inorganic P in bone is described.
- Seven female Wistar strain rats, weighing 200-230 g, were given intraperitoneally 2  $\mu$ Ci  $P^{32}$  as phosphate in physiological saline at time zero and sacrificed after 0.25, 0.5, 1.5, 3.5, 5.5, 8 and 24 hr, respectively. Inorganic P was determined in blood serum and bone powder by the colorimetric method of Fiske and Subbarow (1925) and  $P^{32}$  was counted with an end window Geiger-Miller tube. Specific activity of inorganic P was expressed in counts/min (cpm)/mg of serum or bone inorganic P.
- Forty-nine female Wistar strain rats, weighing 180-320 g, were divided into 3 groups of 22, 16 and 11 animals. All groups received at time zero 2  $\mu$ Ci of  $P^{32}$ ; 4 hr later 11 rats of Group 1 were given an intraperitoneal injection of 4 ml of a 1% solution of Pb acetate (pH 6) in distilled water and all rats were killed after 6 hr; in Group 2, after 15 days 8 rats received Pb acetate as above, and all 16 rats were killed 2 hr thereafter; in Group 3, 6 rats were injected after 4 hr with a solution of Na acetate buffered to pH 6.
- Average P specific activity of bone was 25 cpm/mg/15 min after injection of the radioisotope, 35 after 30 min and 100 after 3 hr, while in the blood it decreased from 34,000 at 15 min to 3000 at 3-4 hr after administration. At 3-4 hr, P specific activity of bone and blood remained constant for a few hr, one at its maximum and the other at its minimum level. The experiments in Group 1 were performed in 3 replications, using 8, 6 and 8 animals; variability between the 3 replications was significant at least at the 0.01 level. Pb-intoxicated rats had a significantly higher P specific activity of blood and a significantly lower one of bone. The average ratio of blood-to-bone specific activity was 117 for the Pb-poisoned rats and 68 for the controls which is a difference of borderline significance. In the rats of Group 2, Pb administration did not produce any difference in P specific activity of bone, as compared with their controls, and in Group 3 no differences were evident in respect to both blood- and bone-P specific activity as compared to 5 controls.
- It is concluded that the administration of Pb causes an interference in the mobilization or deposition of P in the exchangeable fraction of bone. This would in part explain the etiology of the developmental bone lesions produced by Pb.
- 1120 Colicchio, G., Rossi, A., and Grieco, B. (Univ. Naples, Italy): Ricerche sperimentali sulla tossicità di una miscela al piombo tetrametile. (EXPERIMENTAL STUDIES ON THE TOXICITY OF A MIXTURE CONTAINING TETRAMETHYLLEAD.) In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. II, pp. 915-6.
- Since tetramethyllead (TML), because of its greater volatility and more uniform distribution in the motor cylinders, is now being used as antiknock agent instead of tetraethyllead, a study was undertaken to determine the LD50 in subcutaneous exposure and the LC50 by inhalation of an antiknock mixture containing the following components, in a volume %: TML, 33.7; ethylene dibromide, 10.8, ethylene dichloride, 19.9; toluene, impurities, 35.6. A water and alcohol solution of this mixture was administered subcutaneously to 5 groups of rabbits as follows: Groups 1 and 2, single dose of 800 and 400 mg/kg, respectively; Groups 3, 4 and 5, 50, 15 and 5 mg/kg, respectively, daily, 5 days/wk. Animals of Group 1 died within 18-24 hr, showing effects on the central nervous system. Rabbits of Group 2 died after 5-16 days with symptoms of irritability, diffuse tremor, followed by paresis of the backside and muscle contractions of the neck. Rabbits of Group 3 died after the 4th-15th injection with signs of agitation, irritability, diffuse tremors, muscular contractions of the neck, and spastic paralysis of the hind limbs with inability to remain erect. Animals of Groups 4 and 5 survived longer. Examination of blood and liver and kidney functions revealed no alterations in Group 4 until the 10th injection. Between the 12th and 18th injection, nervous symptoms appeared. Administration of the mixture was discontinued and the animals died 1 and 2 days thereafter. Rabbits of Group 5 survived beyond the 180th injection with the exception of 2 animals that died after the 96th and 162nd dose, respectively, probably due to toxic effects on the nervous system and liver. All animals of Group 5 showed a slight hypochromic anemia which was statistically significant, and alterations of the liver functions which were statistically not significant. Control animals treated with the water and alcohol solution (5:5) showed no neurologic symptoms or other changes.
- The experiments show that doses of TML producing acute or subacute intoxication affect predominantly the nervous system. With lower doses, the neurotoxic effects are not constant or evident, but blood changes and alterations of liver and kidney function are produced.
- 1121 Combrisson, A., Desoille, H., and Albahary, C. (Inst. Occup. Health, Paris, France): Durée de vie des hématies et incorporation du fer radioactif dans le saturnisme expérimental du lapin. (LIFESPAN OF RED BLOOD CELLS AND INCORPORATION OF RADIOACTIVE IRON IN EXPERIMENTAL LEAD POISONING IN THE RABBIT.) In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Vol. II: 755-60, 1964.
- Subacute Pb intoxication was induced in 24 male rabbits by intraperitoneal injection of 6 mg Pb/kg body weight as Pb acetate for 19-23 days, while 12 other rabbits were subjected to chronic Pb poison-

ing by gastric administration of Pb acetate 3 times/wk for 3 mo so that each animal absorbed ~500 mg Pb. Both groups showed only slight blood changes compared with controls. The lifespan of red blood cells was moderately but significantly shortened in the intoxicated animals. In chronic Pb poisoning, utilization of Fe for the hemoglobin synthesis was slightly but significantly diminished.

- 1122 Corsi, G.C., Galzigna, L., and Brugnone, F. (Univ. Padua, Italy): Sul metabolismo del triptofano nell'intossicazione sperimentale da piombo tetraetile. (TRYPTOPHAN METABOLISM IN EXPERIMENTAL TETRAETHYLLEAD INTOXICATION.) *Medicina del Lavoro* 55: 665-78 (Nov.), 1964.

This study is a continuation of previous investigations by Galzigna and Brugnone on TEL poisoning in rabbits (1964).

One of the points needing clarification was whether ethanol as the solvent used earlier for TEL had any influence on the urinary elimination of 5-hydroxyindoleacetic acid (HIAA). TEL was therefore administered by inhalation; otherwise, the same experimental conditions were repeated. A larger number of determinations of kynurenic and xanthurenic acid were made in order to verify whether TEL had a significant influence on the metabolism of tryptophan to nicotinic acid. A statistical correlation was established between the volume of excreted urine and the amount of excreted HIAA in order to find out whether the decrease of HIAA in the urine reflects only a smaller quantity of urine. Histochemical methods were applied to elucidate whether monoamine oxidase (MAO) is inhibited by TEL in vivo (its in-vitro inhibition by TEL had been shown by Magistretti et al. in 1962) by comparing the effects of TEL and a known MAO-inhibitor (Marplan).

Groups of 4 adult male rabbits, weighing 2.5 kg each, were subjected to one of the following treatments: (1) inhalation of 1 mg TEL/l air for 30 min/day for 12 days (subacute intoxication); (2) intramuscular administration of 5 ml ethanol/rabbit/day for 12 days; (3) oral administration of 25 mg 1-benzyl-2-(5-methylisoxazolylcarbonyl)-hydrazine (Marplan)/rabbit/day for 20 days; (4) im doses of 20 mg 5-hydroxytryptophan (HTP)/rabbit/day following inhalation of 1 mg TEL/l for 30 min daily; (5) im injection of 2.5 mg Serpasil to each of 4 normal rabbits, 4 rabbits exposed to 1 mg TEL/l for 1 hr/day for 3 days, and to 4 rabbits given orally 100 mg Marplan, twice/day for 4 days. Each group was paired with a control group. The metabolites of tryptophan were determined and the organs of normal, TEL- and Marplan-treated animals were examined histochemically.

On the basis of 485 determinations on 84 rabbits, a statistically significant correlation was found by covariance analysis between the amount of HIAA excreted in the urine and the volume of urine passed by the rabbit. Inhalation of TEL did not seem to influence significantly the elimination of HIAA whereas ethanol and Marplan caused a significant decrease. However, a significant decrease in urinary HIAA was observed in 11 TEL-poisoned rabbits when only the first 2 days following TEL inhalation were considered. TEL also caused a re-

duction in the volume of urine. Treatment with HTP or Serpasil caused no significant differences in elimination of HIAA when TEL-poisoned and control rabbits were compared. No significant difference was found in the urinary excretion of kynurenic and xanthurenic acid in rabbits subjected to TEL inhalation and in normal animals. Histochemical examination of MAO activity in the liver, lung, kidney, brain and intestine of normal, TEL- and Marplan-treated rabbits revealed no differences between the control and TEL-poisoned rabbits while an inhibition was evident in the Marplan-treated animals.

The conclusion was drawn that TEL does not affect the metabolism of tryptophan to nicotinic acid by inhibiting MAO in vivo, but that it probably blocks the pathway of HIAA at a step below that regulated by MAO. Further, the determination of HIAA is therefore not suitable for an evaluation of the effects of TEL poisoning.

- 1123 Cremer, J.E. (Med. Res. Council Lab., Carshalton, Surrey, England): AMINO ACID METABOLISM IN RAT BRAIN STUDIED WITH  $^{14}\text{C}$ -LABELLED GLUCOSE. *Journal of Neurochemistry* 11:165-85 (March), 1964.

In addition to measuring specific activity of amino acids which quickly become labelled from  $^{14}\text{C}$  glucose in normal animals, the effect of 2 neurotoxic compounds (triethyl-Sn and triethyl-Pb) on this labelling was studied. Male Porton albino rats weighing 195-210 g were used and given either triethyl-Sn sulfate (TrESn) (7.5 mg/kg body weight) or triethyl-Pb chloride (TrEPb) (15 mg/kg body weight) as 0.9% (w/v) saline solutions by intraperitoneal injection. In each set of experiments in vivo, control rats were isolated at the same time as these experimental animals. Animals were sacrificed, brain removed and prepared for analysis. Each rat received 10  $\mu\text{Ci}$  ( $\text{U-}^{14}\text{C}$ ) glucose in either 0.1 or 0.2 ml saline by intravenous injection and were sacrificed at selected time intervals.

In the labelling of amino acids in brain using ( $\text{U-}^{14}\text{C}$ )glucose as the isotopic precursor, good agreement was found between the 2 systems, brain cortex in vitro and brain of rats in vivo. In both,  $\gamma$ -aminobutyric acid had the highest specific activity (~1.1 relative to that of glutamic acid, glutamine and aspartic acid ~1/2). This pattern of labelling was quite different from that obtained using glutamate as the radioactive source.

Both TrESn and TrEPb altered amino acid metabolism of brain slices in an identical manner. Their effects in vivo were distinct for each compound. Since one is a depressant and the other an excitant biochemical changes observed in vivo were probably related to behavioral changes. Brain slices prepared from animals given either neurotoxic agent showed an abnormal amino acid metabolism but there was no longer agreement between the results of in vivo and in vitro type experiments. (46 references)

- 1124 Cuccurullo, L. (Univ. Padua, Italy): Contributo allo studio della tubulo-nefrosi da piombo. II. Osservazioni al microscopio elettronico sulla nefrosi sperimentale da acetato di piombo dopo quattro

settimane di trattamento. (CONTRIBUTION TO THE STUDY OF TUBULONEPHROSIS DUE TO LEAD. II. ELECTRON MICROSCOPIC OBSERVATIONS ON EXPERIMENTAL NEPHROSIS DUE TO LEAD ACETATE AFTER 4 WEEKS OF TREATMENT.) Rivista di Anatomia Patologica e di Oncologia (Padova) 26:127-42 (Aug.), 1964.

Alterations of the epithelial cells in the renal tubules were studied by electron microscopy in 20 adult rats, injected intraperitoneally with 20 mg/kg body weight of Pb acetate daily for 4 wk. The results obtained indicated that the alterations caused by Pb were not induced by spasms of the arterioles but were due to a typical tubular nephrosis, without the characteristics of an unspecific toxic nephrosis. The changes are illustrated in 10 photomicrographs.

- 1125 Cuccurullo, L., and Covelli, V. (Univ. Naples, Italy): Primi rilievi ultrastrutturali sulle modificazioni del sistema mitocondriale dell'epitelio renale provocate sperimentalmente da un sale di metallo pesante (acetato di piombo). (PRELIMINARY ULTRASTRUCTURAL DATA ON THE CHANGES IN THE MITOCHONDRIAL SYSTEM OF THE RENAL EPITHELIUM INDUCED EXPERIMENTALLY BY A HEAVY METAL SALT (LEAD ACETATE).) Bollettino della Società Italiana di Biologia Sperimentale 40, Suppl.:1851-3 (Dec. 31), 1964.

In investigations of the ultrastructure of the nuclear inclusions encountered in the kidney in Pb poisoning, the cytoplasmic changes have been scarcely studied. By some they have been considered to be of secondary importance and the result of the nuclear alterations. For these reasons, the authors undertook preliminary studies on the cytoplasmic changes.

Adult rats were given intraperitoneal injections of Pb acetate in physiologic solution at a dose of 20 mg/kg body weight/day. The animals were killed after the 1st, 2nd and 3rd injection, respectively, and kidney sections were prepared for examination under the electron microscope. The architectural structure of the cells was preserved; there were some dilatations and vacuoles at the basal part, but the formations at the apex appeared to be normal. At a greater magnification, marked alterations in the mitochondrial structure were seen. At the perinuclear zone, ovoid formations were noted which contained fibrous material, granules and droplets of osmophilic material. These formations which were surrounded by clear cytoplasmic matrix that was vacuolized in many places, were often found next to the Golgi apparatus, the vesicles of which were dilated. The ergastoplasmia apparatus consisted essentially of a structure with a smooth membrane which in many places was so dilated that it gave the appearance of vesicles, many of which contained granular and strongly electropaque material. The nuclei were surrounded by a fine but distinct nuclear membrane and contained little chromatin which was distributed irregularly in small amounts. Not all the sections tested contained nuclear inclusions.

The conclusion was drawn that the nuclear inclusions are not the cause of the cytoplasmic changes and that the vacuoles at the basal portion

constitute an aspecific alteration which is caused by the endocellular osmotic disequilibrium which occurs in numerous paraphysiologic and clearly pathologic conditions. The mitochondrial alterations are similar to formations occurring in pathologic kidneys and livers and those in initial cytolysis. (The electron microscopic findings are shown in 4 figures.)

- 1126 Dallenbach, F.D. (Dartmouth Med. School, Hanover, N.H.): Phenolrotausscheidung und Trypanblauspeicherung bei der Blei-Nephropathie der Ratte. (EXCRETION OF PHENOL RED AND UPTAKE OF TRYPAN BLUE IN LEAD NEPHROPATHY OF THE RAT.) Virchows Archiv für Pathologische Anatomie und Physiologie und für Klinische Medizin 338, No. 2:91-110, 1964.

In the nuclear inclusions, described to occur in the renal tubules of man and animal after chronic Pb poisoning, the presence of ribonucleic acids, proteins, lipids and occasionally some carbohydrates has been demonstrated by numerous authors. As the Pb content of these inclusions is apparently very small, direct histochemical determination of Pb has so far been unsuccessful, although the author has recently detected it by use of  $^{210}\text{Pb}$  (to be published). The experiments now reported were done to determine a possible functional disturbance of the tubular epithelial cells containing these inclusions.

Six male and 4 female Sprague-Dawley rats, weighing 211-451 g, were given a 1% aqueous solution of Pb acetate as drinking water for 20.5-25 mo (the total quantity of Pb ingested by the rats is not stated). Three male and 2 female rats as controls were given normal drinking water. A sterile physiologic saline (1 ml/200 g) containing 6 mg phenol red/ml was injected into the tongue and femoral veins of the animals during 5-10 sec, and after 45-50 sec the left kidney was removed, and the right, after 4-5 min. A 2nd series of 7 male and 9 female rats were given the Pb acetate-containing drinking water for 19-23 mo, and 48 and 24 hr before sacrifice, were injected intraperitoneally with saline containing 10 mg trypan blue/ml, while 3 male controls received normal drinking water.

The kidneys were studied with a magnifying glass and light microscope. The degree of pathologic changes observed in the kidneys varied from animal to animal as well as within any one kidney. The changes were more or less pronounced dilatation of the tubules up to cyst formation, hyperplasia of the epithelia and development of adenoma, deposition of blood pigment in the cytoplasm of the tubular epithelia, interstitial fibrosis, chronic inflammation, vascular changes and formation of crystals and calculi in the tubule. The presence of nuclear inclusions in many of the cells of the proximal tubule was a prominent feature. From the histologic findings, which are described in detail, the conclusion was drawn that the nuclear inclusions had not changed the cytoplasm either morphologically or functionally to a degree sufficient to hinder the active transport of phenol red by the cells of the renal tubules. The tests with trypan blue indicated that the largest and coarsest dyestuff particles occurred in the proximal tubules

and the fewest and finest in the distal tubules. The accumulation of particles of trypan blue in some epithelia was so large that it appeared as if these cells had phagocytosed beyond their capacity, resulting in cell destruction and necrosis. Whether this accumulation of trypan blue particles in the cells was due to the aging of the cell or to the effect of Pb or trypan blue on the kidney could not be decided. The controls did not show any necrotic tubules.

In summary, only the cells with large nuclear inclusions and swollen granular cytoplasm transported the dyes poorly or not at all. In discussing the origin and significance of the Pb-containing inclusions, the hypothesis was advanced that they represent the interaction of Pb with nucleolar material and ribosomal precursors. The possibility of a correlation between chronic Pb poisoning and the development of renal tumors was pointed out.

- 1127 Dantchev, D., Gajdos, A., and Bénard, H. (Natl. Acad. Med., Paris, France): Action protectrice de l'inosine à l'égard de l'hémolyse réalisée chez le lapin par l'intoxication saturnine ou phénylhydrazinique. (PROTECTIVE ACTION OF INOSINE AGAINST HEMOLYSIS IN THE RABBIT DUE TO LEAD OR PHENYLHYDRAZINE POISONING.) Comptes Rendus Hebdomadaires des Seances de l'Académie des Sciences 259, No. 2:433-6, 1964.

In an earlier communication the authors had shown that adenosine-5'-monophosphoric acid retarded the destruction of erythrocytes in Pb-induced anemia or in that caused by phenylhydrazine. The experiments now reported indicate that a similar action is obtained by inosine.

Rabbits, weighing ~3 kg each, were injected intravenously with 150  $\mu$ Ci radioactive chromium ( $^{51}\text{Cr}$ ) as neutral sodium chromate in an isotonic solution in order to label erythrocytes in vivo. The following day and every 5 days thereafter 1.5 ml blood was collected from the ear vein and heparinized; 0.5 ml was centrifuged, washed with physiologic serum, suspended in 1 ml distilled water and measured with a scintillation counter. The suspension was then diluted to 100 ml with distilled water and hemoglobin was determined spectrophotometrically. Twelve to 15 days after Cr injection the animals were given 3 or 4 daily intramuscular injections of 100 mg neutral Pb acetate (or 5 or 15 mg phenylhydrazine subcutaneously)/kg. Half of the groups were treated with daily intramuscular injections of 30 mg inosine. In the animals not treated with inosine, the survival time of red blood cells dropped from 60-51 days while it remained at the normal level of 60 days in those so treated. Similar results were obtained in the phenylhydrazine-treated animals.

The conclusion was drawn that inosine protects red blood cells against destruction by Pb and phenylhydrazine.

- 1128 Dorfman, R.I. (Worcester Foundation for Exptl. Biology, Shrewsbury, Mass.): ANTI-ANDROGENIC ACTIVITY OF TETRA-N-BUTYLLEAD IN A MOUSE ASSAY. Proceedings of the Society for Experimental Biology and Medi-

cine 116:1055-7 (Aug.-Sept.), 1964.

The comparative antiandrogenic activity of progesterone and tetra-n-butyllead in testosterone-stimulated castrated Swiss albino mice was studied in 4 experiments. The test material was injected subcutaneously, in aqueous suspension, once daily for 7 days starting on the day of the operation. Tetra-n-butyllead was inactive at total dose levels of from 0.1-2.5 mg, but was active in one of 2 trials at 5 mg; significant inhibition of androgenic activity was found in each of 2 trials at 10 mg and in a single trial at 20 mg. Tetra-n-butyllead was studied also for other possible hormonal activities. It was not estrogenic when administered at doses up to 100  $\mu$ g in the immature mouse and it was inactive as an antiestrogen at a dose level of 3 mg in the estrone stimulated immature mouse. It is concluded that the compound is neither an estrogen nor an antiestrogen under the conditions of the experiments.

- 1129 Ferencik, M. (Vet. Res. Inst., Bratislava, Czechoslovakia): (DETERMINATION OF INORGANIC POISONS BY PAPER CHROMATOGRAPHY AND HIGH-VOLTAGE PAPER ELECTROPHORESIS.) Ustav Vedeckotech. Inform. Min. Zemedel. Lesního Vodního Hospodarství, Veterinary Medicine 9, No. 1:43-54, 1964.

Guinea pigs were used in the determination of toxicity of individual inorganic compounds. Salts of As, Hg, Ba, Cu, Pb, Zn, Al, and Tl were used in concentrations to kill the animals within 3-4 hr. The solutions were administered through a tube into the stomach. Various solvent systems and detection reagents were examined in determining toxicologically important cations in the stomach contents and in the organs of experimentally poisoned guinea pigs. Some of the reagents were also used in direct estimation of inorganic substances by drop-tests on paper. (From Chemical Abstracts 61:2383, 1964)

- 1130 Gabbiani, G., Caruso, P.L., and Tuchweber, B. (Univ. Montreal, Canada): Trombosis de la aurícula izquierda producida en la rata por el acetato de plomo y la metoxamina. (LEFT AURICLE THROMBOSIS PRODUCED IN THE RAT WITH LEAD ACETATE AND METHOXAMINE.) Prensa Medica Argentina 51:849-52 (Oct. 9), 1964.

Thirty albino Holtzman rats, initial weight 94-105 g, were divided into 3 equal groups. Animals in Group 1 received an intravenous injection of 5 mg Pb acetate in 1 ml distilled water; rats in Group 2 were injected subcutaneously with 3 mg/rat of methoxamine in 0.5 ml water, and Group 3 received the Pb acetate dose, directly followed by methoxamine. The animals were killed on the 6th day. Neither Pb acetate alone nor methoxamine alone produced thrombosis in the auricle. Pb acetate alone caused no renal lesions while 60% of the rats treated with methoxamine had renal lesions of grade 1.0. Mortality in these 2 groups was 10%. The combined treatment caused thrombosis of the auricle in 80%, renal lesions in 100%, and the mortality rate was 30%. Thrombosis of the left ventricle also occurred, but with less frequency. Histologically, the thrombus consisted of a fibrinous plaque with calcium deposits and frequently



adhered to the wall of the auricular appendage. The calcium deposits occurred in erythrocytes and granulocytes; a mucopolysaccharide material was also noted. Histologic examination of the kidneys revealed necrosis of the tubules and calcification at the periphery.

In discussing the results, the authors state that the mechanism of thrombus formation in the heart is unknown. Neither Pb nor methoxamine appear to act on the coagulation of blood. Stasis could be a factor favoring the precipitation of Ca phosphate.

- 1131 Gajdos, A., and Gajdos-Török, M. (Hôtel-Dieu Hosp., Paris, France): Études de l'activité de l'acide  $\delta$ -aminolévulinique-synthétase dans les mitochondries des hépatocytes de lapin et de rat blanc intoxiqués par l'acétate de plomb. (ACTIVITY OF  $\delta$ -AMINOLEVULINIC SYNTHETASE IN HEPATIC-CELL MITOCHONDRIA OF RABBITS AND WHITE RATS POISONED WITH LEAD ACETATE.) *Revue Française d'Études Cliniques et Biologiques* 9, No. 6:629-32, 1964.

The activity of  $\delta$ -aminolevulinic acid (ALA)-synthetase was studied quantitatively in mitochondria isolated from hepatic tissue of Pb-poisoned rabbits and rats, using the technique of Granick and Urata. Adult rabbits and white rats were given a single intraperitoneal injection of 100 mg Pb acetate/kg body weight and sacrificed within 1-18 days after administration. Urinary excretion of ALA, porphobilinogen (PBG) and coproporphyrin (CP), protoporphyrin content in the red blood cells, Pb content in several samples of mitochondria and ALA-synthetase activity were determined in experimental and normal rabbits and rats, and in rats intoxicated by gastric tube with 300 mg/kg of 3,5-dicarbethoxy-1,4-dihydrocollidine/day. The activity of ALA synthetase was expressed as  $\mu$ M ALA formed/mg protein of the mitochondrial preparation. It was not measurable in the Pb-poisoned rabbits and rats nor in the controls (5 rabbits and 12 rats), with the exception of 2 normal rabbits where a faint activity, amounting to 2.1 and 3.1  $\mu$ M, respectively, was found. In contrast, ALA-synthetase activity in collidine-poisoned rats was 16.6 after 5 days and 12.0 after 7 days. Urinary ALA, PBG and CP and erythrocytic protoporphyrin were distinctly increased in all Pb-poisoned animals as was the Pb content of mitochondria as determined in 2 Pb-intoxicated rabbits.

The results confirm the authors' earlier findings that the accumulation of porphyrins and their precursors in Pb poisoning is not due to an acceleration of their synthesis. The only possible present explanation of this accumulation is that Pb inhibits the utilization of protoporphyrin for heme synthesis.

- 1132 Gajdos, A., Gajdos-Török, M., Dantchev, D., and Bénard, H. (Hôtel-Dieu, Paris, France): Effet de l'inosine et de l'acide adénosine-5'-monophosphorique sur l'anémie et les facteurs qui la déterminent chez le lapin intoxiqué par le plomb. (EFFECT OF INOSINE AND OF ADENOSINE 5'-MONOPHOSPHORIC ACID ON ANEMIA AND THE FACTORS THAT CON-

TROL IT IN THE RABBIT POISONED WITH LEAD.) *Nouvelle Revue Française d'Hématologie* 4, No. 3:383-94, 1964.

Anemia induced in experimental Pb poisoning is defined by the authors as being due to (1) inhibition of hemesynthetase, an enzyme that catalyzes incorporation of Fe into protoporphyrin, (2) inhibition of erythropoiesis and (3) partial hemolysis of the red blood cells which shortens their survival time. These 3 factors were favorably influenced by the administration of adenosine 5'-monophosphoric acid (AMP) or inosine, as demonstrated in the Pb-poisoned rabbit.

Sixteen adult rabbits, weight  $\approx$  3 kg each, were given a single intramuscular injection of 100 mg Pb acetate/kg body weight. Starting on the following day, 8 of these animals received daily intramuscular doses of 100 mg AMP for 1 mo. Examination of the blood of the 7th, 12th and 25th day showed that no anemia had developed in the AMP-treated rabbits, while in the untreated (controls) the number of red blood cells and the content of hemoglobin was decreased. Likewise, the myelogram on the 8th day showed an erythropoietic hypoplasia in 2 controls, but no alterations in the 2 given AMP. In addition, in the controls the curve of maturing erythroblasts showed a shift to the left while in AMP-treated rabbits the curve was identical with that of normal rabbits.

The survival time of the red blood cells was determined, by means of intravenously injected radioactive Cr, in 11 Pb-poisoned rabbits of which 4 had been treated with AMP. While the survival time of the red blood cells in the untreated Pb-poisoned rabbits was markedly reduced, it was normal in those treated with AMP or inosine.

The effect of AMP and inosine on the activity of hemesynthetase, which had previously been studied by the author *in vitro* (1959), was examined in 16 adult rabbits poisoned by Pb as above. When 8 of these animals were subsequently given daily intramuscular injections of 100 mg AMP for 1 mo, their urinary content of  $\delta$ -aminolevulinic acid, porphobilinogen and coproporphyrin significantly decreased after the 3rd day. Uroporphyrin did not appear in the urine until the 25th day after intoxication with Pb and its excretion was also significantly less in the AMP-treated rabbits compared with the untreated ones. The results were confirmed in another series of tests using 10 rabbits. The mechanism of these reactions is discussed.

- 1133 Galzigna, L., Brugnone, F., and Corsi, G. C. (Univ. Padua, Italy): Escrezione di acido 5-idrossindolacetico nell'intossicazione sperimentale da piombo tetraetile. (EXCRETION OF 5-HYDROXYINDOLEACETIC ACID IN EXPERIMENTAL INTOXICATION WITH TETRAETHYLLEAD.) *Medicina del Lavoro* 55:102-6 (Feb.), 1964.

Abnormalities in the urinary excretion of indole derivatives occur in various disorders of the central nervous system. Since tetraethyllead (TEL) is one of the substances inhibiting monoamine oxidase which breaks down serotonin to 5-hydroxyindoleacetic acid (HIAA), the rate of urinary excretion of this acid was deemed of interest from the point of view of diagnosis of TEL poisoning.

Twelve adult male rabbits, weighing 2-3 kg were used in the experiments. Intoxication was effected by daily injections of 50 mg/kg TEL, dissolved in absolute ethyl alcohol; controls were injected only with the solvent. The mean (20 analyses per animal) urinary excretion of HIAA in normal rabbits, ethanol-administered controls and intoxicated animals, of  $714 \pm 160$ ,  $552 \pm 108$  and  $288 \pm 87$   $\mu\text{g}/24$  hr, respectively, demonstrated a significant difference only between the control and TEL-poisoned animals. The urinary excretion of Pb, coproporphyrin, xanthurenic and kynurenic acids was also determined (the last 2 on 2 rabbits). By considering the relative values in individual animals, in the TEL-intoxicated rabbits showing a statistically significant decrease in the elimination of HIAA, only a slight increase in coproporphyrin and a moderate one of Pb was observed. On the other hand, a less marked decrease in the elimination of HIAA was accompanied by noteworthy increases in urinary porphyrin and Pb. Elimination of kynurenic and xanthurenic acids was markedly increased in both cases.

The conclusion was drawn that in general TEL alters the metabolism of tryptophan, since a block in the pathway of the hydroxyindoles involves increased elimination of the amino acid by another pathway, ie, kynurenine. The increased elimination of xanthurenic acid could also reflect a block at some stage of this other pathway such as occurs in vitamin B<sub>6</sub> deficiency. The authors suggest that the block is probably connected with the inhibition by TEL of monoamine oxidase which catabolizes serotonin in the brain, and that the determination of one of the above metabolites may be useful in the clinical diagnosis of TEL poisoning.

- 1134 Gontzea, I., Sutzescu, P., Cocora, D., and Lungu, D. (Inst. Med. Pharm., Bucharest, Romania): Importance de l'apport de protéines sur la résistance de l'organisme à l'intoxication par le plomb. (IMPORTANCE OF DIETARY PROTEINS ON THE RESISTANCE OF THE ORGANISM TO LEAD POISONING.) Archives des Sciences Physiologiques (Paris) 18: 211-24, 1964.

Experiments were carried out on male white rats, weighing  $\sim 200$  g each. Two series of tests were made, 1 during January to April, the 2nd during May to July. In each series, 4 groups of 10 rats each were fed for 2 wk an adequate diet containing  $\sim 18$  g protein/100 g feed. Groups 1 and 2 were continued on this diet throughout the experiment while Groups 3 and 4 received a diet containing 9 g protein/100 g feed. Simultaneously, the rats of Groups 1 and 3 were subjected to Pb poisoning, by injecting them subcutaneously, every other day for 3 mo, with 10 mg/kg body weight of a 1% solution of basic Pb acetate. All animals gained weight during the first 2 wk of intoxication but the rats on the protein-deficient diet gained only half as much as those on the adequate protein diet. After 1 mo of intoxication the weight of the rats on the protein-deficient diet was below their initial weight while that of the rats on the adequate protein diet had increased by 5%. The weight differences in the 2 groups became more pronounced as the intoxication progressed. At the end of 3 mo,

the weight of the rats on the adequate protein diet had increased 6% and that of the rats fed the protein-deficient diet had decreased 14%. On the other hand, the weight differences between the control and experimental groups, fed the adequate protein diet, were not significant, even after 12 wk of Pb administration. The conclusion was drawn, therefore, that the toxicity of Pb is much greater under conditions of a protein-poor diet than under those of a diet adequate in proteins.

There were significant decreases of erythrocyte count and hemoglobin content on both the adequate and reduced-protein diets. After a period of 1 mo, the erythrocyte count had decreased by 6 and 14%, respectively, and the hemoglobin content by 10 and 19%, respectively. After 3 mo, the corresponding figures were 16 and 30%, and 29 and 39%, respectively. In all cases, the decrease of hemoglobin was greater than that of the erythrocyte number.

Determination of the amount of Pb retained by liver, kidney, spleen and tibia showed that rats fed the protein-deficient diet, retained 40-73% more Pb in liver, spleen and tibia than rats receiving the adequate protein diet, whereas no significant differences of retained Pb were found for the kidneys. The fact that the Pb concentration in the kidneys in  $\mu\text{g}/\text{g}$  was about twice as high as in the tibia and  $\sim 7-8$  times as high as in the liver, demonstrates that Pb is eliminated from the body by the kidneys. Therefore, the most frequent and most intensive damage in Pb poisoning occurred in the kidneys and the damage was greater under a regime poor in proteins.

The results of the experiments indicate that Pb affects the metabolism of the amino acids and that the severity of the poisoning is determined to a large part by the availability of proteins.

- 1135 Gontzea, I., Sutzescu, P., Stanciu, V., and Lungu, D. (Inst. Igiena, Bucharest, Romania): Vitamina C in intoxicatia cu plumb la cobai. (VITAMIN C IN LEAD POISONING IN THE GUINEA PIG.) Igiena (Bucharest) 13, No. 6:501-9, 1964.

Based on the finding that in man Pb exposure increases the requirements for ascorbic acid by 2-3 times, the effect of Pb poisoning on body weight, vitamin C content of the adrenal glands, erythropoiesis and accumulation of Pb in the liver, kidneys and tibia was studied in 88 young guinea pigs. The animals were divided into 4 groups; 2 groups received daily 0.5 mg and the other 2, 5 mg ascorbic acid. One group of each pair of groups was then poisoned by oral administration of 20 mg Pb acetate daily for 9 wk, the other groups serving as controls. In the poisoned guinea pigs, the 0.5-mg-dose of ascorbic acid was not sufficient. The animals lost 19.2% of their initial body weight while the controls maintained their weight, and vitamin C content of the adrenals was 37% lower in Pb-poisoned guinea pigs than in controls. Pb-poisoned animals fed 5 mg ascorbic acid/day increased their initial body weight by 6% but showed indications of Pb anemia. Pb accumulation in kidney and tibia was not affected by the high vitamin C intake while Pb contents in the liver were 54% higher than in the low-vitamin group. (From authors' English summary)

- 1136 Haeger-Aronsen, B. (Univ. Lund, Sweden): EXPERIMENTAL DISTURBANCE OF PORPHYRIN METABOLISM AND OF LIVER CATALASE ACTIVITY IN GUINEA PIGS AND RABBITS. *Acta Pharmacologica et Toxicologica* 21, No. 2:105-15, 1964.

The excretion of porphyrin and their precursors and the activity of liver catalase was studied in the following groups of animals: (1) 8 apparently healthy guinea pigs; (2) 9 guinea pigs poisoned with hexachlorobenzene; (3) 10 rabbits, weighing 2.6-3.8 kg, that had been given a single subcutaneous injection of a 4% aqueous solution of Pb acetate at a dose of 125 mg Pb acetate/kg body weight; (4) 5 rabbits given sulphonal, and (5) 5 rabbits given 3-amino-1,2,4-triazole. The animals were killed the day after the injection and the livers were removed for measurement of catalase activity which was expressed as mM of sodium borate decomposed by 0.5 ml of homogenate. Hepatic catalase activity was not affected in the Pb-poisoned rabbits; urinary levels of  $\delta$ -aminolevulinic acid and of coproporphyrin were markedly raised.

A table shows the excretion of porphyrins and their precursors, as well as the concentration of protoporphyrin in the erythrocytes and the activity of liver catalase in patients with acute intermittent porphyria and in animals with different types of experimental porphyria (including Pb-caused porphyria). Pb caused an increase in the concentration of erythrocytic protoporphyrin, the same as it occurs in congenital porphyria and erythropoietic protoporphyria.

- 1137 Hass, G.M., Brown, D.V.L., and Shakerin, M. (Presbyterian-St. Luke's Hosp., Chicago, Ill.): THE PRODUCTION OF RETINOPATHY IN RABBITS BY DIETARY INORGANIC LEAD. *Federation Proceedings* 23, Part 1:Abstract No. 2039 (Mar.-Apr.), 1964.

When 60 New Zealand male albino rabbits were fed a normal diet supplemented with 500 mg% of Pb acetate in water or linseed oil for 1-52 wk, a mild retinopathy developed within 8 wk which increased to a maximum within 30-40 wk. The retinopathy was characterized by a progressive manifold enlargement of retinal epithelial cells by an intracytoplasmic accumulation of closely-packed spherical yellowish brown bodies. They persisted for many months after the animals had been restored to a normal diet but were not accompanied by other lesions detectable by light microscopy. No specific relation was noted between the retinopathy and lesions produced elsewhere by ingestion of Pb. Male Wistar rats were refractory to its production. A group of >300 control rabbits, kept for several months on various toxic debilitating regimes, rarely developed retinopathy of a similar type and then only to a mild degree.

- 1138 Hass, G.M., Brown, D.V.L., Eisenstein, R., and Hemmens, A. (Presbyterian-St. Luke's Hosp., Chicago, Ill.): RELATIONS BETWEEN LEAD POISONING IN RABBIT AND MAN. *American Journal of Pathology* 45:691-728 (Nov.), 1964.

Having found much speculation, but little experimental evidence of a relationship between Pb poisoning and various diseases as reported in the

literature, the authors undertook a comparison of the pathologic effects produced in the rabbit by prolonged ingestion of Pb with those attributed to Pb poisoning in man.

Male rabbits of the New Zealand albino, German Checker and Belgian Hare strains, 3 mo old, 5-6 lb weight, divided into 6 groups, were fed a basal diet of Purina rabbit chow with the following supplements: I - 16 rabbits received 500 mg% Pb subacetate (C.P.); II - 8, 10 g% boiled commercial linseed oil containing the standard "Pb drier" (0.20% Pb, 0.35% Mn, 0.30% Co naphthenates); III - 15, the same as Group I plus that of Group II; IV - 8, the same as Group III plus 300 mg% cholesterol; V - 20, no supplement; VI - 14, 300 mg% cholesterol. The rabbits were killed after 3-55 wk at intervals of 4-8 wk. Complete necropsies were done with special attention to various structures of the nervous system, retina, bone, muscle, kidney, and arterial system.

The results, as summarized and, at the same time, discussed in relation to findings in man were as follows. Hematologic studies: The most severe changes occurred during the first few mo in rabbits fed Pb acetate with or without linseed oil. There was a self-limited progressive anemia, characterized mainly by decreased hemoglobin and changes in various hematopoietic components. The white cell count did not change significantly, except in infections which were usually in the lungs though encephalitis and a generalized mild systemic inflammatory disease of unknown cause were common. This was seen in control animals with about the same frequency. The blood changes, except for those of infectious origin last described, were similar to those found in human cases in which, as a rule,  $\sim 100 \mu\text{g}\%$  Pb in the blood is indicative of toxicity, with manifestations increasing with increasing blood levels. As Pb accumulates in blood, hematologic changes include increased blood protoporphyrin with increased urinary coproporphyrin, as well as basophilic stippling, hypochromia and reduced number of red cells. In Pb poisoning, the rabbit and man are among the few species that exhibit interference with porphyrin metabolism and stippled erythrocytes.

Nephropathy: As seen in rabbits, it was remarkable only in the group on the basal diet plus Pb subacetate and was similar to that in man. The first signs appeared at 8-12 wk and a near maximum was reached after 28-36 wk. The changes consisted principally in an accumulation, first in the straight tubules and later in the convoluted tubules, of an intracytoplasmic brown granular pigment followed by the appearance of giant "anaplastic" tubular lining cells and eosinophilic intranuclear inclusion bodies. As the nephropathy became chronic, cortical subcapsular and radial scars developed in fairly direct proportion to the amount of Pb ingested and in inverse proportion to the amount of cholesterol in the diet. The latter observation is considered to require further study.

Osteopathy: There was no resemblance between the findings in young rabbits and rachitic changes in Pb-poisoned children nor was there any "Pb line" demonstrated microscopically or by X ray in the bones of the animals. There was, however, a retardation of formation of osteoid tissue and an increase of osteoclastic lacunar resorption of

bone. This was detected most easily in young animals and progressed over a period of 6 mo as the severity of nephropathy increased. Bone changes were insignificant in animals fed the basal diet plus the linseed oil mixture alone. The addition of linseed oil mixture to the Pb-subacetate-supplemented diet did not modify the Pb effects, but addition of cholesterol reduced the severity of the osteopathy.

Encephalopathy, myopathy, and neuropathy: The animals did not display any form of these diseases as they occur in infants and adults, respectively. Manifestations referable to these entities occurred also with frequency in control rabbits. It was concluded that Pb poisoning was responsible only for an increase in the severity and incidence of intercurrent myopathic disorders.

Retinopathy and other disorders: None of the visual and neuroretinal changes attributed to Pb poisoning occurred in the rabbit. The retinopathy observed reached a maximum after ~8 mo and was characterized by an accumulation of closely packed brown granules in the greatly expanded cytoplasmic volume of retinal epithelial cells. It occurred regularly at low levels of Pb ingestion and once developed, was either permanent or very slowly reversible upon return to a normal diet. Experiments in progress indicate that retinopathy is not necessarily specific for Pb poisoning and not reproducible in all species.

No specific arterial lesions attributable to Pb, alone, or with cholesterol were seen. Pb favored accumulation of Ca in areas of medial degeneration in the arch of the aorta; linseed oil and cholesterol added to Pb produced no aortic calcification. Atheromatous plaques were not conspicuous in any animal. As chronic Pb poisoning in man is reported to be related to renal and vascular changes, these aspects should be investigated more fully. These effects are considered to be related through some fundamental displacement by the Pb ion of one or more other ions governing normal metabolism.

Among other changes, the excessive splenic hemosiderosis encountered was occasionally complicated by accumulation of material assumed to be a ferric or Ca phosphate or both. Hyperplasia of the thymus and thyroid was seen in many animals on the Pb regime for many mo, and one developed a large thymoma. However, there was no tendency to renal neoplasms such as have been reported in rats. (63 references)

- 1139 Hemingway, R.G., Brown, N.A., and Inglis, J.S.S. (Univ. Glasgow, Scotland): EFFECTS OF DAILY ADMINISTRATION OF LEAD ACETATE AND ZINC SULFATE DURING PREGNANCY ON THE COPPER, LEAD, AND ZINC STATUS OF EWES AND THEIR LAMBS. *Research in Veterinary Science* 5:7-16, 1964.

In extension of their earlier study of the Cu metabolism in lambs (see Abstr. No. 1002) as affected by Pb, and other factors, the experiments here described were performed with 24 5-yr-old Blackface ewes (weight 96-107 lb), from a flock in which swayback occurred to the extent of 3-4 cases per 1200 sheep/yr. As based on the liver and blood Cu contents of dead ewes of the flock (5-20 ppm dry basis, and 0.4 ppm, respectively), their Cu status was relatively low. After mating, they were di-

vided into 3 groups and continued to graze together throughout the experiment. (Cu content in pasture, 13.5 ppm.) Group 1 received orally 250 mg Pb (as acetate)/day; Group 2, 2 g Zn (as sulfate)/day; Group 3, no treatment. Dosage was 6 days/wk for 5 mo, except for a 5-day lambing period. By the end of the experiment, a total of 30 g Pb or 240 g Zn had been given/ewe. The ewes were attacked by dogs in the 3rd mo of pregnancy; 2 aborted, and 3 failed to lamb; 3 of the Zn group died and 1 was slaughtered before lambing.

The Pb ewes gave birth to 9 lambs, 3 of which were stillborn, 1 aborted, and 2 bore no lambs. In the Zn group, 3 ewes died before lambing (1 with 2 and 1 with 1 fetus), 2 had no lambs, 3 bore 7 (1 aborted, 1 stillborn). All controls had lambs (15) of which only 1 was stillborn. All lambs were killed within 19 days of birth. Blood samples were taken from the ewes 11 times during pregnancy, and kidney, liver, brains were removed at death or sacrifice, and from all lambs.

The results showed that although the ewes were initially of low Cu status, Pb administration did not induce swayback in the lambs. However, the total Cu content of the liver and kidneys of both ewes and their lambs was reduced significantly. While Pb reduced the concentration of Cu in these tissues it also reduced the liver and kidney dry weights and this was an important factor in determining their total Cu contents. Zn sulfate did not alter the Cu content of the livers of the ewes. Significant correlations were found between the concentrations of Cu in the whole blood of the ewes and in the livers of ewes and lambs. Significant correlations were also obtained between both the concentrations and the total contents of Cu in the livers of ewes and their respective lambs.

In discussing the results, the authors note that although clinical swayback was not induced in lambs of ewes given Pb, this does not rule out the possibility that consumption of abnormal amounts of Pb by ewes over much longer periods might reduce the Cu in their bodies to the extent that swayback might occur. In addition, an abnormal Pb intake could be of greater importance when combined with a much lower concentration of Cu in herbage than that which was present in the herbage of these animals.

- 1140 Jensen, W.N., and Moreno, G. (Natl. Blood Transfusion Center, Paris, France): Les ribosomes et les ponctuations basophiles des erythrocytes dans l'intoxication par le plomb. (THE RIBOSOMES AND BASOPHILIC GRANULATIONS OF ERYTHROCYTES IN LEAD POISONING.) *Comptes Rendus de l'Académie des Sciences (Paris)* 258:3596-7 (Apr. 1), 1964.

Rats, guinea pigs and rabbits were poisoned with 200-300 mg Pb acetate/kg body weight, over a period of 3 wk. The basophilic granulations were studied under the electron microscope in unstained blood smears and in those stained with methylene blue. In the non-stained erythrocytes of Pb-poisoned animals a much higher than normal proportion of monoribosomes was found. In the stained erythrocytes basophilic granulations consisting of agglomerations of ribosomes were seen.

The results suggest to the authors a special change in these structures as the number of mono-

ribosomes increases considerably at the expense of the polyribosomes.

- 1141 Jordanidis, P.J. (Natl. Tech. Univ., Athens, Greece): Melete tes apekkriseos toy  $\delta$ -aminolevoylikoy oeeos kata ten peiramatiken dia molybdoy deaeteriasin epi koniklon. (EXCRETION OF  $\delta$ -AMINOLEVULINIC ACID IN EXPERIMENTAL LEAD POISONING IN THE RABBIT.) Archeion Iatrikon Epistimon 20: 325-34, 1964.

The excretion of  $\delta$ -aminolevulinic acid (ALA) was studied in 40 normal rabbits for 45 days and in 24 rabbits, poisoned with a 5% aqueous solution of Pb acetate for 181 days. Urinary ALA, as determined by the method of Mauzerall and Granick, increased in the course of Pb poisoning. The diurnal graphic curve showed peaks to occur on the 6th and 48th days.

The author proposes a change of legislation for occupational Pb poisoning by including a study of the biosynthesis of hemoglobin as a sign of early trouble.

- 1142 Kewitz, H., and Wermund, K. (Freie Univ., Berlin, Germany): Hemmung der Acetylierung von Sulfanilamid durch Schwermetalle und Arsen bei der Ratte. (THE INHIBITION OF ACETYLYATION OF SULFANILAMIDE BY HEAVY METALS AND ARSENIC IN THE RAT.) Archiv für Experimentelle Pathologie und Pharmakologie 247, No. 2:180-6, 1964.

The effect of Hg, Pb or As on the acetylation of sulfanilamide in vivo was studied in rats, weighing 120-200 g. The animals were injected intraperitoneally with 2, 3, 12, 24 or 48 mg sulfanilamide and the urine excreted in the following 24 hr was analyzed. Acetylation at 2 mg sulfanilamide was found to be 66%/rat and only 32% at 48 mg. Twenty rats injected with 24 mg sulfanilamide were fed simultaneously Pb nitrate at a dose of  $\sim 1$  g/animal/day. After 23 days, 9 rats had died; the remaining 11 excreted an average of  $27\% \pm 11.4$  of the sulfanilamide in acetylated form. The conclusion was drawn that acetylation was inhibited also in the presence of Pb. The reduced acetylation of sulfanilamide was explained as due to impaired synthesis of coenzyme A.

- 1143 Kosmider, S., Enek, Ya., and Gzhybek, G. (Med. Acad., Zabrze, Poland): Gistokhimicheskie issledovaniya shchelochnoi fosfatazy, kislot fosfatazy, adozin trifosfatazy i diaforazy operechno-polosatnykh myshsakh i myshtse serdtsa pri ostrom otravlenii svintsom. (HISTOCHEMICAL INVESTIGATION OF ALKALINE PHOSPHATASE, ACID PHOSPHATASE, ADENOSINETRIPHOSPHATASE, AND DIAPHORASE IN STRIATED MUSCLES AND IN MYOCARDIUM DURING ACUTE LEAD POISONING.) Gigiena Truda i Professional'nye Zabolovaniya 8, No. 11:29-35, 1964.

Of 8 adult chinchilla rabbits, 2000 g weight, 3 were used as controls, and 5 were subjected to acute Pb poisoning by intravenous injections of 6 mg Pb acetate/kg/day for 12 days, then killed by decapitation. Histochemical examination showed diaphorase activity to be reduced, the reduction being greater in the myocardium than in the skeletal muscle.

Adenosinetriphosphatase and alkaline phosphatase were also decreased in the walls of the small muscular vessels. This phenomenon was related to disturbances in the active transfer of the phosphate ion from the blood to the muscle fibers, thus explaining the disorder in resynthesis of phosphocreatinine in skeletal muscle. The observed increased activity of acid phosphatase was held to be the result of degenerative changes in the sarcoplasm.

The authors conclude that the enzymatic changes taking place may explain the mechanism of the muscular adynamia occurring in Pb poisoning. The less marked reduction in enzymatic activity in the skeletal muscle than in the myocardium is explained by the greater activity of the heart muscle which is therefore exposed to a greater effect of the Pb ion.

- 1144 Kotlyarevskaya, V.A.: Vliyanie uksusno-kislogo svintsy i dvukhloristoi rtuti na sodержanie otedel'nykh fraktsii vodorastvorimykh belkov nekotorykh tkanei krolikov. (THE EFFECT OF LEAD ACETATE AND BICHLORIDE OF MERCURY ON THE CONCENTRATION OF THE INDIVIDUAL FRACTIONS OF THE WATER-SOLUBLE PROTEINS OF SOME TISSUES OF THE RABBIT.) In Farmakologiya i toksikologiya (Pharmacology and toxicology) Zdorov'ya: Kiev. 1:222-7, 1964.

Rabbits were given a single administration of 100 mg/kg Pb acetate or 2 mg/kg of mercuric chloride ( $\text{HgCl}_2$ ). After Pb acetate administration, the amount of albumin in the protein of the liver and kidney decreased and that in the serum remained unchanged. Following  $\text{HgCl}_2$ , the content of albumin in liver and kidney increased and that in the serum decreased. The fractional composition of the muscle proteins was not affected in either case. (From Referativnyi Zhurnal, Otd. Vypusk Farmakol. Khimioterap. Sredstva Toksikol. 1966, No. 1.54.805; Biological Abstracts 48:Abstr. No. 49203, 1967)

- 1145 Kulik, G.I.: (EXPERIMENTAL ANALYSIS OF THE EFFECT OF Pb and Hg ON VARIOUS AGE GROUPS.) Voprosy Prom. i Sel'skokhoz. Toksikol., Kievsk. Med., Inst. 1964:122-31.

In the experiments with Pb, 3 groups of rats, aged 1 mo, 5-6 mo and 20 mo, respectively, were injected subcutaneously (sc), every other day for 18 days, with 50 mg/kg body weight of Pb as aqueous Pb nitrate solution. All the young rats died within 9 days, the old ones within 18 days, while some of the middle group survived for 26 days. In another series of tests, groups of rabbits, aged 2 mo, 12 mo and 30-36 mo, respectively, were injected daily for 10 days with 40 mg Pb/kg. Total blood proteins decreased in all age groups; the decline of the albumin to globulin ratio was of practically the same magnitude since the  $\beta$ -globulin subfraction in the old animals was 10% higher and the  $\gamma$ -subfraction in the 2 other age groups 2% higher. A similar effect was observed in 2 groups of old and middle-aged rabbits, administered a single sc dose of 200 mg/kg of Pb. (From Chemical Abstracts 63:7553, 1966)

- 1146** Kuz'minskaya, G.N. (Leningrad Res. Inst. Ind. Hyg. Occup. Dis., USSR): *Ekspierimental'nyi ateroskleroz na fone svintsvoi intoksikatsii.* (EFFECT OF LEAD POISONING ON EXPERIMENTAL ATHEROSCLEROSIS.) *Arkhiv Patologii* 26, No. 9:21-4, 1964. *Federation Proceedings, Translation Supplement* 24, Part II:833-5 (Sept.-Oct.), 1965.

Four groups of adult male rabbits (2.5-3 kg weight) were treated as follows: I received orally a 10% Pb acetate solution in a dose of 0.025 g/kg body weight every day for 2 mo, and after a 3-wk interval, for an additional 2 wk; II received orally 600 mg cholesterol/day for 3.5 mo; III received Pb as in I together with the cholesterol as in II; IV served as controls (normal). The dose of Pb used produced a moderate degree of Pb poisoning; none of the rabbits died during the experiment and erythrocyte counts changed little in groups I and II; those in III developed a slight anemia, and stippled cells and reticulocytes increased. I showed no changes in the weights of various organs; in II and III a slight tendency to increase in liver weight was noted, kidney and thyroid weights remained unchanged, but spleen and especially adrenal gland weights increased. The aorta and heart and coronary artery in I was not changed, out typical atherosclerotic changes were seen in groups II and III. Planimetric evaluation of the affected area of the aortic intima showed the atherosclerotic process to be more extensive and severe in III. Histiocytic infiltrates were observed in addition to atherosclerosis of the coronary arteries and fatty degeneration of the myocardium; lipidosis of arterial walls in the kidney was promoted as was development of nephrosclerosis. In the spleen atrophy of lymphoid follicles and proliferation of reticular stromal cells were observed; the severity of fatty degeneration in the liver and adrenal glands was increased. It is concluded that Pb poisoning promotes the atherosclerotic processes. (12 references)

- 1147** Makashev, K.K., and Kazachenko, L.V. (Acad. Sciences, Kazak, USSR): (DISTRIBUTION AND EXCRETION OF RADIOACTIVE CALCIUM IN HEALTHY AND Pb-POISONED ANIMALS.) *Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Meditsiny Nauk* 1:50-5, 1964.

Pb poisoning was induced in rats by the daily administration of 1 ml of a 2.5% solution of Pb acetate/kg body weight over a period of 4-5 mo. After the appearance of signs of intoxication, the experimental and control animals received orally radioactive  $^{45}\text{Ca}$ . The poisoned rats excreted less Ca in their feces than the controls, while urinary excretion of Ca was the same in both experimental and control rats. Considerably more Ca was deposited in the bones of the experimental rats.

- 1148** Makashev, K.K., and Rakhimova, Z.P. (USSR): *Raspredelenie i vydelenie  $\text{P}^{32}$  iz organizma zdorovykh i otravlenykh svintsom zhivotnykh.* (DISTRIBUTION AND EXCRETION OF PHOSPHORUS-32 IN HEALTHY AND LEAD-POISONED ANIMALS.) *Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Meditsinskikh Nauk* 1964, No. 2:44-9.

The authors considered it of interest to investigate the effect of Pb on the metabolism of P in view of the importance of P in metabolic processes and of the contradictory reports on the subject. In their experiments, 24 adult white rats, weighing 200-250 g were divided into 2 groups, one of which received daily for 4-5 mo 1 ml/kg of a 2.5% solution of Pb acetate. Both groups then received orally  $^{32}\text{P}$ . Radioactivity was measured daily for 5 days in urine, feces, as well as in the organs and tissues upon sacrifice of the animals.

The results showed that in the Pb-poisoned rats, less  $^{32}\text{P}$  was eliminated (22.31% of the administered dose) than in the controls (33.72%). The difference was obvious in the feces, since elimination of P in the urine was almost the same in both groups. Most of the  $^{32}\text{P}$  was eliminated in the first 2 days. In the organs and tissues,  $^{32}\text{P}$  was distributed irregularly, with bones showing greatest activity, followed by the liver, thyroid and kidney, with least amounts being shown in blood and brain. In comparing the % of  $^{32}\text{P}$  found, the only significant difference was a higher deposition in the bone of the Pb-poisoned rats. As Pb also deposits in bone, the authors conclude that there is a close relationship between the content of the Pb in bone and the metabolism of P in poisoning by Pb.

- 1149** Matioli, G.T., and Eylar, E.H. (Univ. S. California, School Med., Los Angeles): *THE BIOSYNTHESIS OF APOFERRITIN BY RETICULOCYTES.* *Proceedings of the National Academy of Sciences of the USA* 52:508-16 (Aug.), 1964.

The attempt to give direct proof of the synthesis of apoferritin within hemoglobin (Hb) forming cells was studied in male albino rabbits (7-8 lb weight), 1 group of which was injected sc with Pb subacetate 60 mg/lb every 2 days over a period of 15-20 days; some received in addition 30 mg Fe sulfate iv 3 times/wk for 2 mo. At the end of Pb treatment, acetylphenylhydrazine (APH) was injected to promote intense reticulocytosis. In other experiments, rabbits received turpentine to promote local aseptic inflammations; Fe followed by APH; controls were injected only with APH. After APH injection, blood was collected, reticulocytes separated and incubated with  $^{14}\text{C}$ -DL-leucine. Following digestion by ribonuclease, the Hb and ferritin were separated from the incubation mixture by centrifugation. As noted in the discussion, the results clearly established the ability of reticulocytes to synthesize apoferritin. The incorporation of leucine into apoferritin was markedly stimulated in Pb intoxication and turpentine treatment, whereas Hb biosynthesis was diminished, particularly at 30 min. (19 references)

- 1150** Matsushita, H. (Nat'l. Inst. Ind. Health, Kizuki-Sumiyoshi, Kawasaki, Japan): *RELATIONSHIP BETWEEN PHYSICO-CHEMICAL PROPERTIES OF METAL CATIONS AND THEIR ACUTE LETHAL DOSES TO RABBIT, RAT AND MOUSE.* *Industrial Health (Pub. Nat'l. Inst. Ind. Health, Kawasaki)* 2:1-10 (Mar.), 1964

The relationships between some physico-chemical properties and the acute lethal doses of various metal cations including Pb for rabbits, rats and

mice were studied. Data on the acute lethal doses of the chlorides and nitrates of the metals were taken from Spector's Handbook of Toxicology (1956). It was found that the acute lethal doses of the metal cations decreased linearly with increase of the logarithm of the stability constant of their chelates with ethylenediaminetetraacetate, the product of electronegativity and ionic charge of the metal cation and its standard electrode potential.

These results suggest to the authors that acute severe toxic action by most metal cations seems to be independent of the specific cation. This non-agreement with the generally accepted view that metal toxicity is rather specific for the kind of cation is explained as follows: in chronic poisoning the metal ions administered accumulate in the specific organs (thus demonstrating specific toxicity). In the determination of acute lethal doses, large amounts of the cation come in contact with all of the body tissues after entrance into the general circulation, forming in the tissues metal complexes with biologically important substances. Caution is expressed in attempting to define the toxicity of new substances on the basis of LD<sub>50</sub>'s.

- 1151 Mileshin, P. Ya.: (A STUDY OF THE CONCENTRATION OF SOME TRACE ELEMENTS IN THE BLOOD AND URINE OF ANIMALS UNDER EXPERIMENTAL CONDITIONS.) Nekotorye Voprosy Kardiologii, Mikroelementy, Voronezh, Sbornik 1964:96-8.

Rabbits, given a single intravenous injection of a mixture of Cu, sulfate and Ni, Pb and Zn nitrates in amounts 25 times in excess of these trace elements in the blood, tolerated this load very well. A 24-hr urine sample was taken on the 1st day of injection and a blood sample at the end of the 1st 24 hr. Zn, Pb and Ag concentrations were increased in blood and urine; Cu content in the blood was increased and decreased in the urine, and Mn and Ni were unchanged. (From Referativnyi Zhurnal, Biologiya Khimiiya 1964, Abstr. No. 22F822; Chemical Abstracts 62:15298, 1965)

- 1152 Minden, H., Zegarski, W., and Rothe, R. (German Inst. Occupational Med., Berlin, Germany): Fermentuntersuchungen bei experimenteller Bleivergiftung. (ENZYME STUDIES IN EXPERIMENTAL LEAD POISONING.) Internationales Archiv für Gewerbepathologie und Gewerbehygiene 20, No. 5:461-70, 1964.

The reaction of various enzymes in blood serum and liver was studied in 10 rabbits (5 males, 5 females) which had been administered intravenously 4 mg Pb/kg/day as Pb acetate, on 6 consecutive days. One animal died intercurrently. Before the start of the experiment and on the 8th day, 1.5 g of liver tissue was removed under anesthesia from the left and right part of the liver, respectively; a 3rd sample was taken from the center of the liver on the 15th day, after the animals had been sacrificed. In each case, blood was collected simultaneously. Five male rabbits, as controls, were subjected to the same treatment but did not receive Pb injections.

Data of the average activity in the 3 liver sam-

ples and in serum of experimental and control rabbits were tabulated for acid and alkaline phosphatase, glutamic oxaloacetic and pyruvic transaminase, hexokinase, creatinephosphokinase, catalase and glucose-6-phosphate dehydrogenase as well as data of hemoglobin, erythrocytes, reticulocytes, stippled basophils, siderocytes and body weight. Acid phosphatase increased appreciably both in liver and serum; alkaline phosphatase in the serum decreased to 1/10 of normal but remained practically unchanged in the liver. Serum glutamic oxaloacetic and pyruvic transaminase and glutamic pyruvic transaminase in the liver increased considerably during the acute stage of intoxication. Hexokinase, glucose-6-phosphatase and fructose-1, 6-diphosphatase did not show a definite trend; catalase was probably specifically inhibited. Glucose-6-phosphate dehydrogenase in the erythrocytes increased. All values rapidly returned to normal after discontinuation of Pb administration. The conclusion was drawn that no irreversible liver injury was caused by subacute Pb poisoning. (35 references)

- 1153 Molnar, J.J., and Gueft, B. (New York, N.Y.): OBSERVATION ON THE ULTRASTRUCTURE AND HISTOCHEMISTRY OF LEAD INDUCED INCLUSION BODY. In Forensic Immunology, Medicine, Pathology and Toxicology, Report of the Third International Meeting, April 16-24, 1963. Amsterdam, Excerpta Medica Foundation, 1964, pp. 136-7.

Rats were poisoned by iv and im injections of basic Pb acetate. Following iv Pb injections, electron microscopy studies showed a stippling in the red cells which was not ferritin, and accumulations of dense granules and an increase of ferritin in the Kupffer cells of the liver. Droplets of eosinophilic fat in the cytoplasm of the liver cells appeared <1 wk after Pb administration, and a well-formed intranuclear inclusion body with definite structural layers appeared 4 wk after Pb poisoning. Contact X-ray microscopy revealed no Pb in the inclusions. The findings were confirmed by histochemical tests and electron diffraction studies.

- 1154 Moskalev, Yu. I.: (DISTRIBUTION OF LEAD (THORIUM B) AFTER INTRA-ARTERIAL AND INTRAVENOUS INJECTION.) In Raspredelenie, Biologicheskoe Deistvie, Uskorenie Vyvedeniya Radioaktivnykh Izotopov. Moscow, Meditsina, 1964, pp. 161-4.

Experiments carried out with 11 rabbits showed that the distribution of <sup>212</sup>Pb varied with the method of its administration. Relatively more of it was found in the kidneys, liver, spleen, and blood after intravenous (iv) injection than after subcutaneous (sc) or intra-arterial. After iv injection it was most abundant in the kidneys, and after intra-arterial, in the kidneys and bone marrow on the side of the injection site. After intra-arterial injection, bone, bone marrow, and muscular tissue on the side of the injection site contained 10-18 times more activity than after iv or sc injection. The liver, kidneys, lungs, and spleen contained almost half as much <sup>212</sup>Pb after sc injection as after iv or intra-arterial injection, showing that absorption of the isotope from

sc tissue was comparatively slow and incomplete. The results of experiments on 15 rats show that the distribution of  $^{212}\text{Pb}$  differs markedly, depending on whether it is injected into the mesenteric or tail vein. A day after injection into the mesenteric vein, the liver contained 3.3 times more  $^{212}\text{Pb}$  than after injection into the tail vein. The author considers that his findings are significant not only because they indicate the nature of isotope distribution in relation to the route of entry into the body, but also because they may throw light on several problems in physiology pertaining to the mechanism of action of stimulants following iv and intra-arterial injection. (From Nuclear Science Abstracts 19:Abstr. No. 40333, 1965)

- 1155** Müller, H.A., and Stöcker, E. (Univ. Würzburg, West Germany): Autoradiographische Befunde an den "direkten" Kerneinschlüssen im Hauptstückepithel der Rattenniere nach experimenteller Bleivergiftung. (AUTORADIOGRAPHIC FINDINGS WITH RESPECT TO THE DIRECT INTRANUCLEAR INCLUSIONS IN THE CONVOLUTED TUBULES OF RAT KIDNEY AFTER EXPERIMENTAL LEAD POISONING.) *Experientia* 20: 379-80 (July), 1964.

The "direct" nuclear inclusions are defined as those occurring in the earlier stages of Pb poisoning, which, depending on age and size, lie freely and directly within the nucleus in the form of flocculent, vacuolar or cellular structures. In order to explore the relationship of these bodies to ribonucleic acid (RNA) and proteins, poisoning was induced in female albino rats by a 1% solution of Pb acetate given ad lib as drinking water for 170 or 142 days. The animals were sacrificed 20 min and 1 hr, respectively, after intraperitoneal injection of  $\text{H}^3$ -l-phenylalanine. The kidneys were fixed in 10% formalin for 48 hr and autoradiographed (using the stripping film). Both after cytidine and phenylalanine, the autoradiograms showed the cellular nuclear inclusions to be practically free of radioactivity. The same condition prevailed in the early stages of the inclusions, i.e., the flocculent-vacuolar precipitates. This is interpreted as an indication that in Pb poisoning no synthesis of RNA or protein occurs in the direct intranuclear inclusions; they must thus be considered as artificially inactive structures within the nucleus. However, radioactivity was seen in the nucleoli which shows that here synthesis occurs.

- 1156** Murphy, G.P., Sharp, J.C., Lawson, N.L., Greer, R.B., and Johnston, G.S. (Walter Reed Army Med. Center, Washington, D.C.): THE CHRONIC FUNCTIONAL AND MORPHOLOGIC ALTERATIONS CAUSED BY PROLONGED EXPERIMENTAL NEPHROTOXIC STATES IN THE RAT. *Investigative Urology* 1:529-51 (May), 1964.

A long-term experiment, using 117 male Sprague-Dawley rats, was designed to study the renal and systemic responses to chronic Pb ingestion and to an exposure to radiation, and to their possible interaction. The Pb group received a solution of 2% Pb acetate in their drinking water, ad lib for as long as 12 mo, the radiation group a single total body dose of 430 rads/rat and a 3rd group

received both the oral Pb and the radiation dosage. All 3 groups and their appropriate controls were sacrificed at 4, 5, 7, and 12 mo. Two initial pilot studies were carried out for 2 and 3 mo. Nuclear-inclusion bodies and deposits of yellowish-orange material were seen in the Pb group rarely after 2-3 mo, but they became more frequent and larger in size over the 12-mo period. Tubular dilatation and an apparent medullary pleomorphism appeared at 4 mo. In some instances, large cystic changes developed in the cortical-medullary areas. At 7 mo, an apparent metaplasia of the individual cells of the parietal layer of Bowman's capsule was noted. Renal adenomas formed under the combined influence of Pb and radiation in some animals. In this group a vascular fibrosarcoma with metastatic lung lesions was also formed. Two of 6 animals treated with Pb had pulmonary tumors at 12 mo. A significant decrease in renal uptake of  $^{197}\text{Hg}$ -neohydrin, which was not related to structural deformities, was seen in the Pb rats. Two-way analysis of variance showed an increase, with age as a significant interactive factor, of body weight, kidney weights, plasma total solids and urine-plasma osmolar ratios, and a decrease in plasma osmolality; balance studies were made during rest and periods of dehydration and increased fluid intake.

The conclusion was drawn that in chronic nephrotoxic states, a variety of retrogressive and reparative renal morphologic processes occur in the absence of azotemia. (28 references)

- 1157** Najean, Y., Ardailou, N., Mulmann, M., and Bernard, J. (St. Louis Hospital, Paris, France): Étude des compartiments non héminiques du fer. III. Cinétique du fer et synthèses héminique 'in vitro' dans le réticulocyte pathologique. (STUDY OF NON-HEMIN IRON COMPARTMENTS. III. KINETICS OF 'IN VITRO' IRON AND HEMIN SYNTHESIS IN THE PATHOLOGICAL RETICULOCYTE.) *Nouvelle Revue Française d'Hématologie* 4:55-68 (Jan.-Feb.), 1964.

Reticulocytes of blood from thalassemic patients, from rabbits and rats with hemolytic anemias, and rats with aplastic anemia were incubated in the presence of  $^{59}\text{Fe}$  and glycine-2- $^{14}\text{C}$ . The reticulocyte in hypochromic anemia fixes a large amount of Fe which is 1st used to build up the Fe reserves without increasing heme synthesis above normal. The cells in aplastic anemia behave like young reticulocytes with rapid changes in Fe and a normal rate of crude synthesis of heme. The same phenomenon was noted in Pb poisoning in rats, where there was also a decrease in de novo heme synthesis. In the in vivo studies, 3 groups of rats were given 1 intramuscular injection of 100, 200 or 250 mg/kg Pb acetate and  $^{59}\text{Fe}$ , and were killed at varying intervals of 2-20 days after injection. The blood findings were compared with those of controls killed on the same days. (55 references)

- 1158** Nigmatullina, N.K., and Odyets, R.N.: EFFECT OF Pb ON Cu METABOLISM IN GROWING WETHERS. *Obmen Veshchestv u Zhivotn. i Rast.*, Akad. Nauk Kirg. SSR 1964:69-72. Wethers, 5-6 mo old, maintained on a ration con-



taining 6.8-7.0 mg Cu/kg dry substance, were treated as follows: Group 1 were given daily 30 mg and Group 2, 60 mg Pb acetate; Group 3, 60 mg Pb acetate + 40 mg Cu sulfate. The Cu balance, determined after 180-210 and 360-390 days, was negative in Groups 1 and 2, and in controls in the 1st experimental period which was probably due to poor consumption of hay; negative only in Group 2, and positive in the remaining animals at the end of the 2nd period. Red and white blood cell counts and hemoglobin were within normal limits. (From Chemical Abstracts 63:3384, 1965)

- 1159 Odyets, R.N., and Nigmatullina, N.K.: (EFFECT OF LEAD ON THE METABOLISM OF CALCIUM AND PHOSPHORUS IN YOUNG GROWING WETHERS.) *Mikroelementy v Zhivotnovodstve i Rastenievodstve*, Akad. Nauk Kirg. SSR 1964:33-6.

Forty wethers, 5-6 mo of age, were divided into 4 groups and fed rations containing hay, crushed barley, mashed oats, wheat bran and NaCl. Group 1 served as controls; Group 2 received with their food 30 mg Pb acetate daily; Group 3, 60 mg Pb acetate, and Group 4, 60 mg Pb acetate and 40 mg Cu sulfate. Groups 3 and 4 had a very high loss of reserve Ca: 0.88-1.06 g/day, and their fecal elimination of Ca was 4.5-11.1% higher than in the controls. Fecal P in the 3 experimental groups was 104.3, 111.9 and 121.3% of that in the controls. The strength of the bones decreased most in animals fed 60 mg Pb acetate/day; blood-Ca was reduced in all experimental groups; blood sugar increased somewhat in Groups 1, 2 and 3 but remained unchanged in the 4th group. Inorganic P did not change in the 1st 3 groups and increased a little in the 4th. The concentration of total P increased in the 1st and 4th group, did not change in the 2nd and decreased considerably in the 3rd group. (From Chemical Abstracts 63:1139, 1965)

- 1160 Pecora, L., Pesaresi, C., and Lamanna, P. (Univ. Naples, Italy): Attività dell'ALA-sintetasi di mitocondri del fegato nell'intossicazione sperimentale da piombo. (ACTIVITY OF AMINOLEVULINIC ACID SYNTHETASE OF LIVER MITOCHONDRIA IN EXPERIMENTAL LEAD POISONING.) *Folia Medica* (Naples) 47:985-91 (Oct.), 1964.

The activity of  $\delta$ -aminolevulinic acid (ALA) synthetase of liver mitochondria was studied in guinea pigs and rabbits intoxicated with Pb acetate or 3,5-dicarbethoxy-1,4-dihydrocollidine (DDC). The rabbits were given orally 2 ml/day of a 20% solution of Pb acetate for 1-10 days; the guinea pigs were injected subcutaneously with 1 ml of this solution daily for 2 days. The progress of the intoxication was followed by urinary elimination of ALA and Pb. DDC poisoning was achieved in guinea pigs by oral administration of 2 g DDC daily for 2 days for acute intoxication and 0.5 g for 2 days for subacute intoxication. Liver mitochondria of normal guinea pig and rabbit did not synthesize ALA from a substrate containing glycine, succinyl-CoA and pyridoxal phosphate. This synthesis did take place in guinea pig liver mitochondria, but only in acute intoxication by DDC. In Pb poisoning, only in some cases was ALA synthetase activity noted, and then but an extremely

weak one was found.

As in Pb poisoning the liver mitochondria behaved the same as those from normal animals, it could be excluded that disturbances of porphyrin metabolism induced by Pb are linked to a stimulation of ALA synthetase activity as was found to occur in acute DDC poisoning. In the latter case, the increase in ALA synthetase was due to a de novo synthesis of the enzyme or to an activation of a protein already present. In any event, DDC acts only on ALA synthetase and on no other enzymes that enter into synthesis of porphyrins. Therefore DDC stimulates the activity of ALA synthetase of liver mitochondria, produces a porphyrin of hepatic type and has no action on blood cells and on bone marrow. On the other hand, the opposite is true of Pb: it exerts no action on liver mitochondria, but stimulates those of the cells of the hemopoietic system in the synthesis of porphyrins.

- 1161 Pernis, B., de Petris, S., Beard, R.R., and Karlsbad, G. (Univ. Milan, Italy): THE ULTRASTRUCTURE OF RED CELLS IN EXPERIMENTAL LEAD-POISONING. *Medicina del Lavoro* 55:81-101 (Feb.), 1964.

Guinea pigs, weighing 300-400 g each, were given daily 50-60 mg Pb as nitrate dissolved in saline by esophageal catheter. After 3-4 wk on this treatment, the animals showed 2000-30,000 stippled erythrocytes/million red cells. Those with the higher counts were bled from the heart and upon centrifugation a suspension of red cells including as many as 50% stippled cells was obtained, which was prepared for phase-contrast and electron microscopy. In another experiment, 2 adult male Leghorn chickens were poisoned by 2 weekly subcutaneous injections containing 50 mg Pb chloride/kg body weight, for 2 mo, and then bled from the wing vein. No stippled erythrocytes were found in their blood, although they had become anemic and one had developed paralysis of both sciatic nerves. The blood was processed for electron microscopy without prior centrifugation. Blood from 2 healthy control chickens was treated correspondingly.

Phase-contrast microscopy of a suspension of erythrocytes from guinea pigs showed many cells larger than normal, some of which had vacuoles in their cytoplasm, while electron microscopy of thin sections of erythrocytes from the same cell suspension showed some remarkable structures in the cytoplasm, such as vacuoles of large or medium size, clusters of small vesicles, ferritin molecules and other formations of bizarre shape. Reticulocytes prepared from the blood in normal guinea pigs failed to show the abundance of vacuoles as in the Pb-poisoned animals, but many normal mitochondria were seen, which was seldom found in the cells of Pb-poisoned animals. No differences at the submicroscopical level were seen in leukocytes of intoxicated and normal guinea pigs. In chicken erythrocytes, mitochondria, normal or transformed in vacuoles, were considerably less abundant than in guinea pigs; when present, they were in the vicinity of the nucleus. However, similar formations were seen in the controls. Although the suspension of red cells rich in stippled erythrocytes was also rich in cells with de-

generated mitochondria, the authors do not believe that the degenerated mitochondria represent the morphological basis of the stippled erythrocytes but rather assume that the latter are composed of ribonucleic acid (RNA) or ribonucleoproteins. Their reasoning against the 1st and for the 2nd assumption is given in detail. Furthermore, the hypothesis is advanced that, in Pb poisoning, the presence of soluble RNA in some young red cells in abnormal amounts is not due to any direct action of Pb on the metabolism of nucleic acids or proteins, but that it is an indirect consequence of the blockade by Pb of the heme synthesis. The stage of potential stippled elements is traversed in mammals by each red cell for a very brief period of its life. Pb prolongs this period and thereby increases the number of cells which at a given time will show this phenomenon. Species, such as chickens, in whose nucleated erythrocytes soluble RNA is never produced in excessive amounts, will not produce stippled cells even in the most severe Pb poisoning. Thus, the formation of vacuoles and the stippling of erythrocytes are 2 different consequences of the same biochemical damage induced by Pb, namely the blockade of heme synthesis, one being the direct morphological consequence of the alteration of the mitochondria where heme is synthesized, the other being the consequence of an abnormal persistence of soluble RNA due to the slowing down of globin synthesis, which itself is a consequence of the heme blockade. (The findings are illustrated by 12 microphotographs.)

- 1162 Pernis, B., Vigliani, E.C., de Petris, S., and Karlsbad, G. (Milan, Italy): THE RED CELLS IN LEAD POISONING (A STUDY WITH THE ELECTRON MICROSCOPE). The XIV International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. Industrial Medicine and Surgery 33:147 (Mar.), 1964.

Pb-poisoned guinea pigs and chickens were bled and the pathological cells concentrated by differential centrifugation. Blood from control animals was treated similarly. The enriched suspensions were examined by phase contrast, light microscopy and electron microscopy. While dried smears of treated guinea pigs showed up to 30% stippled cells, only up to 5% showed alterations by phase contrast. In thin sections, intracytoplasmic structures were visible in many red cells. In chickens, stippled cells were absent from blood smears and no ultrastructural differences were detected between cells from control and treated animals. The mitochondrial alterations probably reflect the Pb-induced blockage in the synthesis of the heme which normally takes place largely in these organelles. Since basophilic punctations are known to consist of ribonucleic acid or ribonucleic proteins, it is suggested that the type of ribonucleic acid responsible for stippling is the nonribosomal one, persisting in abnormal amounts or conditions in these cells. Considerations are advanced to explain how such a situation might arise.

- 1163 Pokotilenko, G.M. (Inst. Med., Luga, USSR): B<sub>6</sub>-vitaminoterapiya pri eksperimental'nykh intoksikatsiyakh svintsom i

benzolom. (VITAMIN B<sub>6</sub> THERAPY IN EXPERIMENTAL LEAD AND BENZENE INTOXICATIONS.) Farmakologiya i Toksikologiya 27, No. 1: 88-9, 1964.

The experiments described were carried out in order to define the hemopoietic action of pyridoxine in poisoning by benzene and Pb. In the experiments with Pb, 15 rabbits of 1.8-2.5 kg weight received on 3 successive days intravenous injections of a 0.5% solution of Pb acetate at a dose of 2 mg/kg body weight. Beginning with the 8th day after injections were discontinued, 8 of the rabbits received daily intramuscular injections of pyridoxine at 1.5-2 mg/kg; 7 rabbits served as controls. The number of erythrocytes increased by 25% already by the 8th day of treatment; the increase in the number of polychromatophils and reticulocytes in the first few days was even greater, and hemoglobin rose by 10%. By the 24th day of treatment, the blood picture of the treated rabbits returned to normal. In contrast, in 3 of the controls the anemia progressed, 1 rabbit showed a somewhat better picture, in 2 there was no change, and 1 rabbit died. Bone marrow biopsy at 2 and 3 wk after treatment was initiated showed diminished normoblastic reaction and a growing number of mature cells of the erythroblast series. The myelogram, however, did not return to normal. In the controls the bone marrow disorders persisted.

By the end of the experiment, 2 deaths had occurred in the control group, and 1 in the treated. Both experiments vouch for the benefits of pyridoxine treatment in poisoning by Pb and benzene.

- 1164 Raddi, R., D'Angelo, V., and Cassandro, M. (Univ. Florence, Italy): Il comportamento delle prove di funzionalità epatica nella intossicazione sperimentale da piombo. Contributo sperimentale e considerazioni patogenetiche. (THE BEHAVIOR OF LIVER FUNCTION IN EXPERIMENTAL LEAD POISONING. EXPERIMENTAL PATHOGENESIS.) Lavoro Umano 16, No. 9:413-29, 1964.

Twenty-five rabbits, av weight 2 kg, were divided into 5 groups of 5 animals each. Two rabbits in each group, serving as controls, received daily by stomach tube physiologic saline at a dose of 0.5 ml/kg body weight. The other 3 rabbits of each group received in the same manner a 10% aqueous solution of Pb acetate at 0.5 ml/kg body weight. Blood was collected from each rabbit by cardiac puncture before and on the 8th, 16th, 24th, 32nd and 40th day of intoxication. The detailed findings on the various reactions and components indicative of liver damage were tabulated. A eu-colloid state became obvious after the 32nd day of intoxication. With the marked anemia which developed, together with involvement of liver function, the bilirubin level in the blood increased after the 24th day. Total proteins decreased. Total cholesterol was changed only slightly although a moderate decrease of the esterified and an increase of the free fraction were found. More evident was an increase in percentage of  $\beta$ -lipoproteins.

The following conclusions were drawn: the decrease in albumin and the increase of the globulin fractions which are not accompanied by particular

modifications of the total blood proteins are due to a changed ability of the liver to synthesize albumin. The increase of  $\beta$ -globulin is related to the increase of the lipoprotein fraction, whereas the increase of  $\gamma$ -globulin, which occurs always when the mesenchyma is in a reactive stage, is related to the formation of antibodies. The blood changes and the histopathologic findings point to the possibility that Pb attacks all organs and systems and in particular the liver, thereby impairing those hepatic functions which are important to the whole organism.

- 1165 Raddi, R., D'Angelo, V., and Marras, O. (Univ. Florence, Italy): Sulle modificazioni del numero e dell'agglutinabilità delle piastrine in corso di intossicazioni sperimentali. Nota III - Il comportamento delle piastrine in corso di intossicazione sperimentale da piombo. (THE CHANGES OF THE NUMBER AND THE AGGLUTINABILITY OF BLOOD PLATELETS IN EXPERIMENTAL INTOXICATIONS. III. THE BEHAVIOR OF BLOOD PLATELETS IN EXPERIMENTAL LEAD POISONING.) Lavoro Umano 16, No. 11:626-9, 1964.

Twenty-five rabbits, av weight 2 kg/animal, were divided into 5 groups of 5 each. Two out of each group, serving as controls, were given daily by stomach tube a physiological solution while the 3 remaining of each group were given in the same manner 0.5 ml/kg/day of a 10% aqueous solution of Pb acetate. Blood samples for platelet counts were taken before the start of the experiment and on the 8th, 16th, 24th, 32nd and 40th day of poisoning, and the data obtained were tabulated. A slight decrease in the number of platelets, without morphological changes, and an insignificant reduction in agglutinability were noted only in the terminal period of the experiment. The authors conclude that these phenomena cannot be considered as responsible for the alterations in blood clotting observed in experimental Pb poisoning.

- 1166 Raddi, R., D'Angelo, V., and Pengue, L. (Univ. Florence, Italy): Il comportamento della coagulazione del sangue nella intossicazione sperimentale da piombo. Contributo sperimentale e considerazioni patogenetiche. (BLOOD COAGULATION IN EXPERIMENTAL LEAD INTOXICATION. EXPERIMENTAL DATA AND CONSIDERATION OF PATHOGENESIS.) Lavoro Umano 16, No. 11:578-88, 1964.

Twenty-five rabbits, av weight 2 kg each, were divided into 5 groups of 5 animals each. Two animals in each group, serving as controls, were given daily by stomach tube a physiologic solution at 0.5 ml/kg weight; the other 3 animals of each group received in the same manner 0.5 ml/kg of a 10% aqueous solution of Pb acetate. Blood samples were collected before and after 8, 16, 24, 32 and 40 days of poisoning. Coagulation tests included a thromboelastogram according to Hartert, recalcification time, prothrombin activity, fibrinogen and platelet measurement. The data obtained were tabulated. The results indicated impairment of the coagulation of the blood from the 24th day on. The hypothesis was advanced that this phenomenon might be related to a disturbed liver function.

- 1167 Roe, F.J.C., and Lancaster, M.C. (Royal Cancer Hosp., London, England): NATURAL, METALLIC AND OTHER SUBSTANCES, AS CARCINOGENS. British Medical Bulletin 20:127-33 (May), 1964.

A review of fungal and plant toxins, metals, pharmaceuticals and agricultural chemicals as carcinogens is presented. Pb acetate and phosphate as having caused renal cancer in experiments performed with rats by Zollinger (1953), T8nz (1957), Matthews and Walpole (1958), Boyland et al (1962) and Esch et al (1962) are covered in the brief section on Pb. The authors state that no special association between exposure to Pb and renal cancer has been noted in man, but follows this by saying that "Boyland points out that the mortality from renal cancer in males in England and Wales has increased during the past decades (Case, 1956) and, at the same time, so has the amount of Pb in road dust especially since Pb tetraethyl has been added to petrol." (166 references)

- 1168 Rosenblum, W.I. (New York Univ. Bellevue Med. Center, N.Y.): THE CONTRACTILE RESPONSE OF PIAL ARTERIES TO TOPICAL  $\text{BaCl}_2$  AND THE INHIBITION OF THEIR RESPONSE BY OTHER AGENTS. Bulletin of the New York Academy of Medicine 40, No. 12:988, 1964.

The pia of anesthetized mice were exposed by craniotomy, then continuously irrigated. When applied topically to the pial arteries,  $\text{BaCl}_2$  0.5 or 5.0%, caused marked, reversible, reproducible, and atraumatic constriction of the arteries. These effects were not reproduced by solutions of Ca, Mg, Sr, Zn, or Pb of similar pH tonicity, and molarity. At  $10^{-3}\text{M}$  or less, Pb dilated pial arteries and inhibited the response to  $\text{BaCl}_2$ . These data contradict theories pertaining to Pb encephalopathy that ascribe symptoms to a hypothesized ability of Pb to constrict cerebral arteries.

- 1169 Rüssel, H., and Schöberl, A. (Vet. Coll., Hannover, Germany): Abnorme Bleigehalte in tierischen Lebern. (ABNORMAL LEAD CONTENTS IN THE LIVER OF ANIMALS.) Deutsche Tierärztliche Wochenschrift 71:537-8 (Oct. 15), 1964

In the period from March 1962-May 1964, 180 determinations of Pb in animal organs (mainly liver) were made, including Pb in feeds, etc. About 40% were above suspicion, 60% had increased Pb content. In most cattle, in the liver Pb ranged from 2-5 ppm; 10 samples showed 5-10, 6, 10-20, 1, 36 and 1, 78 ppm. Of the 18 cattle, 14 came from regions of Pb smelters or Pb mines. Of the cases with Pb poisoning, many showed high Pb content in the liver. However, not in every case should the severity of poisoning be judged on the basis of Pb content in the liver. Since Pb stored in the liver is inactive, the animals could appear to be healthy until the stores become activated and produce signs of poisoning. Storage in the liver may be assumed as a defense mechanism. The success of such detoxication depends upon amounts of Pb ingested and absorbed as well as on solubility of Pb compounds. By deposition of the circulating Pb in the liver, Pb cannot be eliminated fast enough, thus giving rise to acute poisoning. This may explain the relatively low Pb concentrations in the

liver in spite of a higher intake of Pb. In these cases, the Pb content in blood must be determined. Analytical procedures are discussed.

- 1170 Scheiman-Tagger, E., and Brodie, A.G. (Univ. Illinois, Chicago): LEAD ACETATE AS A MARKER OF GROWING CALCIFIED TISSUES. Journal of Dental Research 43, Supplement: Abstract No. 74 (Sept.-Oct.), 1964.

Bone growth patterns in decalcified sections were demonstrated by using Pb acetate vital staining. Growing Rhesus and Cebus monkeys and New Zealand white rabbits were given 4-7 intravenous injections of 4 mg Pb acetate/kg body weight at various time intervals. Skull, mandible and femurs were fixed, decalcified in 1% HCl through which H sulfide was constantly bubbled and imbedded in gelatin; frozen sections were cut at 15-20  $\mu$ . The contrast of the lines was increased by toning with Na bisulfate. The rate of growth was measured from the spacing of the lines. The lines were lanceolated in areas of fast growth and straight in those of slower apposition. Growth along the lower border was faster than that along the lateral surface.

- 1171 Schepers, G.W.H. (Office Med. Examiner, Delaware, Wilmington): TETRAETHYLLEAD AND TETRAMETHYLLEAD. COMPARATIVE EXPERIMENTAL PATHOLOGY: PART I. LEAD ABSORPTION AND PATHOLOGY. Archives of Environmental Health 8:277-95 (Feb.), 1964.

In preliminary experiments with rats, the approximate oral lethal dose of tetraethyllead (TEL) was found to be 17 mg/kg (11 mg Pb/kg) and for tetramethyllead (TML) 108 mg/kg (83 mg Pb/kg). Differences in responses to the 2 alkyls were noted in that rats exposed to TEL displayed enhanced sensorimotor neurological activity and rats ingesting TML showed an opposite neurologic trend. Virtually identical effects were induced by inhalation or cutaneous exposure. Although occupational contact would be by the latter 2 routes, the experiments with rats to gauge the long-term effects were conducted by oral administration as this method is appreciably less complicated.

Groups of 6 male and 6 female Charles River cesarean-derived albino rats each, 22 days old, were fed Purina Laboratory Chow (containing 0.0012% Pb) and given Pb-free water for 9 days. Then, a single dose of 17 or 1.7 mg/kg TEL or 108 or 10.8 mg/kg TML, dissolved in peanut oil with toluene as stabilizer, was administered by intragastric intubation to each rat. These animals were sacrificed after observation for 144 days. Other groups of rats were dosed repetitively over a period of 21 wk as follows: peanut oil with toluene only (controls); daily, 5 times/wk for a total of 100 doses, 0.17 or 0.0017 mg/kg TEL, or 1.08 or 0.001 mg/kg TML, so that at the smaller amounts, the cumulative doses equaled the doses administered singly. These animals were sacrificed during the 1st or 2nd day after administration of the last dose. The results of each series of experiments are described in detail and these findings tabulated. These include signs, delayed and cumulative effects and mortality; terminal body and organ weights; water and ash contents of tissues; distribution of Pb in tissues; gross

pathology; and histopathology.

A proportion of the rats receiving the single high doses died within a few days. The low single doses produced no detectable abnormalities and all rats survived until sacrificed. Multiple doses caused no initial abnormalities. Later, signs of toxicity were observed but a degree of tolerance developed in some rats. Peripheral hyperemia was noted at the higher doses; it was more pronounced in the male TML rats that also showed greater irritability, while hypermotility was more pronounced in the female rats on low doses of TML. The differential pathogenic action of the 2 compounds is expressed generally in a schema that shows ranges of 2 maximums caused by TML, then TEL at high levels of multiple dosage to a minimum caused by TEL at low multiple doses. In discussing the findings generally, the histologic examination revealed that the administration of multiple doses, equivalent cumulatively to a single dose, was more injurious, which might be of significance for human exposure as it is more likely to be repetitive than massive. The apparent contradiction between general condition of the rats and the severity and prevalence of organic lesions indicates that lack of weight loss and absence of symptoms are no guarantee that Pb had not caused damage in vital organs. Female rats were somewhat less prone to severe injury, perhaps due to temporary storage of Pb in the more abundant adipose tissue. Both alkyls had severe effects on the nervous system with TML showing greater destructiveness of the neurones. This may explain the lack of hyperstimulatory signs and the insidious onset of coma by that compound. Severe reactions were observed in the liver, pancreas, endocrine and renal systems, and a hypertrophy of the left ventricle of the heart was noted. Assuming similar action of Pb alkyls in man, metabolic investigations of the hepatic, pancreatic, endocrine and renal systems may furnish clinical clues concerning the severity of the intoxication. The evident lack of accumulation or retention of Pb in the nervous system in the presence of marked neurologic signs and evidence of neuronal and neuroglial injury poses the question whether the damage was caused directly by TEL or TML or by any of their metabolites or whether other neurotoxic mechanisms may be involved. The severe hepatic and pancreatic damage observed is considered relevant in this connection. It is also considered that interference with carbohydrate metabolism and enzyme functioning incident to severe injury to liver and pancreas may induce significant neurological changes, suggesting that glucose therapy may be beneficial. The demonstrable hypertrophy of parathyroids found in some rats may have resulted in an imbalance of Ca metabolism. Pb was distributed in the tissues unequally and selectively. A correlation seemed to exist between Pb levels in certain organs (such as liver and pancreas) and the histologic damage. A discrepancy between Pb levels in the blood and the variable severity of damage in many organs, particularly after TML absorption, was noteworthy. Other findings included: no specific effects on the intestine, although duodenitis was seen in a few rats; only dose-related changes in the stomach; emphysema and edema in the lung (although almost all rats had a low-grade enzootic

pneumonitis and tracheobronchitis); hypoplasia of the thymus; hyperplasia of the thyroid and pituitary; depression of the adrenal cortex; no significant abnormalities in the sex organs and urinary bladder, and of the reticuloendothelial system.

- 1172 Schmidt, R., and Rautschke, R. (Martin Luther Univ., Halle-Wittenberg, Germany): Schwermetallkationen im tierischen Organismus; spektrographische Untersuchungen an Organen normaler und alloxanbehandelter weisser Ratten. (HEAVY METAL CATIONS IN THE ANIMAL ORGANISM: SPECTROGRAPHIC STUDIES OF ORGANS OF NORMAL AND ALLOXAN-TREATED WHITE RATS.) *Acta Histochemica* 17, No. 5-8:302-13, 1964.

Trace elements were determined spectrographically in 300 specimens of the following organs of normal and alloxan-treated white rats: salivary glands, stomach, small and large intestines, liver, spleen, pancreas, kidneys, adrenals, uterus and tubes, testicles and epididymis, brain, thyroid, pituitary, heart, lungs. Special emphasis was laid on the heavy metals reacting with dithizone. Pb was found in all organs tested with the exception of testicles and epididymis. An extensive bibliography is included.

- 1173 Schroeder, H.A., Balassa, J.J., and Vinton, W.H., Jr. (Dartmouth Med. School, Hanover, N.H.): CHROMIUM, LEAD, CADMIUM, NICKEL AND TITANIUM IN MICE: EFFECT ON MORTALITY, TUMORS AND TISSUE LEVELS. *Journal of Nutrition* 83:239-50 (July), 1964.

The authors had reported earlier the effects of small doses of several metals including Pb on growth and survival of mice up to 21 mo of age in experiments attempting to duplicate accumulation of these metals in man. Observations over the lifetime of mice are now reported. About 700 white Swiss mice of the Charles River strain, in groups of 50 or more, were fed a diet deficient in Cd and low in other metals. One of the following as acetate or oxalate was added to the drinking water at 5 ppm/metal: Cd, divalent Pb, trivalent Cr, divalent Ni or tetravalent Ti. The total elapsed time until all animals had died was 36 mo. Tissue concentrations comparable to those of man were observed. Sex differences appeared. Mortality of females was unaffected; mortality of males on Cd, Pb and Ni was increased compared with that of the Cr group, and of those on Cd and Pb compared with the controls. Longevity of the oldest 10% of both sexes was less in Pb and Ti groups, and of males in the Cd group, compared with controls. Body weights at death were greater in Ti, Cr and Pb groups. No metal was carcinogenic; incidence of tumors in males on Cd and Pb, and in females given Ni was decreased. Mean concentrations of the various metals in kidney, liver, heart, lung and spleen are tabulated. No metal accumulated markedly with age. Large increments of Ti, moderate increments of Cd and Ni and lesser increments of Cr and Pb, compared with controls, were observed. Analysis of the whole carcasses of 5 stillborn mice gave no Pb while it was present in the mother's tissues. Eight of 10 tumors of control females contained 0.08-2.1  $\mu\text{g}$  Pb/g. All metals except Cr exhibited one or more signs of innate toxicity.

- 1174 Selye, H., Gabbiani, G., and Serafimov, N. (Univ. Montreal, Canada): HISTOCHEMICAL STUDIES ON THE ROLE OF THE MAST CELL IN CALCERGY. *Journal of Histochemistry and Cytochemistry* 12:563-9 (Aug.), 1964.

Experiments were performed on rats, using special histochemical stains for the demonstration of metachromatic materials, Pb, Ca, phosphate, and carbonate, to study calcergy, the induction of soft-tissue calcification by topical treatment with certain compounds such as Pb acetate. In 1 experiment, 25 Sprague-Dawley rats (weight, 97 g) received 100  $\mu\text{g}$  Pb acetate in 0.2 ml water subcutaneously (sc) at 2 points under the dorsal and the ventral skin respectively. In a 2nd experiment, another 25 rats received 5 mg Pb acetate in 1 ml water intravenously (iv) and immediately afterwards 10  $\mu\text{g}$  polymyxin-B sulfate in 0.2 ml water, both under the dorsal and ventral skin.

In simple calcergy, when Pb acetate was directly injected sc, it was seen to impregnate the collagen fibers in the injection site without noteworthy participation of the mast cells. The Pb-treated area secondarily attracted Ca, phosphate, and possibly carbonate. In mastocalcergy, the Pb acetate was injected iv and local calcification was produced by the simultaneous injection of a mast-cell discharger such as polymyxin. Here, the mast cells in the treated area first showed degranulation without any mineralization, but this was soon followed by Pb uptake on the mast-cell granules. Finally, the discharged and calcified mast-cell granules disintegrated into a dust-like, fine precipitate which was transferred to the circumjacent collagen fibers where it initiated an intense process of mineralization, eventually leading to complete petrification of the polymyxin-injected area.

It was concluded that even if the uptake of Pb, Fe, or Ca by mast-cell granules were a secondary phenomenon, the mast-cell granule is highly capable of metal binding.

- 1175 Selye, H., Gabbiani, G., and Tuchweber, B. (Univ. Montreal, Canada): NEUROTROPIC CALCERGY. *Neurology* 14:1084-90 (Dec.), 1964.

After a brief definition of the new concepts of calcergy and calciphylaxis (Abstract No. 1178), a recently observed neurotropic form of calciphylaxis is described in which the vagus nerves undergo massive calcification in the absence of similar changes elsewhere in the nervous system. Such a selective calcification of autonomic nerves was produced in rats given an intravenous (iv) injection of Pb acetate simultaneously with a subcutaneous (sc) injection of histamine.

One hundred sixty female Sprague-Dawley rats of the Holtzman strain, initial weight 95-104 g, were divided into 16 equal groups to perform 3 experiments. All animals were injected iv with 5 mg Pb acetate in 1 ml water on the 1st day. In the 1st experiment, 20 mg histamine, 3 mg serotonin-creatinine sulfate or 5 mg acetylcholine chloride were administered sc to different groups of rats immediately after the Pb acetate injection. In the 2nd experiment, the histamine injection was given 1 hr or 30 min before, at the same time, or 30 min and 1 hr after the Pb injection. In the 3rd experiment, histamine was always administered

simultaneously with the Pb injection, but at various dosages and by various routes (5, 10, 20 and 40 mg sc; 20 mg intraperitoneally (ip) and iv). On the 6th day after the injections, survivors were killed and the tissues examined for possible Ca deposits.

In the 1st experiment, neither histamine nor Pb acetate given alone produced any detectable calcification in the autonomic nervous system, whereas combined treatment with histamine and Pb acetate induced a 87-88% incidence of Ca deposition in the vagi and sympathetic nerves, but not in any other organs. The histologic findings were reported in detail. Rats given serotonin-creatinine sulfate or acetylcholine in addition to Pb acetate, showed no calcification in the nervous system or other organs except in the renal infarcts which are usually produced by high doses of serotonin-creatinine sulfate. In the 2nd experiment, the most pronounced vagus and sympathetic calcification was obtained when histamine was injected simultaneously with or 30 min after Pb acetate. In the 3rd experiment, a 100% incidence of vagus and sympathetic nerve calcification was obtained at 40 mg histamine, injected sc at the same time as Pb acetate. The mortality in this case was only 10%, so that this procedure appeared as the most satisfactory one for consistent production of these lesions. Subcutaneous injection of histamine just after iv injection of Pb acetate will cause topical calcification, and in the event of ip injection of histamine, topical Ca deposits were sometimes seen in the peritoneum. If incidental calcifications are to be avoided, the iv route for histamine may have its merits although it produces only a 70% incidence of calcification.

The highly specific action of histamine, both with regard to the chemical nature of the compound required to produce autonomic nerve calcification and the selectivity of the effect which singles out only certain portions of the nervous system, was emphasized. Although calcification of peripheral nerves is rarely, if ever, seen in man, the authors wonder whether certain types of polyneuritis as caused by various toxic compounds, including Pb, might not be related to mild forms of neurotropic calcergy that are unaccompanied by manifest mineralization.

- 1176 Selye, H., Tuchweber, B., and Caruso, P.L. (Univ. Montreal, Canada): PROTECTION AGAINST NEUROTROPIC MASTOCALGERGY. *Experimental Neurology* 10:451-61 (Nov.), 1964.

Experiments were reported to show that rats can be made resistant to topical calcification and the associated neurotropic mastocalgergy, produced by Pb acetate and histamine, if they are pretreated with certain mast-cell dischargers, mast-cell constituents or substances known to have an antihistamine effect.

Two hundred and twenty female Sprague-Dawley rats of the Holtzman strain, mean initial body weight 102 g, were divided into 22 groups of 10 and given 1st a single intravenous injection of 5 mg of neutral Pb acetate, followed immediately afterwards by a subcutaneous injection of 40 mg histamine phosphate. One of these groups served as control; the remaining 21 groups were given prophylactic treatment with numerous agents or procedures to

test their possible ability to prevent neurotropic mastocalgergy. In the control rats, calcification in the autonomic nervous system was obvious. The most striking calcification occurred in the vagi, celiac plexus and sympathetic nerve trunks, while the ganglia showed no or only occasional traces of Ca deposits. No calcification was seen in the brain, spinal cord, sciatic, femoral and cranial nerves. Rats pretreated with mast-cell dischargers (compound 48/80, polymyxin, chlorpromazine) or certain mast-cell products (histamine, serotonin) showed little or no calcification either in the vagus or sympathetic system; heparin had no prophylactic value, neo-antergan and cyproheptadine offered good protection. No conclusions could be drawn from the mortality rates because of the small groups of rats used and of the toxicity of histamine itself to Pb acetate-pretreated rats, which caused 20% mortality. Additional treatment with prophylactic agents further increased this mortality rate.

- 1177 Selye, H., Tuchweber, B., and Caruso, P.L. (Univ. Montreal, Canada): TOPICAL RESISTANCE TO MASTOCALGERGY. *Journal of Pharmacology and Experimental Therapeutics* 146:252-7 (Nov.), 1964.

Following a brief definition of the new concept of calcergy and calciphylaxis, experiments are reported which show that, in rats prepared by a single intravenous (iv) injection of Pb acetate, topical connective tissue calcification can be produced by minute doses of various mast cell components (histamine, 5-HT) or mast cell dischargers (48/80 polymyxin). This form of calcergy can be inhibited by topical pretreatment with any one among the substances just mentioned. Here both the production of cutaneous calcinosis and its prevention appear to depend on compounds that can be liberated by mast cells, which accounts for the term mastocalgergy. In rats similarly prepared by an iv injection of Pb acetate, the subcutaneous injection of formalin or crushing of the skin with a hemostat produces topical calcification. However, this form of calcinosis cannot be prevented by pretreatment with mast cell dischargers, mast cell products, formalin or trauma. Apparently this is not mastocalgergy, but an essentially different mechanism dependent on the localization of blood-borne Pb and subsequently of Ca salts owing to severe vascular leakage. (From authors' summary; 15 references)

- 1178 Selye, H., Tuchweber, B., and Gabbiani, G. (Univ. Montreal, Canada): THE PASSIVE TRANSFER OF CALCERGY. *Growth* 28:213-9 (Sept.), 1964.

In this study, continuing the elucidation of the mechanism of soft-tissue calcification, the authors first define the terms for 2 newly observed biologic reactions: Calciphylaxis is the induction of selective calcification in various organs by pretreatment with a systemic calcifier (parathyroid hormone, vitamin D (the "sensitizers")), followed after an interval ("critical period") by an eliciting agent ("challenger"). Calcergy is produced, without previous sensitization, by parenteral administration of direct calcifiers (in this case Pb acetate). Most challengers and cal-

cergens are metallic compounds. Histamine liberators play an important role in the mechanism of some calciphylactic syndromes and calcergic phenomena through their mast-cell discharging effect, which are designated "mastocalciphylaxis" and "mastocalcergy," respectively.

The experiments here reported were designed to determine whether cutaneous calcification, once initiated by a subcutaneous injection of polymyxin in a rat given Pb acetate intravenously, will continue to develop if the treated area is transplanted onto an unpretreated host.

Thirty female Sprague-Dawley rats of the Holtzman strain with an initial body weight of 96 g, acting as donors, were subdivided into 3 groups. Animals of Group 1 were injected into the jugular vein with 5 mg neutral Pb acetate in 1 ml water and immediately afterwards received 50 µg polymyxin B-sulfate subcutaneously under the shaved skin of the back. In half of these rats, a skin flap was excised 4 hr and in the other half 8 hr after the topical application of the mastocyte discharger. Part of the skin was taken for histologic study and the rest transplanted into unpretreated recipients, Group 2 receiving the 4 hr and Group 3 the 8 hr specimens. The hosts were sacrificed on the 8th day after transplantation.

The results show that the discharged mast-cell granules at the subcutaneous injection site underwent calcification followed by disintegration and transfer of the Ca to collagen fibers. When the polymyxin-treated skin region of the donor was removed after 4 or 8 hr (when virtually only the mast-cell granules were calcified) and transferred to an unpretreated donor, the development of calcinosis in the graft proceeded essentially as if the skin had remained in the donor.

It is concluded that, under these conditions, the entire complex physicochemical mechanism necessary for the development of a massive collagen calcinosis is fully determined at the injection site within a few hr. Then it runs its normal course although the treated skin area is transferred to an unpretreated host at a stage when mast-cell calcification has barely begun.

- 1179 Senczuk, W. (Med. Acad., Gdansk, Poland): (ACCUMULATION AND EXCRETION OF LEAD IN RATS CHRONICALLY POISONED WITH LEAD.) Gdanskie Towarzyst. Nauk., Wydział Nauk. Mat.-Przyrodniczych, Rozprawy Wydziału III No. 1:15-23, 1964.

Wistar rats, weighing 150-200 g, were divided into groups of 15 each. Group 1 was fed daily 20 µg Pb as aqueous solution of Pb nitrate; Group 2 was exposed 8 hr/day to an aerosol containing 0.42 mg Pb/m<sup>3</sup> air. The rats were killed after 2, 4 and 6 mo. Urinary and fecal Pb values were 0.8 µg/100 ml and 9.8 µg/100 g, respectively, in Group 1, and 0.6 and 7.6, respectively, in Group 2. The total amount of Pb excreted by the orally poisoned rats increased with time but never matched the daily intake of Pb. The Pb content in the liver in the 2 groups was 11.4 and 9.6 µg/100 g, respectively. The Pb level in the lungs could not be compared because, in Group 2, it was too low to be measured. In the bones, Pb accumulation amounted to 19.6 and 13.3 µg/g, respectively. Pathologic and histochemical examination revealed damage in the liver, kidneys

and lungs of all poisoned animals. It was pointed out that if the accumulated Pb would become suddenly released by some metabolic changes, symptoms of acute poisoning might appear. (From Chemical Abstracts 64:14847, 1966)

- 1180 Shakhbazyan, G.Kh., and Savitskii, I.V.: Osobennosti toksicheskogo vliyaniya svintsa i rtuti na organizm pri deistvii ikh na fone vysokoï temperatury vozdukhnoï sredy. (THE TOXICITY OF LEAD AND MERCURY IN A HOT-AIR ENVIRONMENT.) In Shakhbazyan, G.L., ed.: Voprosy Promyshlennoi i Sel'skokhozyaistvennoi Toksikologii. (Problems of Industrial and Agricultural Toxicology.) Kiev, Medychnyi Instytut, 1964, pp. 84-95.

In the experiments described, 98 rats and 40 rabbits were exposed to Pb dusts and Hg vapor at room temperature, 16-18°, and at 40°. The animals were examined as to cardiac and respiratory function, body temperature, ratio of blood serum protein fractions (determined by paper electrophoresis), and serum and liver sulfhydryl (SH) groups (by amperometric titration). In the 1st series, the animals were exposed to finely dispersed Pb dusts (as oxide) in a concentration of 0.00010 mg/l of air. The animals exhibited no signs of disorder throughout the experimental period. However, on the 3rd day, the first changes were observed in rabbits in the form of a 22.7% decrease in serum SH groups; by the 10th day, the decrease amounted to 30.9%. No changes in body weight were found. The serum γ-globulin fraction showed a 35.8% increase, while the serum albumin decreased 15.5%. After 20 days, the serum SH groups dropped by 41.3%, and those of liver albumin, by 16%. No changes were observed in rabbits exposed to 0.00003 mg/l for 10 days, and statistically insignificant changes in serum and liver homogenate SH groups occurred in rats after a 50-day exposure. In experiments with Hg, similar changes were seen following exposure to 0.00010-0.00012 mg/l.

In the 2nd series, to determine the effects of high temperature as such, the animals were exposed to an air temperature of 40° for 5 hr a day, over periods of 30 or 10 days; water was made available to them in the hot chamber. No changes in serum proteins or SH groups were observed. Rabbits lost 9.6% weight by the end of the experiment; and there was inhibition of growth among rats. There were marked changes in behavior. The animals were restless during the first few days, the respiratory rate increased. Some habituation was observed, but no hyperthermia.

In the 3rd series, the animals were exposed to 38-40° atmospheric temperature and Pb dust in concentrations of 0.00003-0.00004 mg/l. A much greater effect was seen, as the animals tolerated this temperature with difficulty; they were asthenic, the fur of the rats became moist, and respiratory rate rose to 280-300/min. There was a lowering in the serum and liver protein SH groups by 8.6 and 26% respectively in rats, and a similar decrease in the blood SH groups in rabbits (15.4%). Exposure to 0.00010 mg Pb/l of air at 39-40° caused a 36.7% drop in serum SH groups in rabbits, 21.3% in rats, and liver proteins decreased 11.3%. The serum protein fractions showed no essential



changes.  $\gamma$ -Globulin increased 12% and albumin decreased.

Exposure to Hg at 0.00003 mg/l at 40° lowered serum SH groups by 31.1% and in liver homogenates by 21.5% in comparison with controls. In rabbits, serum SH groups dropped 30%. There was a sharp loss in the weight of rats. At 0.00010-0.00012 mg/l, the serum SH groups fell 33.4%, and SH groups in liver homogenates decreased 26.7% in rats; in rabbits the values dropped 29% in serum SH, 12.3% in serum albumin fraction, and the  $\gamma$ -globulin fraction increased 23%. The combined action of Pb and Hg at 40° resulted in a shorter survival time and higher mortality of the animals, as compared with those observed at room temperature. In view of the greater toxicity of Pb and Hg at higher environmental temperature, the authors suggest revision of the industrial hygiene standards by including specification as to the temperatures at which they are effective.

- 1181 Sherman, H., Hood, D.B., and Barnes, J.R. (E.I. Du Pont de Nemours and Co., Wilmington, Del.): COMPARATIVE TOXICITY STUDIES WITH TETRAMETHYLLEAD AND TETRAETHYLLEAD. American Industrial Hygiene Conference Abstracts, Philadelphia, Pennsylvania, Apr. 27, 1964, p. 50.

The acute lethal dose of tetramethyllead (TML) was greater than that of tetraethyllead (TEL) when the materials were administered orally or by inhalation to rats or by skin absorption to rabbits. Both compounds affected the central nervous system in the rat, but the clinical signs of toxicity differed. Repeated daily oral administration to rats of 1/5 the lethal dose of TML or TEL resulted in marked cumulative toxicity, TEL being the more active in this respect. Similar results were obtained when rats were exposed to inhalation of TML or TEL for 1 hr daily for 5 days, at concentrations equivalent to 0.7 mg Pb/l. Chronic oral studies with TML and TEL, carried out on male and female rats in which groups were given single doses equal to the lethal dose of 1/10 the lethal dose and observed for 144 days, and other groups receiving daily doses equal to 1/100 and 1/10,000 the lethal dose 5 times/wk for 21 wk, suggest that TML caused slightly greater cumulative toxicity than TEL. However, this may reflect the administration of approximately 7 times as much Pb in the form of TML as was administered as TEL.

- 1182 Shifrine, M., Steck, F.T., and Kusch, M. (Univ. Calif., Davis): DETERMINATION OF TRACES OF LEAD IN LIVER AND FECES OF CHICKENS. American Journal of Veterinary Research 25:870-1 (May), 1964.

The Pb content of different tissues of chickens that had ingested Pb pellets, was assayed by a method previously used for determination of Pb in foods (Johnson, E.I., and Polhill, R.D.A.: Analyst 82:238-41, 1957). Pb was separated from other ions in ashed liver and feces on an anion exchange column and the eluted Pb was measured colorimetrically with dithizone. The Pb concentrations found for chickens fed Pb pellets and normal chickens, respectively, were,  $\mu\text{g/g}$  of dry weight: liver, 127-510, 3-49; feces, 102-2910, 1-85. It was found that the troughs containing the drinking

water for the control birds had Pb-soldered seams and the water from these troughs contained 5-46  $\mu\text{g}$  Pb/l, which accounted for the high Pb concentrations found in their tissues. When the livers and feces of 5 chickens watered from circular troughs were assayed, no Pb was found in the livers and 19  $\mu\text{g}$ /dry weight in the feces.

The analytical method described in this study can be used to detect 1  $\mu\text{g}$  Pb/5 g of dry sample. Since Ca, Mg or P reduce Pb retention on the anion exchange column, a smaller sample must be used when bones are to be assayed.

- 1183 Silvestroni, A., and Balletta, A. (Univ. Naples, Italy): (THE BIOSYNTHESIS OF NICOTINAMIDE NUCLEOTIDES IN THE ERYTHROCYTES AFTER EXPERIMENTAL LEAD INTOXICATION.)

Biochimica Applicata 11, No. 6:250-7, 1964. The effect of nicotinamide on coenzyme synthesis was studied in washed erythrocytes from heparinized rabbit blood. Samples of a mixture of erythrocytes and Krebs-Ringer phosphate buffer were incubated at 37° for 22 hr with and without addition of 2% nicotinamide and the amount of nicotinamide nucleotides formed was determined by the method of Colowick (1951). Administration by stomach tube of 2 ml 20% Pb acetate to adult rabbits reduced the production of nicotinamide nucleotides in the erythrocytes from an initial 126  $\mu\text{g}/\text{ml}$  to 112 in 7 days, 95.8 in 14 days and 81.7 in 21 days, while simultaneously the protoporphyrin content increased from 20.7-56.1, 98.5 and 136  $\mu\text{g}/100$  ml, respectively. Urinary excretion of coproporphyrin increased from 13.8-82.6, 205.6 and 276.5  $\mu\text{g}/24$  hr and that of  $\delta$ -aminolevulinic acid from 0.024-0.72, 0.81 and 1.4 mg/100 ml, respectively. (From Chemical Abstracts 63:4855, 1965)

- 1184 Silvestroni, A., and Balletta, A. (Univ. Naples, Italy): L'acido nicotinico nella biosintesi eritrocitaria dei nucleotidi nicotinici durante l'intossicazione sperimentale da piombo. (NICOTINIC ACID IN ERYTHROCYTE BIOSYNTHESIS OF NICOTINIC NUCLEOTIDES DURING EXPERIMENTAL LEAD POISONING.) Folia Medica (Naples) 47:1121-9 (Nov.), 1964.

The effect of nicotinic acid on the erythrocytic synthesis of pyridine nucleotides during Pb poisoning was studied in 22 rabbits, av weight 2.5 kg. Group A of 4 rabbits, serving as controls, received daily subcutaneous injections of 30 mg nicotinic acid for the duration of the experiment. Group B, 6 rabbits, treated as above, were fed daily 200 mg Pb acetate. Group C, 6 rabbits, were fed daily 200 mg Pb acetate and after the 10th day received nicotinic acid as above. Group D, 6 rabbits, received 200 mg Pb acetate daily for 10 days and after the 10th day were treated only with 30 mg nicotinic acid/day. The rate of erythrocytic synthesis was determined at the beginning and after 7, 14, and 21 days, respectively. The stage of the intoxication was followed by determining free erythrocytic protoporphyrin, urinary coproporphyrin, and urinary  $\delta$ -aminolevulinic acid. The nicotinic nucleotides and the rate of erythrocytic synthesis was estimated by the method of Leder and Handler (1951). In the controls, synthesis increased from 140.25  $\mu\text{g}/\text{ml}$  of red blood cells in



the 1st wk to 157 after 7 days and at 14 and 21 days was 132 and 130.33, respectively. The corresponding values were: Group B, 158.50, 158.66, 132.83, 128.33; Group C, 154.16, 114.16, 96.16, 80; and Group D, 151.60, 99.60, 104.20, 128.60. These results confirm clearly the inhibitory action of Pb on the synthesis of the pyridine coenzymes. Nicotinic acid given by itself produced a slight initial stimulation of this synthesis (Group A); when it was administered simultaneously with Pb, it moderated the inhibitory action of Pb (Group B), but the differences between the values in these 2 groups were not significant statistically. Some hypotheses concerning the mechanism of the action of Pb on the biosynthesis of the pyridine coenzymes are advanced.

- 1185 Silvestroni, A., and Balletta, A. (Univ. Naples, Italy): L'azione della D'penicillamina sulla sintesi eritrocitaria dei nucleotidi nicotinici durante l'intossicazione sperimentale da Pb. (ACTION OF D-PENICILLAMINE ON ERYTHROCYTE SYNTHESIS OF NICOTINIC NUCLEOTIDES DURING EXPERIMENTAL POISONING WITH LEAD.) *Folia Medica* (Naples) 47:1326-32 (Dec.), 1964.

Since in a preceding paper the inhibitory action of Pb on the enzyme system governing synthesis of nicotinic nucleotides in the erythrocyte had been shown, it appeared of interest to study the behavior of the enzymatic activity of these nucleotides after administration of D-penicillamine. Seventeen rabbits, av weight 2.5 kg, were subdivided into 3 groups. Pb poisoning was produced in Group A (5 rabbits) by daily oral doses of 0.2 g Pb acetate; Group B (6 rabbits) was given the same Pb dose combined with 60 mg/day of D-penicillamine; Group C of 6 rabbits was given Pb acetate for 9 days and from the 10th day on was treated solely with a daily oral dose of 60 mg D-penicillamine. In all animals, the pyridine nucleotide content in the erythrocytes was determined at the start of the experiment and after 7, 14 and 21 days, and also after 28 days in Group C. The stage of intoxication was followed in each group by the determination of free erythrocytic protoporphyrin and urinary coproporphyrin and  $\delta$ -aminolevulinic acid (ALA). The biosynthesis of the pyridine nucleotides, expressed as  $\mu$ g/ml of red cells, decreased progressively in Group A from 125.40 pre-experimentally to 111.80, 93.80 and 79.00 after 7, 14, and 21 days, respectively. The corresponding values in Groups B and C were 132.66, 131.66, 131.83, 136.66, and 134.50, 83.16, 88.33, 116.66 and 128.66 (after 28 days), respectively. Thus, administration of D-penicillamine prevented the progressive reduction of the rate of synthesis of nucleotides in the erythrocytes and produced an increase of the rate in rabbits already poisoned, so that the values ranged around the baseline throughout the experiment when D-penicillamine was given simultaneously with Pb acetate (Group B). It was also seen in the same group that the increase of erythrocyte protoporphyrin and of urinary coproporphyrin and ALA was quite modest. The effect of D-penicillamine was notable after 4 days of administration, and as it declined in the later stages (after 28 days), administration of the chelate for at least 3 wk is recommended.

- 1186 Sinitsyn, S.N. (Sci. Res. Inst. Hyg., Moscow, USSR): Nekotorye dannye o toksichnosti sinteticheskogo i etilirovannogo sinteticheskogo benzinov. (DATA ON THE TOXICITY OF SYNTHETIC AND ETHYLATED SYNTHETIC GASOLINES.) *Farmakologiya i Toksikologiya* 27, No. 5:619-20, 1964.

Synthetic gasoline is defined as a colorless liquid of unpleasant odor, specific gravity 0.685, beginning boiling temperature 42°, final 189°, octane number 31. Ethyl gasoline contains in addition 30.3% benzene and 0.5 ml ethyl fluid/l. In investigating the toxicity of these two types of gasoline, that of aviation naphtha gasoline was included for comparison. In the inhalation experiments described, the acute lethal concentrations for mice were, in mg/l of air: LC-100, 125 for synthetic gasoline, 110 for the aviation naphtha gasoline, and 100 for ethyl gasoline; the respective LC-50's were 105, 86.5, and 74.4; and the maximum tolerated doses, >90, >60, >55. All mice survived the latter concentrations, and 24 hr after exposure showed no differences from controls. Synthetic gasoline appeared least toxic, as disorders of motor coordination were seen with this substance at 40 mg/l and with the ethylated, at 30 mg/l. In 22% of the mice exposed to the latter for 2 hr, pulmonary edema was found, while none was seen in mice that died from exposure to synthetic gasoline. In mice exposed to 3, 5, 10, 15 and 20 mg/l of synthetic gasoline, the onset of rigor mortis of the tail was not affected at the lowest concentrations, with acceleration being seen only with the higher levels; the ethyl form accelerated rigor mortis even at the lowest level. Swimming performance was diminished by ethyl gasoline at concentrations starting with 10 mg/l and by the nonethylated starting with 15 mg/l. The same concentrations of the respective gasolines caused depression of cholinesterase activity.

The chronic toxicity of ethyl gasoline with high benzene content was studied in rabbits exposed daily for 2 hr over a 5-mo period and for 4 hr during the 6th mo to 0.4-0.6 mg/l. At the end of exposure, the number of leukocytes of all rabbits decreased from 8000-5000. The leukocyte formula showed a relative increase of segmented nuclear neutrophils and decrease in lymphocytes. Red cell counts remained unchanged. Control animals showed no changes.

- 1187 Sroczyński, J., and Jonderko, G. (Silesian School Med., Zabrze, Poland): (THE PROPHYLACTIC USE OF DISODIUM-CALCIUM VERSENATE IN EXPERIMENTAL LEAD POISONING IN RABBITS. I. EFFECT ON THE BLOOD LEVELS OF REDUCED GLUTATHIONE. II. EFFECT ON CATALASE ACTIVITY OF ERYTHROCYTES.) *Archivum Immunologiae et Therapiae Experimentalis* 12, No. 2:225-8, 229-31, 1964.

I. Ten adult chinchilla rabbits, weighing 2.5-4 kg, were injected intravenously (iv) for 3 mo with 20 mg Ca disodium ethylenediaminetetraacetate (EDTA)/day, 3 days/wk, and 1 hr later, also iv, with 4 mg/kg of Pb acetate; 10 control rabbits received only EDTA injections for 6 mo. In the controls, the initial arithmetic mean of blood glutathione was 35.3 mg%, and glutathione index 10.9; after 6 mo the corresponding values were 34.5 and

10.6. This difference was statistically insignificant. In the Pb-poisoned animals, blood glutathione was lowered insignificantly from an initial 36.1-34.3 mg% after 3 mo, and the glutathione indices were 9.9 and 10.0, respectively. Also, the number of stippled erythrocytes was small compared with that in chronic Pb poisoning when EDTA was not administered prophylactically.

The conclusion was drawn that administration of EDTA per se does not significantly affect blood glutathione and glutathione index, but that prophylactic administration of EDTA protects rabbits to a marked extent from Pb poisoning and prevents lowering of blood glutathione.

II. The experiment was set up in the same manner as in I. In the controls, the arithmetic mean catalase activity (as determined by the method of Jolles, modified by Gepner-Wozniowska) was 11.2 before the experiment and 11.9 6 mo later. In the experimental group, the corresponding figures were 12.3 and 12.9 (after 3 mo).

It was concluded that prolonged administration of EDTA does not affect catalase activity in the red blood cells of rabbits, and that prophylactic administration of EDTA to Pb-poisoned rabbits prevents the increase of catalase activity in the red blood cells which is a nonspecific sign of chronic Pb poisoning.

- 1188 Sroczyński, J., Kujawska, A., and Piekarski, B. (Clinic Internal Dis., Zabrze, Poland): *Obraz białek surowicy krwi w zatruciu ołowiem. (THE PICTURE OF BLOOD SERUM PROTEINS IN THE COURSE OF LEAD POISONING.)* *Medycyna Pracy* 15, No. 2:77-81, 1964.

Changes in blood serum proteins were examined electrophoretically in 20 rabbits in which acute and chronic Pb intoxication had been induced by means of Pb acetate, and in 60 subjects suffering from chronic Pb poisoning. The human patients were subjected simultaneously to the thymol turbidity and Takata-Ara tests, and the activity of alanine aminophenase was determined. The conclusion was drawn that the protein dyscrasia may be due to toxic injury of the liver cells by Pb. (From authors' English summary)

- 1189 Stanković, M., and Mokranjac, M.St. (Inst. Health Protection, SR of Serbia, Belgrade, Yugoslavia): *CHOLINESTERASE ACTIVITY IN EXPERIMENTAL TETRAETHYL LEAD POISONING.* In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. II, pp. 831-4.

The effect of tetraethyllead (TEL) on cholinesterase activity was studied in sheep, using Davies-Nichols' method, and correlating it with the content of Pb in the blood. In 20 selected healthy sheep with Pb in blood ranging from 13-17 µg%, cholinesterase activity varied from 48-53 min, the mean value being ~50 min at 20° C. For the purpose of the experiment, one group of sheep was administered TEL orally in capsules for 90 days and a control group was given Pb acetate, with quantities of Pb being equivalent in both cases. TEL

administration had to be interrupted when the level of Pb in the blood reached 260 µg% since the animals showed symptoms of intolerance, while in the case of Pb acetate, tolerance was good up to a Pb level in the blood of 328 µg%. Inhibition of cholinesterase activity occurred much more rapidly in TEL poisoning than in Pb acetate poisoning. The period of recovery after poisoning was slightly protracted in the case of TEL. It took 2.5 times as long for cholinesterase to resume its normal level than the period it took to produce chronic TEL poisoning.

- 1190 Stover, B.J., Atherton, D.R., Buster, D.S., and Keller, N. (Utah Univ., Salt Lake City): *METABOLISM OF THE Th<sup>228</sup> DECAY SERIES IN ADULT BEAGLE DOGS. II. Ra<sup>224</sup> (ThX), Pb<sup>212</sup> (ThB), AND Bi<sup>212</sup> (ThC).* In Research in Radiobiology. Annual Report of Work in Progress on the Chronic Toxicity Program, Sept. 30, 1964. US Atomic Energy Doc. COO-119-231, pp. 110-72. Retention and distribution of <sup>224</sup>Ra, <sup>212</sup>Pb and <sup>212</sup>Bi was studied for 3 yr in beagles after intravenous injection of <sup>228</sup>Th. <sup>212</sup>Pb was found to be associated with the blood cells. While initially <sup>224</sup>Ra in plasma decreased more rapidly than <sup>228</sup>Th in plasma, the concentrations of <sup>224</sup>Ra in plasma and <sup>212</sup>Pb in cells later were 24 and 480 times, respectively, that of <sup>228</sup>Th in plasma. (From Nuclear Science Abstracts 19:Abstr. No. 10739, 1965)

- 1191 Tesić, D., and Labudović, D. (Univ. Belgrade, Yugoslavia): *Eksperimentalno ispitivanje toksičnosti olovoarsenata. (TOXICITY OF LEAD ARSENATE.)* *Acta Veterinaria (Belgrade)* 14, No. 3:171-7, 1964. Five groups of white mice (20-40/group) were given Pb arsenate in their food in a proportion of 0.02-20.48%, for 1 mo or less. The animals refused food containing 0.32% Pb arsenate and more, starting on the 1st day, while food consumption was not affected by 0.02-0.08% Pb arsenate. Body weight was not influenced by 0.02% Pb arsenate, compared with controls, except in the 1st 5 days when it increased significantly. Body weight decreased markedly at 0.08% Pb arsenate, and 33.3% of the mice died. Of 30 mice fed 0.32% Pb arsenate, 96.7% died within 146.75-216.50 hr (av 90.40); doses of 1.28, 5.12 and 20.48% were 100% lethal, with deaths occurring in an av of 47.90, 42.60, and from 35.40-51.40 hr, respectively.

- 1192 Tesić, D., and Labudović, D. (Univ. Belgrade, Yugoslavia): *Usporedno ispitivanje toksičnosti olovoarsenata, olovooksida i arsenpentoksida. (COMPARATIVE INVESTIGATIONS OF THE TOXICITY OF LEAD ARSENATE, LEAD OXIDE, AND ARSENIC PENTOXIDE TOXICITY.)* *Acta Veterinaria (Belgrade)* 14, No. 3:179-83, 1964. Groups of 20 white mice each were given with their food the following compounds, respectively, for a maximum of 1 mo: 0.16 and 2.56% Pb arsenate, 0.048 and 0.652% arsenic pentoxide (As<sub>2</sub>O<sub>5</sub>), or 0.0792 and 1.2672% Pb oxide. The respective average hours of survival were: 290 and 66.3; 148 and 11.9; 579.5 and 271.0. Thus, the survival time of the

mice poisoned with Pb arsenate was significantly shorter than that of mice poisoned with Pb oxide and significantly longer than in mice poisoned with  $As_2O_5$ . Food consumption decreased when Pb arsenate and  $As_2O_5$  was administered but was unchanged by Pb oxide. Body weight decreased more with  $As_2O_5$  than with Pb arsenate and was unaffected by Pb oxide. The conclusion was drawn that in poisoning by Pb arsenate the toxic effect is mainly due to As. The higher the doses used, the more obvious this was found to be the case.

- 1193** Tikhonov, N.N.: Soderzhanie mediatorov v krovi pri svintsovoi intoksikatsii. Soobshchenie II. O soderzhanii atsetilkholina v dinamuke otravleniya svintsom v eksperimente. (PRESENCE OF MEDIATORS IN THE BLOOD IN LEAD INTOXICATION. II. ACETYLCHOLINE IN EXPERIMENTAL LEAD POISONING.) Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Meditsiny Nauk 1964, No. 3:65-9.

After preliminary examination of the blood picture and acetylcholine (ACH) content of the blood, acute Pb poisoning was induced in the 1st group of 8 dogs (average-sized animals of both sexes were used in all experiments) by 1 ml of a 5% solution of Pb acetate/kg body weight (route is not indicated). In 3 of the dogs in which the intoxication had a rapid course (death after 28-32 days) the ACH content of the blood increased from the onset of poisoning; 3 dogs with a less rapid course of intoxication (death after 58-64 days) ACH levels did not change in the 1st 10 days of poisoning, then increased and in the terminal stages exceeded the normal values by 2-3 times; in 2 dogs that died after 84-88 days, increased ACH levels occurred later.

In the 2nd group of 7 dogs administered 1 ml of 2.5% solutions of Pb acetate/kg, poisoning developed slowly and the animals lived up to 5-6 mo. ACH in the blood rose only slightly for 170 days, then increased sharply to an average of 150  $\mu$ g/ml when the condition of the dogs deteriorated. The individual variations of the blood ACH values of dogs both in the pre- and post-experimental stage are pointed out.

- 1194** Todd, J.R. (Vet. Res. Div., Stormont, Belfast, North Ireland): THE INCIDENCE OF LEAD POISONING IN CALVES IN NORTHERN IRELAND. Veterinary Record 76:845 (Aug. 1), 1964.

The author had earlier estimated the incidence of Pb poisoning in cattle in Northern Ireland to be 4.5% on the basis of finding concentrations >25 ppm in the kidney cortex of lambs <300 lb, received in the year 1960-1961 at a large knackerery, with a finding of 10-25 ppm being interpreted as abnormal but of doubtful significance. As other authors' estimates were lower (1.5%), the survey was repeated in the year 1963-1964 and at another knackerery over a 2-yr period of 1961-1963. Tabulation of the results together with those of the first survey showed levels of Pb >25 ppm in 51 or 4.1% of a total of 1247 kidneys; 21 or 1.7% contained 10-25 ppm. Most of the 51 "positive" contained very high Pb concentrations and only 9 were from 25-50 ppm. Thus, using a figure of 50 ppm as criterion, as some authors have done, would

reduce the percentage incidence of deaths from Pb poisoning only to 3.4%.

- 1195** Tolgskaya, M.S. (Inst. Ind. Hyg. and Occup. Diseases, USSR): Soderzhanie nukleoproteidov v tkanyakh vnutrennikh organov i nervnoi sistemy zhivotnykh pri intoksikatsii mysh'yakom, svintsom i anilinom. (THE NUCLEOPROTEIN CONTENT OF THE INTERNAL ORGANS AND NERVOUS SYSTEM OF ANIMALS POISONED WITH ARSENIC, LEAD, AND ANILINE.) Toksikologiya Novykh Promyshlennykh Khimicheskikh Veshchestv 1964, No. 6:128-44.

Of a total of 110 white rats used in the experiments, 39 received Pb acetate in doses of 0.01-0.04 g/kg/day orally or subcutaneously to induce acute, subacute or chronic poisoning. The duration of administration varied from 1-180 days. The state of Pb poisoning was followed by observation of loss in weight and appetite, convulsions, blood examination as to basophilic stippling of erythrocytes, reticulocytes. Sections of the organs and tissues of rats that died or were sacrificed were examined histochemically for RNA (method of Brash) and DNA (method of Fel'gen). For comparison, sections from 23 control rats were used. A more or less pronounced decrease of RNA was seen in the cells of the brain, bronchial epithelium, liver, kidneys, pancreas, submaxillary salivary gland, myocardium, gastroenteric epithelium, and epidermis of all poisoned rats (including those subjected to As and aniline poisoning). The decrease in RNA paralleled the severity of poisoning and the clinical and pathologic picture; it was most clearly pronounced in cells normally rich in RNA. The RNA decrease was also more marked in the tissues for which the particular poison has an affinity. The DNA content of the nuclei was more stable and changed only in severe poisoning, a drop in DNA coinciding often with the destruction of the cell. One of the earliest changes exerted by low doses of aniline, As and Pb was a disturbance of the nucleoproteid metabolism. The author concludes that in view of the importance of the latter in the synthesis of proteins, protein metabolism is early disturbed by small doses of the poisons studied, and suggests that histochemical methods may provide the detection of early morphologic changes while the usual methods as yet do not reveal pathologic processes.

- 1196** Watrach, A.M. (Univ. Illinois, Urbana): DEGENERATION OF MITOCHONDRIA IN LEAD POISONING. Journal of Ultrastructure Research 10, No. 3/4:177-81, 1964.

Six pigs, 8 wk of age, were fed daily 20-60 mg of Pb acetate/lb body weight for 3-6 mo; a 7th pig was kept as control. Signs of intoxication were loss of weight, anorexia, and trembling hind legs. The animals were killed at 6-wk intervals. Electron microscopic studies of the liver revealed the presence of fine, closely packed, parallel arrays of lamellar formations in some of the mitochondria. The individual lamellae measured 55-85 Å in thickness and 0.1-0.5  $\mu$  in length. The mitochondria containing such structures were usually enlarged and had only a few, short cristae. The presence of these changes was interpreted as a sign of mitochondrial malfunction and degeneration. (From

- 1197 Witschi, H.P. (Univ. Berne, Switzerland): Tierexperimentelle Untersuchungen zur enteralen Bleiausscheidung. (EXPERIMENTAL STUDY OF THE ENTERAL LEAD EXCRETION IN ANIMALS.) Internationales Archiv für Gewerbepathologie und Gewerbehygiene 20, No. 5:449-60, 1964.

Experiments were carried out on albino rats, average weight 270 g, in order to study whether a correlation exists between the enteral Pb excretion and the enteral plasma protein metabolism. Four groups of rats were acutely poisoned by infusing 1 ml of a 10% solution of Pb acetate into a 10- to 15-cm loop of the distal jejunum. Group 1 served as controls; Group 2 was subjected to total body radiation with 800 r to induce an exudative enteropathy; in Group 3, a trypsin-inhibitor was instilled into the intestinal lumen; and in Group 4, the bile flow into the duodenum was interrupted by an operative procedure. Pb was determined 8 hr after the start of the experiment in blood and various ligated parts of the intestinal tract (stomach, duodenum, jejunum, ileum, cecum, colon). An enteral Pb excretion was observed in all intestinal parts of the control animals. In the irradiated and protease-inhibited rats a significant increase of Pb excretion in the duodenum was observed; finally, blockage of bile flow caused no decrease in duodenal Pb excretion. Therefore, independent of bile flow, the above manipulations caused increased Pb excretion in the duodenum. The findings led to the hypothesis that part of the Pb circulating in the blood is transported by carrier proteins (the fractions of which are not yet identified) into the intestinal lumen where Pb is liberated by intraintestinal proteolysis and partly reabsorbed. This phenomenon takes place mainly in the duodenum and may be enhanced here by either radiation or a protein inhibitor.

Implications with regard to treatment of Pb poisoning are mentioned. The question is raised whether a substitution therapy with plasma proteins or still to be determined fractions could effect increased intestinal Pb excretion or even modify the distribution of Pb in the organism by complex-forming proteins. (31 references)

- 1198 Yanase, M. (Nagoya City Univ. Med. School, Japan): EFFECTS OF ENVIRONMENTAL TEMPERATURE ON CHRONIC LEAD POISONING. Journal of Nagoya City University Medical Association 15, No. 2:55-81, 1964.

Three groups of rabbits were injected with 5 mg Pb/kg/wk and kept in environments of 31°, 15° and 0° C., respectively, for 14 wk. Signs of Pb poisoning, such as urinary coproporphyrin and a decrease of hemoglobin and reticulocytes, appeared earlier in animals maintained at 0° C than in those at 31° and appeared the latest in rabbits at 15° C. The symptoms receded earlier in animals at 31° than in those at 0° C. All 3 groups showed liver damage. (From Excerpta Medica 11, Section 17:Abstr. No. 5881, 1965)

- 1199 Zel'tser, M.E.: MORPHOLOGICAL CRITERIA OF THE FUNCTIONAL ACTIVITY OF THE THYROID IN RATS WITH ACUTE LEAD POISONING. Izv.

In rats with acute Pb poisoning the thyroid epithelium was flattened and the follicles were enlarged, reducing the secretory action. (From Chemical Abstracts 62:9676, 1965)

## IV. MAN

### A. ADULTS

1950

- 1200 Antoniotti, F.: La reazione di Takata-Dohmoto (cifra di flocculazione) in un gruppo di operai tipografi. (THE TAKATA DOHMOTO REACTION (FLOCCULATION NUMBER) IN A GROUP OF TYPOGRAPHERS.) *Rass. med. infortunista e patologia del lavoro* 3:132-7 (Jan.-Feb.), 1950.

Pb does not seem to produce, at least in the first stages of its action, any irreversible epithelial changes of the liver parenchyma. However, there is a rather accentuated action on the connective tissue. It is known that the serine-globulin relationship of the serum is regulated by liver function; also, it is known that in diseases affecting this organ the hydrophil plasma proteins of more minutely dispersed molecules tend to increase. The author studied the Takata-Dohmoto reaction in a certain number of typographers. In this test, a series of 9 test tubes are prepared into which, with a pipette, 0.1 ml of serum is placed, as well as 0.9 NaCl and anhydrous Na carbonate. This is mixed thoroughly, then 0.7 Takata reagent (bichloride of Hg combined with fuchsin) is added. If there is an absence of precipitate in the first test tube a certain quantity of the reagent is added to the second and so on. The minimum quantity of the reagent which produces flocculation is determined. Thus the method expressed on a scale from 0-100 gives a measure of the lability of the serum proteins. The normal figure is 60. In 5 of 25 cases normal values were found. There were cases suffering from sclerosis without serious changes in liver cells. In 17 cases there were mild disturbances and in 1 case the value was 40. (From Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 12:369 (Abstracts), 1951)

- 1201 Barbasso, E. (Univ. Milan, Italy): Sul saturnismo nella lavorazione delle carrozzerie di automobili. (LEAD POISONING IN AUTOMOBILE MANUFACTURE.) *Medicina del Lavoro* 41:86-95 (Mar.), 1950.

Several hundreds of workers employed in filing automobile bodies were examined periodically from 1946 through 1949. Thirty-three cases of Pb poisoning occurred. The frequency of the symptoms was as follows: All had anemia, with an average of 3.2 million erythrocytes and 66% Hb (Sahli); 79% had increased coproporphyrinuria, 61% Pb line, 60% stippling (>100/million); 60% suffered from intestinal disorders; constipation was present in 45% of cases, Pb pallor in 33%, Pb colics in 18%, myalgia and arthralgia in 12%, Pb hypertension in 12%, hyperthyroidism in 9%. One case showed Pb palsy.

The great danger of filing bodies with grinding

machines and rotating brushes is stressed. Several technical measures for prevention are suggested, the most important of which is to discontinue filing with mechanical means and return to the system of filing by hand. (22 references)

- 1202 Bastos, R., Pimenta de Mello, R., and Cruz, W.O. (Inst. Oswaldo Cruz; Min. Labor, Rio de Janeiro, Brazil): URINARY EXCRETION OF COPROPORPHYRIN IN WORKERS HANDLING LEAD. *Memorias do Instituto Oswaldo Cruz* 47:211-30, in English 231-40, 1950.

The daily urinary Pb excretion of 2 normal men varied between 38 and 84, and 10 and 79,  $\mu\text{g/l}$ . The urines of >100 workers were examined who were employed in the following occupations: printing, monotyping, stereotyping, TEL production, manufacture of Pb pipes, pig Pb, and Pb paints. Working conditions were classified as good, bad, or very bad, according to the provisions existing in each establishment for the removal of dust and other atmospheric pollution. In every instance where adequate provisions were provided for the removal of polluted air, the urinary coproporphyrin (CP) values of the workers fell within normal ranges, but wherever hygienic conditions were inadequate, elevated CP values were encountered. Highest Pb absorptions existed in Pb pipe, pig Pb, and Pb paint manufacturing establishments where CP values of 4000 to >10,000  $\mu\text{g/l}$  of urine were encountered. The CP contents of the urines were determined by the procedure of Schwartz et al.

- 1203 Bénard, H.: (LEAD POISONING AND PORPHYRIN METABOLISM.) *J. Practiciens* 64, No. 28: 344, 1950.

A brief discussion. (From Chemical Abstracts 45: 4356, 1951)

- 1204 Bénard, H., Rambert, P., Gajdos, A., Gajdos-Török, A., and Malvezin: Un cas de colique saturnine avec troubles profonds du métabolisme porphyrique et plombémie normale. (A CASE OF LEAD COLIC WITH PROFOUNDLY DISTURBED PORPHYRIN METABOLISM AND NORMAL LEVEL OF LEAD IN THE BLOOD.) *Bull. et Mem. Soc. Med. Hôpit. de Paris* No. 21/ 22:1120-5, 1950.

The authors describe a case of Pb poisoning in a 41-yr-old man who had been working under very unhygienic conditions. He presented violent abdominal colic and on investigation was found to have a hemoglobin of 58%, a red cell count of <3 million/ $\text{mm}^3$ , abundant punctate basophilia and a urinary porphyrin (24 hr) of 1784  $\mu\text{g}$ . Despite this level, Pb in his blood was within normal limits (90  $\mu\text{g}/100 \text{ cc}$ ). The literature dealing with the disturbance of porphyrin metabolism in Pb poison-

ing is reviewed. Two schools of thought exist; one holds that the rise in porphyrin in the blood is due to destruction of red blood cells, while the more modern view attributes the rise to a breakdown in the synthesis of hemoglobin. The authors support Kench and his collaborators in their contention that there was no quantitative relationship between blood protoporphyrins and the level of coproporphyrin in the urine. The newer work of Grinstein et al (1950) in which they suggest that coproporphyrin III is the precursor of protoporphyrin, is briefly discussed. Increase in urinary porphyrin excretion is regarded as an early sign of Pb intoxication, appearing before punctate basophilia. The authors emphasize the fact that, despite the clinical picture and the profoundly disturbed porphyrin metabolism in their case, the level of Pb in the blood was normal. The value of this finding as an index of Pb absorption is gravely suspect. (From Bulletin of Hygiene 26:161, 1951)

- 1205 Bilecki, G.: Die Frühdiagnose der Bleivergiftung. (THE EARLY DIAGNOSIS OF LEAD POISONING.) Z. Ärztl. Fortb. 44:482, 1950.

As discussed by the author, the occurrence of Pb poisoning is becoming more rare, and a differential diagnosis of the mild cases encountered now is difficult. Early recognition is based on 4 "cardinal symptoms": Pb pallor, blood changes, porphyrinuria, Pb line. The most important blood changes are: Increase in basophilic stippling, increase in vital granulation, polychromasia. The importance of preventive measures is stressed: frequent examinations, and changes for those most exposed to Pb. (From Zentralblatt für Arbeitsmedizin und Arbeitsschutz 3:22 (Abstracts), 1953)

- 1206 Bloomfield, J.J.: STUDIES OF HEALTH HAZARDS IN INDUSTRY. METALLIC POISONS. Industrial Hygiene Newsletter 10:11-3 (Nov.), 1950.

Brief review of Pb poisoning hazards in various industries and their control.

- 1207 Butt, E.M., and Simonsen, D.G. (Los Angeles County Hosp.; Univ. S. California School Med.; Los Angeles): MERCURY AND LEAD STORAGE IN HUMAN TISSUES. WITH SPECIAL REFERENCE TO THROMBOCYTOPENIC PURPURA. American Journal of Clinical Pathology 20:716-23 (Aug.), 1950.

In the course of an investigation of fatal purpuras, appreciable amounts of Pb and Hg were found in the tissues of some patients with acute thrombocytopenic purpura. This report deals primarily with the quantitative values of Hg in tissues found in 134 autopsies. Both Hg and Pb determinations were made by a dithizone method. The values presented are based on the analysis of 2 g of wet tissue. The lower limits of the method are 10 µg/100 g wet tissue and negative figures may actually lie between 0 and 10 µg. There may be traces of Hg in all tissues. However, the authors were interested not in traces, but in values that may be related to disease processes. In all cases, the values refer to wet tissue.

In 69 cases with no known sources of Hg, the average Hg storage in livers was 0.006 mg and in re-

nal tissue, 0.075 mg/100 g wet tissue. In 2 instances with values >0.1 mg, it is suspected that the patients had received Mercurhydrin for congestive heart failure. In a group of cases whose deaths may have been related to storage of metal, the average Hg values in liver was 0.058, in kidney, 0.192 mg/100 g. Some of the causes of death were: Pb encephalitis, acute mercurial nephritis (Pb present), Pb poisoning with acute necrosis of the liver, cerebral hemorrhage with Pb poisoning, and aplastic anemia with a high Pb content. The patient with acute mercurial nephritis presented a typical picture of glomerulonephritis. The patient with Pb encephalitis was a 10-mo-old infant whose mother had been working in a pottery plant during the first 7 mo of her pregnancy and delivered a Pb poisoned baby. One year after delivery, the mother was still excreting Pb with no signs of poisoning. A miscellaneous group of 8 patients with nephrosis, 5 of whom died, is described. Hg levels ranged from 0-0.370 mg/100 g in livers and from 0.100-0.790 mg/100 g in kidneys.

In a group of 22 patients who had received mercurial diuretics in treatment of congestive heart failure and who died, the average amount of Hg in livers was 0.757, and in kidneys 8.619 mg/100 g. In another group of deceased patients who had received the same treatment for conditions other than congestive heart failure, the average liver Hg was 0.659, the renal, 3.171 mg/100 g. The use of Mercurhydrin, particularly in patients with carcinoma of the stomach and malignant nephrosclerosis, is questioned.

In the last group of patients, who died of acute thrombocytopenic purpura, Hg and Pb levels were as follows: In fresh tissue, the average Hg was 0.287 in liver, 0.704 mg/100 g in kidneys. Pb values ranged from 0.010-0.240 in livers and from 0.080-0.533 mg/100 g in kidneys. Pb storage values were higher than the usually accepted levels. Because of this unusual finding, 7 additional cases of acute thrombocytopenic purpura were examined. The kidney and liver tissues were insufficient, but determinations in other organs revealed elevated levels of Pb and Hg. In formalin-fixed tissues, Hg levels ranged from 0.030-1.360 in livers and from 0.150-1.0 mg/100 g in kidneys. Pb levels in lungs were 0.045-0.318 mg/100 g; in brain, 0.127, in liver, 0.224, in mixed tissues, 0.136, in spleen, 0.100-0.173. Five of the 13 cases were children, 7 wk-9 yr old; the others were from 27-75 yr old. The 7-wk-old had been ill since birth; mother had been exposed to Pb fumes of an open-air pottery plant where her husband worked. She had earlier given birth to a normal child, but had not been exposed to Pb during that pregnancy. Pb content of liver of the infant was 0.091 and kidney 0.228 mg/100 g.

- 1208 Campbell, A.M.G., Herdan, G., Tatlow, W. F.T., and Whittle, E.G. (Univ. Oxford and Bristol, England): LEAD IN RELATION TO DISSEMINATED SCLEROSIS. Brain 73:52-71, 1950.

The history of association of Pb with diseases of the central nervous system was reviewed. The Pb content of the soil was studied in the homes of country cases of disseminated sclerosis, all of whom had long been resident in their villages. In

the soil of one village the Pb content was significantly high. The total Pb contents ranged in 1 village from 60-150 ppm, and acetic acid soluble Pb, 9-20 ppm. The garden soils associated with other cases of disseminated sclerosis showed 350-600 ppm total Pb, and acetic acid soluble, 3.0-32 ppm. The incidence of the disease in the 2 villages studied was abnormally great compared to findings in other areas.

Pb as an occupational hazard is discussed in relation to cases resembling disseminated sclerosis. Two cases of frank Pb poisoning with neurological symptoms resembling true disseminated sclerosis are described; 1 was due to contaminated water (analytical findings are not included), the other, to occupation (house painter). In both normal blood picture and spinal fluid were found, but 0.15 mg/100 ml blood. The Pb content of the teeth of disseminated sclerosis cases was on the average significantly higher than in control groups. The Pb content of teeth in normals ranged from 8.6-120.9 ppm; in the disseminated cases (48 are tabulated), 11.4-210 ppm. In the normals, age and sex differences appeared, but not in the disseminated cases; in the latter there was a difference between town and country residents, the former showing the higher levels. It is suggested that this evidence implies that Pb does play some part in the etiology of disseminated sclerosis, and that Pb may interfere with some essential mineral, vitamin, or enzyme reactions and thus precipitate demyelination. This is also discussed in relation to other diseases of the nervous system. (49 references)

- 1209 Carstens, M.: (VENTRICULAR ANEURYSM AFTER ACUTE LEAD POISONING.) Fortschr. Gebiete Röntgenstrahlen 72:339-44, 1950.

A 31-yr-old patient developed gastroenteritis followed by violent attacks of angina pectoris after eating apple sauce containing Pb. After a few yr an aneurysm of the left ventricle developed. The causal relationship between the condition and the Pb poisoning is discussed on the basis of the literature. (From Chemical Abstracts 46:10437, 1952)

- 1210 Chakraborty, M.K., Rao, M.N., and Banerji, B. (All-India Inst. Hyg. Public Healthn, Calcutta, India): A STUDY OF OCCUPATIONAL LEAD HAZARD IN SELECT INDIAN INDUSTRIES. Indian Journal of Medical Research 38:429-56 (Oct.), 1950.

Clinical and biochemical examination was made of 189 exposed and 11 control workers in 3 printing plants and 2 engineering concerns having soldering as one of their main operations. The blood and urine of each worker and the air of their working environment were analyzed for Pb and the percentage of basophilic cells were counted in blood. Although none of the 189 exposed workers had pathological lesions of Pb poisoning, 40% showed high absorption of Pb in the body as revealed by the amount of Pb in the body and the basophilic aggregation of the red blood cells above permissible limits.

- 1211 Dagnini, G.: Sulla paralisi periferica saturnina. (PERIPHERAL PARALYSIS IN LEAD POISONING.) Archivio di Patologia e Clinica Medica 37, No. 5:347-65, 1950.

A case of subacute Pb poisoning is presented. It was first characterized by early lesions, digestive and parenchymatous, then by delayed peripheral nerve lesions with paralysis of the radial nerve and weakness of muscles of forearm and shoulder. The development of the illness extended over 18 mo. The muscular weakness disappeared very rapidly but the radial nerve affection took a great deal longer to improve and disappear. (From Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 13:288 (Abstracts), 1952)

- 1212 De Dominicis, G.: Prevenzione del saturnismo: È utile la somministrazione del latte agli operai? (PREVENTION OF SATURNISM: IS THE INTAKE OF MILK BY THOSE WHO ARE EXPOSED TO IT EFFECTIVE?) Diffesa Sociale No. 3:159-63, 1950.

From the results published by various authors and from personal experience, the author believes that if the order of supplying milk to Pb workers is continued, it is more on a psychological and dietary than preventive basis. (From Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 12:370 (Abstracts), 1951)

- 1213 Di Porto, A.: Orientamenti diagnostici in tema di saturnismo. (DIAGNOSIS OF LEAD POISONING.) Diffesa Sociale No. 3:178-84, 1950.

The author proposes that the diagnosis of Pb poisoning can be made systematically thanks to a number of laboratory analyses which should be made for every subject suspected of the disease. These tests consist in the determination of intermediate exchange of lecithin, choline and various proteins. If, as Antoniotti has shown by the Takata-Dhomoto reaction, Pb poisoning involves the liver, it involves not only this organ but the greater part of the organism as well. According to di Porto it is necessary to utilize a method (a practical and rapid one) for the determination of these proteins. (From Archives des Maladies Professionnelles des Médecine du Travail et de Sécurité Sociale 12:367 (Abstracts), 1951)

- 1214 Dizon, G.D. (Bureau Health, Manila, Philippines): STUDY OF PHILIPPINE WORKERS EXPOSED TO LEAD SHOWS HIGH RATE OF ABSORPTION. Industrial Hygiene Newsletter 10:17-9 (Dec.), 1950.

See following abstract.

- 1215 Dizon, G.D., Luciano, V.J., Navarro, J.Y., Anselmo, J.E., and Pesigan, D.E. (Bureau Health, Manila, Philippines): LEAD POISONING AMONG LEAD WORKERS. Journal of the Philippine Medical Association 26:417-22 (Sept.), 1950.

A study was made of the effect of Pb on 20 workers employed for 1-18 yr in 4 establishments in Manila engaged in manufacturing of Pb batteries, washers, bars, and seals. Concentration of Pb in workroom atmospheres varied from 0.23-2.48 mg/m<sup>3</sup> of air, thus very much higher than the MAC Pb (0.15 mg/m<sup>3</sup>), and showed that the workers were subjected to a considerable exposure of Pb dust and fumes. Laboratory examinations of the workers' urine and

blood strengthened the suspicion of early Pb poisoning. Of the 20 urine samples, 12 or 60% showed positive porphyrin tests. Six or 30% gave high urinary Pb values, ranging from 0.15-0.60 mg/l (normal, 0.03-0.08 mg). Examination of the blood showed that of the 17 samples, 15 or 88% had lower hemoglobin content, 11 or 64.7% with lower red cell counts and 8 or 4% had high Pb values (0.08-1.07 mg/100 ml). The above findings with the common complaints of the workers, mostly in the manufacture of batteries, of weakness and anorexia at times, intermittent abdominal pain, metallic taste, headache, vertigo, and neuralgia tended to strengthen the suspicion that some of the Pb workers under study were affected by Pb to a certain degree.

The authors conclude by stating for the protection of workers in Pb industries, control measures are necessary, consisting of medical and engineering controls. The medical control should consist in pre-employment, and periodical physical examination, treatment and follow-up of cases, personal hygiene, sanitary maintenance of the working environment, provision of separate lunchrooms, individual lockers, safe drinking supply, and others. The treatment of cases is the concern of the factory physician. However, the following treatments may be mentioned: for acute poisoning, Ca gluconate intravenously; opiates for pain, and milk and eggs for diet; for chronic poisoning, deleading by diet which contains very little Ca, by dilute phosphoric acid, ammonium chloride, and Na bicarbonate; Mg sulfate, pressure, and heat on the abdomen for colic; Ca gluconate intravenously for palsy and for Pb paralysis, massage, electrotherapy and salicylates. The engineering control of atmospheric contamination by Pb dust and fumes is by installation of local exhaust ventilation consisting of hoods or enclosures at the source of contamination connected by air ducts or piping to the collector and exhauster by which the contaminated air is conveyed to the collector or to the outside.

- 1216 D'Onofrio, V., and Sicca, U. (Inst. Ind. Med. E.N.P.I.; Univ. Genoa, Italy): Colica saturnina e appendicite. (LEAD COLIC AND APPENDICITIS.) *Rassegna di Medicina Industriale* 19:288-9 (Nov.-Dec.), 1950.

In view of the possibility that Pb colic may be mistaken for appendicitis, the authors studied 62 cases of Pb poisoning, 50 of whom exhibited symptoms of gastrointestinal disorders, principally colics. In all these cases, Pb poisoning was established on the basis of laboratory findings and symptomatology. The 50 cases were divided into 2 groups: (1) 22 who had suffered a single attack; (2) 27 who had suffered repeated attacks of colic in the past years. All were subjected to careful examination as to clinical and radiologic signs of appendicitis. According to the criteria the authors had set, 4 of Group 1 (18.1%) and 9 of Group 2 (33.3%) presented signs of appendicitis. They did not find this surprising, for Koelsch had called attention to the possibility that in Pb colic, spasms, vascular changes, small hemorrhages, etc, occur in the appendix and that under such influences conditions predisposing infection may develop. Without wishing to state an occupational cause for appendicitis, the authors conclude that

repeated colics and chronic colitis cause changes in the appendix.

- 1217 Dulong de Rosnay, M.: Anémie saturnine aplastique. (APLASTIC SATURNINE ANEMIA.) *Proceedings of the Society of Industrial Medicine, Bordeaux. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 11:633, 1950.

A case of Pb poisoning in a solderer 42 yr old is presented. Hematologic examination showed severe anemia: 2,610,000 red blood corpuscles and the presence of a number of stippled erythrocytes. In spite of removal from work, the patient presented 2 wk after the examination an attack of colic, constipation, vomiting and pains in joints. The anemia was in an aggravated condition. Treatment consisted of hospitalization and administration of liver extracts, repeated transfusion. Recovery on the part of the blood picture took ~1 mo.

- 1218 Engel, H.: (LEAD AND HYPERTENSION). *Neue med. Welt* 1:528 (Apr. 15), 1950.

It is pointed out that the theory that the majority of symptoms of Pb poisoning are due to vascular effect of Pb (either vasoconstrictive or toxic) is a clinical theory which has been derived from the observation that there is a considerable increase in blood pressure during the acute manifestations of Pb intoxication. The author reviews the literature on the relationship of Pb poisoning and hypertension. While there are contradictory opinions on most aspects of this problem, it is most generally accepted that the so-called "Pb kidney" is a hypertensive, contracted kidney which differs from other nephroscleroses only in etiology. This type of renal disorder, according to some observers, is ~3 times as frequent in Pb workers as in persons not exposed to Pb. Some of the reports cited by the author are concerned with the role of the age factor and the length of exposure to Pb. It has been pointed out that hypertension with or without renal involvement occurs in Pb workers only after years of exposure and chiefly in workers of more advanced age. As Teleky has pointed out, more information might be obtained on this relationship of Pb poisoning and hypertension if studies were made on large numbers of Pb workers who have been exposed to Pb >20 yr and who are >40 yr of age. (From *Archives of Industrial Hygiene and Occupational Medicine* 2: 609 (Abstracts) 1950)

- 1219 Ferretti, G.: Olfatto ed intossicazione cronica da piombo (studio clinicospirimentale). (OLFACTORY CAPACITY AND CHRONIC LEAD INTOXICATION (CLINICAL AND EXPERIMENTAL STUDY).) *Archivii Italiani di Laringologia* (Suppl. 1) 58:47-58, 1950.

- 1220 Fields, L.B., and Charles, G.W. (Univ. Oklahoma, Norman): A SPECTROGRAPHIC INVESTIGATION OF TRACE ELEMENTS IN HUMAN TEETH. *Proceedings of the Oklahoma Academy of Science* 31:47-8, 1950. (Pub. Nov., 1951).

Spectrographic analysis of unfilled and filling-free sections of 26 filled and unfilled teeth showed Ca, Mg, P, Na, Cu and Zn in all, and B in some.



Pb and Ag were found in most of the samples which were made from filled teeth. Their occurrence was less frequent in the spectra of the unfilled teeth. Filled teeth sometimes contained Sn, Hg, Au, Pd, and Bi. The increase in concentration of Ag, Zn, Sn and Pb with approach to the crown of the tooth in filled teeth but not in unfilled teeth is evidence for migration of restoration metals.

- 1221 Fischer, P. (Regional Hosp., Ballenstedt a. Harz, Germany): Zur Kasuistik der Bleitetraäthylintoxikationen. (TETRAETHYL LEAD POISONING.) Zeitschrift für Ärztliche Fortbildung 44:598-600, 1950.

Among 11 workers engaged in the recovery of residues from the distillation of TEL, 6 men were subjected to medical observation. In the mild cases, the signs of intoxication disappeared in 3 wk. One man, a tubercular, after 10 days' exposure to distillation residue, developed acute signs of poisoning, which rapidly progressed to violent delirium and death. Autopsy showed cerebral edema, 0.49 mg Pb/kg 100 g fresh liver, 5 mg/50g feces, 0.12 mg/100 ml blood. Three other cases in which the poisoning was accompanied by mental disturbances, are described. The exposure to TEL was similar, and the symptoms had appeared after a similar latency period.

- 1222 Gerrits, W.B.J., and Heinemann, H. (Holland): (LEAD POISONING.) Nederlandsch Tijdschr. Geneesk. 94:2721-84 (Sept. 23), 1950.

The authors examined 60 printing shop employees who had recently been exposed to a powder with a high Pb content used in the offset process. In the examination particular attention was paid to the Pb color of skin and mucous membranes, the Pb line, weakness of extensor muscles and blood pressure. The blood was examined for Hb content, number of erythrocytes and leukocytes, basophilic stippling, polychromasia, anisocytosis, poikilocytosis and other changes. The urine was studied for porphyrin and Pb content. The authors stress the need to differentiate between symptoms of increased Pb absorption and those of Pb intoxication. Of the 47 workers who were studied thoroughly, 44 showed signs of increased Pb absorption, but only 21 had typical symptoms of Pb poisoning. (From Journal of the American Medical Association 145:268 (Abstracts), 1950)

- 1223 Goldstein, D.H. (New York Univ. Coll. Med., N.Y.): LEAD POISONING. Compensation Medicine 3, No. 4:11-6, 1950.

In diagnosing industrial Pb poisoning it is very important to ascertain a history of exposure, appraise symptoms and signs carefully, and obtain confirmatory laboratory findings. Virtually all occupational Pb poisoning is produced primarily through inhalation of air containing Pb dust, fumes, or vapor. An occupational exposure may be defined as one in which Pb may be absorbed into the tissue of the worker, but the worker must be sick with a well-defined syndrome of symptoms before the evidence of absorption can be considered Pb poisoning and compensable. Pb is not a normal physiologic constituent of the body tissues; yet,

because it is ingested with food and drink and inhaled, small amounts are absorbed into the body and normal Pb values of 0.06 mg/100 ml of whole blood, 0.08 mg/l (large samples) of urine, and 0.50 mg/g of fecal ash are frequently given. Values in excess of these figures mean abnormal absorption but do not of themselves mean Pb poisoning. It is important to remember that the higher the urinary Pb concentration, the greater the hazard of incurring Pb poisoning; fecal Pb is valuable chiefly as an index of exposure, not of absorption; both blood and urine analyses are excellent guides to Pb absorption, provided contamination (both in collection of sample and in laboratory) is avoided. When a worker is removed from occupational exposure, blood Pb returns to normal much faster than does urinary Pb. A gingival Pb line and erythrocyte stippling also indicate absorption and not necessarily intoxication. The basic requisite for a diagnosis of Pb poisoning is that the condition shall be symptomatic. The clinical picture is traditionally separated into 3 syndromes: gastrointestinal, neuromuscular, and cerebral. There is frequent overlapping. Of the peripheral blood changes, only the stippled cell count in excess of 1000/million red cells in the presence of normal or slightly reduced Hb content and red cell count is infrequently encountered except in Pb poisoning. Of the suspected sequelae of Pb poisoning, only the possibility of kidney damage has not been disproved. The therapy of Pb poisoning is controversial; the prime indication is to remove the patient from the Pb exposure. Diagnosis is not always easy. (14 references)

- 1224 Greenfield, I., and Gray, I. (Woodmere; Brooklyn, N.Y.): LEAD POISONING. IX. THE FAILURE OF LEAD POISONING TO AFFECT THE HEART AND BLOOD VESSELS. American Heart Journal 39, No. 1:430-5, 1950.

A variety of studies were performed in 340 patients who had Pb poisoning. As reported in previous studies, this group was assigned into groups: (1) with acute poisoning; (2) with chronic absorption and acute exacerbations; (3) with chronic poisoning. In all cases, exposure had been occupational, and the patients had been observed at various intervals over a period of 10 years. Special studies including the cardiovascular and the peripheral vascular systems as well as renal function studies were made in a selected group of 40 patients who had pronounced clinical symptoms of acute Pb poisoning and who in some instances had pronounced and disabling neurological complications. Of these, 6 were <30 yr old; 9 had been exposed for <10 yr; 32 for 10-50 yr. Three were women (30-50 yr).

Studies of the peripheral vascular system did not reveal any findings to indicate any state of vascular spasm or any other change in the peripheral vessels. The size of the heart was not abnormal as ascertained either by physical examination or by teleroentgenography. No electrocardiographic abnormalities were noted. In ~3-4% of the entire group of 340 patients there was hypertension, transient in nature, which was present for a brief interval during the acute episode. This transient hypertension was evident during the height of the clinical symptoms and during the

period of abnormal Pb metabolism. The blood pressure in this group returned to normal following removal of the patient from the occupational hazard and remained normal. The blood pressure in the entire group was essentially the same as that usually present in similar age groups irrespective of occupation. The authors conclude that on the basis of these investigations it is evident that the absorption of Pb does not have an adverse effect on the cardiovascular or the peripheral vascular systems. (18 references)

- 1225 Hay, W. (Royal S. Hosp., Liverpool, England): LEAD ENCEPHALOPATHY IN A COOPERAGE. *British Journal of Industrial Medicine* 7:177-86 (Oct.), 1950.

A cooperage was described in which a severe Pb hazard (air samples showed 20-1300 mg Pb/10 m<sup>3</sup> at different locations; MAC amount is 2 mg/10 m<sup>3</sup>) caused 2 cases of Pb poisoning among 4 coopers apparently exposed to similar risk, with 1 developing encephalopathy. His case report is summarized as follows: A 39-yr-old man, an alcoholic, complained of headache, vomiting, anorexia, weakness and polyuria as well as double vision, deafness, tinnitus and dizziness. After admission to the hospital, the patient was the victim of delirium and hallucinations. Following several suggested diagnoses, examination on the 5th day showed the presence of a blue line near the gum margin, leading to the suspicion of Pb poisoning. Blood studies showed marked punctate basophilia with increased polychromasia, 9.7 g hemoglobin, 3,500,000 red cells, color index 0.9, 4.5% reticulocytes, 9500 white corpuscles, normal differential, 0.33 mg Pb/100 g (normal 0.01-0.06). Cerebrospinal fluid showed 0.06 mg Pb/100 g, and urine 0.5 mg Pb/l (normal 0.01-0.08). (Analysis was carried out by Snyder's dithizone method.) The patient was treated with Ca levulinate and Ca lactate, lumbar punctures were performed and his condition improved. After 1 relapse and 9 wk in the hospital, he was discharged. Four to 7 mo later, the Wechsler-Bellevue intelligence test and the Shipley-Hartford test gave confirmatory evidence of intellectual deterioration. Electroencephalography revealed no abnormality.

The authors suggested that the patient was predisposed to Pb poisoning because of carelessness at work and alcoholism. The syndrome of Pb encephalopathy in adults was reviewed. The difficulties in diagnosis, the possible causes of apparent susceptibility to Pb, the absence of hypertension in this and other cases, and the treatment of encephalopathy were discussed. Some of the essential differences between this form of encephalopathy and that due to TEL were outlined.

- 1226 Heap, R., Saunders, B.C., and Stacey, G.J. (Univ. Chem. Lab., Cambridge, England): ORGANO-LEAD COMPOUNDS. PART IV. (a) A NEW METHOD FOR PREPARING DIETHYL-LEAD SALTS. (b) DERIVATIVES OF MIXED PLUMBANES. *Journal of the Chemical Society* 1951:658-64.

A new method of preparing diethyllead (diEL) salts, by treating diEL sulfite with the appropriate acid, is described. The following compounds, when dispersed at concentrations of 1 ppm in a testing chamber, did not exert appreciable sternutatory

effects on observers, and were placed in Grade 0 (of authors' test described in Part I): diEL dichloride, dibenzoate, bischloroacetate, bistrichloroacetate, ditolueno- and p-sulfonate, and bithioacetate. Other compounds, found to have high sternutatory action (Grade 3+) were: ethyldipropyllead (EdiPrL) chloride, EdiPr-pumbitoluene-p-sulfonamide, diEPrL propionate, and chloroacetate, and n-butyl diEL chloroacetate.

- 1227 Hertz, T.: Al har'alat oferet. (ON LEAD POISONING.) *Dapim R'fujim* (Tel-Aviv) 9, No. 1:60, 1950.

A storage battery factory worker, employed for 4 yr, had been treated during those years by the house physician repeatedly for constipation, anorexia, fatigue, weakness and tremor of right hand. Hypertension of 200/110 mg Hg was found with changes in the eye fundus. The author diagnosed Pb poisoning when he attended patient with acute abdominal colic, jaundice of hemolytic type, disturbances in kidney function and all the former symptoms in more pronounced grade. A Pb line was found and there was a pronounced anemia with increase of reticulocytes to 45%. It could be proved that exposure had increased just before the acute attack through leakage in mask worn at work. Pb excretion in urine was 0.3 mg in 24 hr even 3 mo after cessation of exposure. No X-ray changes in bones were found. The author discusses the possible connection between Pb exposure and hypertension, jaundice and kidney damage in this patient with reference to similar reports in the literature. He concludes with the repeated demand for thorough pre-employment examinations and better education and supervision (both medical and technical) of workers exposed to Pb.

- 1228 Holstein, E. (Berlin): Beiträge zur Bleitetraäthylvergiftung. (CONTRIBUTIONS TO LEAD TETRAETHYL POISONING.) *Arbeit u. Sozialflrs.* 5, No. 18, 1950.

In the manufacture of TEL (smelting of Pb with Na, addition of ethyl chloride), Pb residues containing 0.4% TEL were conveyed for settling in pits or tanks and finally to smelting furnaces. The workers assigned to this operation wore protective clothing and masks, and were under medical surveillance. Over a period of 16 yr, 6 cases of poisoning occurred. Two of the cases are described. When, after the war, the Pb sludge was transported under different circumstances by motor to the railroad, 5 of 10 workers thus engaged became ill, showing symptoms of central nervous system and gastrointestinal disturbances. One case ended in death. Autopsy showed cerebral and pulmonary edema, fatty degeneration and high Pb concentrations in the liver, hemorrhages in the cardiac muscle. The supervising authority ordered suspension of this operation. The cars which had been used for shipping the Pb residue had also been used for the transport of feed, and a number of animals that had ingested this feed had died. After proper measures had been instituted, the disposal of Pb sludge was accomplished without further accidents. (From *Zentralblatt für Arbeitsmedizin und Arbeitsschutz* 2:23 (Abstracts), 1952)

- 1229 Huder (Pamplona, Colombia): Néphrite toxique d'origine saturnine. (TOXIC NEPHRITIS ATTRIBUTABLE TO LEAD.) Journal d'Urologie Médicale et Chirurgicale 56: 556-7, 1950.

In presenting this case (a gypsy, 36 yr old, exposure to Pb not indicated), Huder emphasizes the rarity of its occurrence, the fact that the diagnosis which was made by the determination of important changes in the erythrocytes and the therapy which had been employed with success: anesthetic infiltration of the renal pedicle (thus diuresis and arterial tension were reestablished). Huder states that he has used this method systematically and with success. (This report was sent to J. Michon who presented it at a meeting of the French Society of Urology.)

- 1230 Johnson, W.S., and Whitman, N.E. (Bethlehem Steel Co., Pa.): COPROPORPHYRINURIA AS AN INDEX OF LEAD ABSORPTION. A.M.A. Archives of Industrial Hygiene and Occupational Medicine 2:170-4 (Aug.), 1950.

The method of de Langen and ten Berg for the determination of urinary coproporphyrin (CP) was modified to serve as a method for screening Pb-urine specimens on the basis of the characteristic red fluorescence of CP. During 1 mo of the 11-mo period of this study, 1 of the authors ingested 2 mg Pb daily (as acetate) to determine how soon Pb excretion and CP would occur. Elevation of urinary Pb soon occurred (5 days), but CP lagged by ~12 days and disappeared 16 days after ingestion stopped; urinary Pb was then within normal limits. Two hundred and ninety-four urine specimens from workers who had undergone various Pb exposures were examined for both CP and Pb. A table of results is presented in which the data are divided into 7 groups according to degrees of red fluorescence. There was good correlation between the means and degrees of fluorescence. Of the entire group of specimens, 2 showed no red fluorescence when urinary Pb concentrations exceeded 0.15 mg/l. As was found in the personal experiment shown above, it appeared that at the beginning of a Pb exposure, CP elimination is not established as quickly as elevations of urinary Pb. It is stated that with further refinement the method can be made roughly quantitative for urinary Pb.

- 1231 Kahan, V.L. (Oxford Child Guidance Clinic, England): PARANOID STATES OCCURRING IN LEADED-PETROL HANDLERS. Journal of Mental Science 96:1043-7 (Oct.), 1950.

The author describes 6 cases of Indian patients 22-40 yr old (assigned to Persia), all working in close contact with gasoline (5 for 2-6 mo; 1 for 2 yr), who developed emotional disturbance, varying from acute excitement and confusion to depressive traits such as hypochondriasis, vague fears and insomnia. Hallucinations, delusions, or ideas of reference appeared in all. The patients worked long hours in high natural temperatures, filling and stacking cans of gasoline in enclosed spaces. At the time the disturbances appeared, the gasoline had had its octane number considerably raised by further addition of TEL. The 1st patient, who had been ill for some time, was transferred to the mental hospital wing because of increasing ex-

citement, restlessness and unmanageability. In addition to the great excitement, he seemed to experience acute terror, and, with fixed gaze, he seemed to be visually hallucinated. He died on the 5th hospital day. The 2nd showed the same restlessness, noisiness, and obvious fear. He was disoriented and confused, and experienced auditory hallucinations. He continued noisy, destructive and uncooperative, and died on the 20th hospital day. The 3rd attempted to cut his throat before admission, became aggressive, negativistic and resentful of nursing care. There was evidence that his violence was related to delusions of persecution of an unspecific type. His fear became worse at night. The 4th was found wandering at large, and on admission was stuporous and confused. Later he became aggressive and destructive. The 5th ran away from his unit believing he was going to be murdered. After admission he still believed his life was in danger. The 6th patient, who had complained of vague pains and uneasiness for 2 or 3 wk before admission, continued to feel vaguely that something dangerous was going to happen to him. In cases 3, 4, and 5 the possibility that vaporized Pb might be a factor was recognized, and intravenous Mg sulfate and an alkaline mixture were given early, with subsequent improvement. The last patient received no specific therapy, but improved rapidly. The absence of physical findings in all cases, as well as their common history as handlers of gasoline, led to the diagnosis of TEL psychosis. Treatment was directed at immobilizing the Pb in the tissues, releasing it slowly, and controlling the patient's excitement and maintaining his physical condition.

In his discussion, the author states that analyses for Pb were impossible under local conditions. Above diagnosis was made in part on the finding that all patients showed a reticulocytosis of ~4-7%.

- 1232 Los Angeles City Health Department: LOS ANGELES STAFF SEEKS SOLUTIONS TO PERPLEXING PROBLEMS. LEAD POISONING - SOURCE UNKNOWN. Industrial Hygiene Newsletter 10:14 (Sept.), 1950.

The Department consistently felt that one of the Pb storage-battery plants in this city was so well laid out in its new quarters, and the engineering controls have been so well designed, that there was no likelihood of Pb poisoning among the workers in that plant. However, an occupational disease report indicated acute Pb poisoning in a worker who had been employed only from August 1949 to February 1950 (in the new plant). A thorough study on a day when the exhaust equipment was not operating properly, showed that in only 1 location was the Pb concentration in the air in the hazardous range, and this location was far removed from the work station of the affected worker. Subsequent tests at the downdraft packing table where this man had worked, showed relatively low Pb concentrations in the range of 0.11-0.12 g/m<sup>3</sup>. The length of exposure and the concentrations of airborne Pb found in the tests were not consistent with acute Pb intoxication. However, it was found that some of the workers were in the habit of smoking or eating on the job, and it was concluded that the affected worker must have acquired the excessive Pb through

ingestion rather than inhalation. What stood out most strikingly in this case was the lack of pre-placement and periodic physical examinations, which would have indicated whether the affected worker had absorbed excessive Pb in his previous employment or entirely in this plant. The establishment of a program of physical examinations, both pre-placement and periodic, and improvements in practices which contribute to airborne Pb and to the dangers of ingestion of Pb were recommended.

- 1233 Mathisen, H.S. (Ullevål Hosp., Norway): Blyforgiftning. I fire tilfelle, hvorav tre er behandlet med dimercaptol. (LEAD POISONING. FOUR CASES, THREE OF WHOM WERE TREATED WITH DIMERCAPROL.) Tidsskrift for den Norske Lægeforening 70:80-2, 1950.

Of the 4 occupational cases reported, 1 (a woman) was treated with Ca gluconate iv, and the others with BAL im, in doses of 2.5 mg/kg body weight 4 times daily for the 1st day, then twice daily for 6-3 days. The patients had been admitted with typical symptoms and signs of Pb poisoning, 1 of whom presented neurologic signs; anemia of normocytic type was present in 3; urinary Pb was up to 690 µg/l; Pb in blood was 112-218 µg/100 ml; coproporphyrinuria was 0.6-4 mg/l. None showed renal disorders. BAL treatment increased urinary excretion of Pb. Aside from nausea in 1 patient and some local pain upon im injection, side effects were not observed. On the basis of the good results, the author suggests the value of BAL for diagnostic purposes.

- 1234 Mendoza, A.Z.: (PORPHYRINURIA DETERMINATIONS IN NORMAL SUBJECTS AND IN COCA LEAF ADDICTS.) Anales fac. farm. y bioquim., Univ. nacl. mayor San Marcos (Lima, Peru) 1:383-96, 1950.

Porphyrinuria determinations in normal subjects varied between 11 and 41.8 µg/l for men, and 14.3 and 72 µg/l for women. Studies in 2 female subjects given cocaine-HCl indicated that porphyrinuria decreased with tolerance to the drug. Coca leaf chewers showed normal values, but lower than in persons with Pb poisoning. (33 references) (From Chemical Abstracts 47:11513, 1953)

- 1235 Muller, J. (Dept. Ind. Hyg. Occup. Dis., Prague, Czechoslovakia): Příspěvek k otázce mechanismu otravy olovem. (FACTORS INFLUENCING THE MECHANISM OF LEAD POISONING.) Pracovní Lékařství 2:49-61 (May 15), 1950.

Having observed among employees exposed to the risk of Pb poisoning a poor correlation between the level of Pb in blood and symptoms of poisoning, the authors investigated one of the factors that might shed light on why in 2 cases with equal levels of blood Pb, 1 will show signs of poisoning and the other none. They chose to study the ability of red blood cells to adsorb Pb. As summarized by the author, in nonexposed cells, the finding of Behrens and Pachur of a logarithmic relationship between Pb added and Pb adsorbed by a red cell was verified. Further it was shown that there are differences in the ability of red cells of different individuals to adsorb Pb. It was assumed that the appearance of nonhematological

symptoms of Pb poisoning depended on the Pb flowing into the interstitial fluid and that only Pb not bound to red blood cells is available to reach the interstitial fluid. Therefore, persons whose red cells have a smaller ability to adsorb Pb will show hematological signs of Pb poisoning sooner than those whose red cells adsorb Pb better. The ability of the individual cells to adsorb Pb, therefore, can be used as a measure of individual resistance to Pb poisoning. In persons with adequate previous exposure a different shape of absorption curve was found. The shape of the curve gives an indication of immediate danger.

- 1236 Pedinelli, M., and Stringari, M. (Soc. Organic Inorganic Ind., Trento, Italy): Un anno di controllo e di profilassi industriale contro l'avvelenamento professionale da piombo-tetraetile. (A YEAR OF INDUSTRIAL CONTROL AND PREVENTION OF OCCUPATIONAL TETRAETHYLLEAD POISONING.) Rassegna di Medicina Industriale 19:57-68 (Mar.-Apr.), 1950.

The authors state that at the time only 1 industry, located in Ravenna, produces TEL in Italy (another one was destroyed during the war), while there are relatively many gasoline blending stations, usually connected with distilleries, refineries, or civilian or military airports. In describing their experience as factory physicians, they say that unlike Pb poisoning, TEL poisoning is usually acute or subacute rather than chronic, and that absorption is via the respiratory tract or the skin, very seldom via the alimentary system. They review briefly the symptoms and signs. In laboratory investigations, the authors give first importance to the determination of Pb in the urine, blood and feces, and consider from 0.10-0.12 mg/l urine to be normal; 0.20 or more suggest poisoning and 0.30 mg to indicate a serious condition with less chance of a complete recovery. In following the course of a case, it is important to examine frequently body weight, blood pressure and level of Pb in the urine.

Workers should be examined at the time of employment and on every change of job within the factory. At employment, men should not be older than 30-35 yr, should not show any abnormality of the gastrointestinal, circulatory, renal or nervous systems, and should show no indication of excessive addiction to alcohol or tobacco. Preventive measures have included the reduction of all hazardous processes to a minimum; adequate time spacing of such unavoidable processes; sufficient spacing of such parts of the installation as may give rise to poisonous fumes; effective exhausts; reduction of manual operations to the minimum. Personal protective measures are important, although the aim should be to reduce atmospheric contamination to a sufficiently low level so as to avoid the use of masks where possible. Medical preventive measures include: a daily meal of 1700 calories with 200 derived from meat, 150 from milk and 180 from fats; short shifts at risky jobs, limited to 6 hr at a time, separated by 24-hr rest periods and interrupted every week by 1-wk work in a safe part of the factory; medical inspection frequent enough to insure that every worker is checked once a week; immediate transfer to a "safe" job of any worker

showing the slightest suggestion of poisoning; permanent removal from risky jobs of anyone who had suffered twice from poisoning; careful records and work planning for each individual; provision of locker rooms both for work clothes and outdoor clothing; compulsory shower baths after each shift.

As a result of these measures, notification of cases has dropped from an incidence of 13% in 1942 to 1% (1 case only, which is described) in 1947 in spite of a 7-fold increase in production between these years. The authors emphasize that the individual susceptibility or resistance to TEL must be kept in mind by the factory physician.

- 1237 Pezzeri, V., and Antonioti, F.: Modificazioni dei valori della pressione arteriosa e della eliminazione urinaria del piombo in operai tipografi durante e dopo bagni termali con acque carbonico-solfuree. (MODIFICATIONS IN ARTERIAL PRESSURE AND IN URINARY ELIMINATION OF LEAD IN TYPOGRAPHERS DURING AND AFTER CARBONIC-SULFUR BATHS.) *Rassegna Medica di Infortunistica e Patologia del Lavoro* 3:147-52 (Jan.-Feb.), 1950.

In Pb poisoning, the smaller blood vessels are affected by an arteriosclerotic process which can eventually be accompanied by alterations of proliferative or degenerative type. Pb acts on the smooth muscle either directly or indirectly through metabolic disturbances which take place. The authors have studied the reactions in 15 printers exposed to the poisoning for >17 yr and who were 33-61 yr of age but were free from renal abnormalities and arteriosclerotic symptoms. The cure consisted of 12 baths at 37° given every 2 days of 15-20 min duration and in the absorption of 200-400 g of water from 2 different springs containing dissolved C dioxide and H sulfide (Tivoli water, Regina and Colonnelle springs). The results were as follows: Treatment caused a lowering of 2 maximum and minimum arterial pressures in 13 patients. In 2 patients whose pressures did not seem to have been lowered, the urinary elimination of Pb was reduced. Eight hr after the end of the cure a steady diminution of arterial pressure was noted in 7 cases, in 4 a lowering of 25-30 mm for the maximum and of 15-20 mm for the minimum was noted. Four cases did not seem to have been influenced. The urinary elimination of Pb which was 0 in 10 patients before treatment again manifested itself in 3 patients and was increased in 5 others. Eight hr before the end of the cure, Pb was determined in 3 cases. The discussion directed toward the explanation of these phenomena argues in favor of the role of S contained in these mineral waters. (From Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 12:368 (Abstracts), 1951)

- 1238 Pomerantseva, E.N. (USSR): Khronicheskaya intoksikatsiya tetraetilsvintsom. (CHRONIC INTOXICATION WITH LEAD TETRAETHYL.) *Klinicheskaya Meditsina* (Moscow) 28, No. 3:67-70, 1950.

The majority of foreign and many Soviet authors hold that chronic intoxication with TEL does not exist, on the grounds that persons exposed for long periods to the substance do not show the cardinal symptoms of saturnism. The author does

not agree with this view, and in the course of periodical examinations of workers in TEL has encountered several cases of chronic intoxication. She classifies symptoms into 2 syndromes: (1) Disturbances of the vegetative nervous system, manifested by hypotonia, bradycardia, hypothermia, salivation, sweating, and tremor in the extended fingers, the tongue, and the eyelids. (2) Asthenic state, shown by general weakness, proneness to rapid exhaustion, headaches, and disturbing dreams. Later, disturbance of the intellectual faculties and loss of weight are observed.

While many cases show both syndromes, one or the other dominates in each case. It is sometimes difficult to decide whether the condition is one of chronic intoxication or the initial stage of acute poisoning. The development of psychopathic symptoms points to the latter, as does the patient's restlessness and anxiety about his condition; the patient with chronic intoxication, while complaining of his symptoms, does not as a rule show grave concern.

The majority of cases of chronic intoxication are not associated with basophilic stippling, hematuria, or any great increase in the excretion of Pb. The symptoms may show temporary remission, but this cannot be regarded as a sign of cure, and they often return and progress. On the whole, disturbances of the vegetative nervous system are associated with a better prognosis than is the asthenic syndrome.

- 1239 Prosperi, G. (Inst. Ind. Med., Florence, Italy): Il saturnismo nell'industria poligrafica. (LEAD POISONING IN THE POLIGRAPHIC INDUSTRY.) *Rassegna di Medicina Industriale* 19:281-7 (Nov.-Dec.), 1950.

The literature of Pb poisoning in printing trades is reviewed and the experience of the author gained from the bimonthly medical examination (prescribed by law) of typographers in 71 printing shops in Florence are discussed. The author concludes that the occurrence of Pb poisoning among printers has diminished significantly thanks to the preventive measures which have been enforced by law. However, in spite of this reduction in the incidence of Pb poisoning, vigilance should not be relaxed but should continue to be enforced. (13 references.)

- 1240 Ramsak, A., and Ramsak, M. (Ljubljana, Yugoslavia): Lastna opazovanja saturnizma v rudniku Mezica. (SOME OBSERVATIONS UPON SATURNISM IN THE MINE OF MEZICA.) *Združenjski Vestnik*, 19, No. 11/12:230-2, 1950.

Observations have been made on the occurrence of saturnism among Pb smelters at a mine in Mezica in Slovenia since 1927, during the course of which over 1000 persons were investigated. The works were old, and hygienic conditions were poor; until 1932 there was no medical supervision of the works and workers, and in 1927, for example, there were 48 cases of gross saturnism with several instances of encephalopathy and paralysis. After proper supervision had been instituted the incidence fell greatly, and only 3 cases were observed in 1937. The incidence rose later after the liberation when the production of Pb was increased. The workers were then examined every week. Signs and symptoms of Pb poisoning were absent in 15-20% of the per-

sons, and 60% had a basophilia of up to 30,000/million without showing any symptoms. If 5000/million were present, or 1000/million in the presence of symptoms, the worker was transferred to other work for 8 wk; this could be carried out without danger to health, and it was not considered necessary to lay off affected persons.

The main symptom of poisoning was colic which was often severe enough to simulate an acute abdominal emergency. There were also pains in the limbs and joints. The severity of the colic showed no correlation with the degree of basophilia. No case of encephalopathy occurred after regular health inspection had been instituted; previously there had been 1 or 2 cases each yr. Neuritis and muscular atrophy were not encountered but there were occasional cases of nephrosclerosis. The poisoning was considered to arise from the inhalation of dust, since it did not occur in workers who were not exposed to dusty conditions. A severe case of Pb poisoning also occurred as a result of eating flour which had been contaminated with Pb dust during grinding. Preventive measures are described, consisting mainly of the avoidance of dust, and transferring workers at regular intervals in order to avoid long periods of work in the dangerous sections of the plant. (From Bulletin of Hygiene 27:67, 1952)

- 1241 Rejsek, K., and Váňa, V. (Dept. Occup. Med., Charles Univ., Prague, Czechoslovakia): Príspevek k otázce protoporphyrinu v krvinkách. (A NOTE ON PROTOPORPHYRIN IN BLOOD CELLS.) Pracovní Lékařství 2:201-9, 1950.

The authors studied the problem of Pb poisoning with special reference to a certain aspect of the metabolism of protoporphyrin in blood cells, ie, the influence of Pb and of extrahemoglobin Fe. The results from 235 of the 410 persons examined are included in this work. The subjects were divided into 4 groups. The 1st group comprised 60 persons who did not come into contact with Pb in any form; the 2nd group, 91 persons working under insignificant hazard, where Pb poisoning practically never occurs; the 3rd group, 52 working under conditions of considerable hazard of Pb poisoning. In these places there was a group of 32 persons in whom Pb poisoning was found both by clinical examination and laboratory test. There was no case of serious poisoning. The results have been treated statistically. It was shown that Pb definitely influences the metabolism of protoporphyrin. The opinions of other authors on the clear evidence of the relation to extrahemoglobin Fe have not been confirmed. This is explained, however, by the complexity of the process, or rather, by its dynamics. The authors are now carrying out a study of the dynamics. (From authors' summary)

- 1242 Ruždić, I. (Inst. Ind. Hygiene, Zagreb, Yugoslavia): (INFLUENCE OF LEAD ON THE ACTIVITY OF CHOLINESTERASE.) Arhiv Hig. Rada 1:160-4, 1950.

Pb nitrate was found to increase slightly the activity of cholinesterase (ChE) from normal human serum in vitro. However the activity of ChE in serum from Pb-poisoned people (Pb in blood >100 µg/100 ml) is found to be less than in normal serum,

respectively, 0.01-0.05 and 0.08-0.12. The activity of cholinesterase was expressed as extinction values through a S 57 filter (Stufen photometer) of an Fe complex of the AcOH released by hydrolysis of the acetylcholine. Because Pb poisoning is accompanied by increase in porphyrins, tests were made indicating that hematoporphyrin does inhibit the activity of ChE. (From Chemical Abstracts 45:4356, 1951)

- 1243 Ruždić, I. (Inst. Ind. Hyg., Zagreb, Yugoslavia): Porfirinurija kao rani znak nastupa opasne apsorpcije olova. (PORPHYRINURIA AS EARLY SIGN OF DANGEROUS LEAD ABSORPTION.) Arhiv za Higijenu Rada 1, No. 3:263-70, 1950.

As summarized by the author, each case of Pb poisoning causes an increased excretion of coproporphyrin (CP) isomer III. Some workers have tried to use this fact for an early detection of dangerous Pb absorption; however, the methods recommended by them did not assure detection of the start of excessive absorption. Such a detection would be a much more useful and reliable means for estimating various forms of Pb intoxications than that of "stippled" erythrocytes. By using a semi-quantitative method developed by himself (in press), the author succeeded in diagnosing early Pb absorption by detecting CP in urine, the amount of which increased with the increase of Pb absorption. Data on the demonstration of CP in urine in 53 workers (as tabulated) proved that the phenomenon of dangerous Pb absorption can be observed in this way. (20 references)

- 1244 Schiøtz, E.H. (Municipal Workers' Hosp., Oslo, Norway): Tidlig-diagnostikk av bly-påvirkning. (EARLY DETECTION OF LEAD ABSORPTION.) Tidsskrift for Den Norske Laegeforening 70, No. 19:607, 1950.

Stippled cell counts as performed in 1066 workers in Oslo exposed to Pb revealed pathologic values in 20% of the workers. Counts varying from 500-900 stippled cells (SC)/million were obtained in 11.6% of the workers, from 1000-2400 in 5.6%, and ≥2500 in 3%. Pb absorption was obviously most marked in Pb welders ≥2500 in 50%. Next came storage battery workers, Pb foundry workers, fingerprint experts, ceramics workers and automobile radiator workers. Printers were less exposed (only 0.5% showed ≥2500). Clinical evidence of Pb poisoning was encountered in 5 cases. In cases where the count exceeded 5000, the worker was temporarily removed from Pb exposure. In 10 storage battery workers the urinary contents of coproporphyrin varied from 0.24-1.72 mg/l. Simultaneous counts of SC and basophilic aggregations (BA) (Larsson and Swensson's modified technique) were carried out in 188 subjects. The results are tabulated. Simultaneous counts of BA and reticulocytes in 96 individuals (79 of them having been exposed to Pb) showed that the number of reticulocytes exceeded the number of BA in 21%. In 6 workers with >1000 SC/million (1/1000) and reticulocyte counts varying from 12-22/1000, the BA values were normal (≤11/1000). The author concludes that counting of SC is less time consuming and is an easier method to use by untrained personnel. On the other hand, it fails in a certain percentage of cases, for

which reason the Factory Inspection Board of Oslo keeps to the SC count as the standard hematologic method for early detection of Pb absorption. (From author's summary; 20 references)

- 1245 Shiels, D.O. (Dept. Health, Victoria, Australia): INFLUENCE OF LEAD ABSORPTION ON THE RATIO OF LARGE TO SMALL LYMPHOID CELLS. Medical Journal of Australia 2:205-11 (Aug. 5), 1950.

The author states that much more attention has been given to erythrocytes than to leukocytes in Pb poisoning and he feels that this might explain the difference of opinion as to whether there are any definite changes in the white cells in Pb poisoning. In 1934 Ferguson and Ferguson investigated the effects of Pb on the blood of men exposed to Pb in ship-breaking. They found an increase in the ratio of large lymphocytes plus monocytes to small lymphocytes. In investigations covering hundreds of persons engaged in Pb mining, Pb smelting, etc, Shiels confirmed the general observations of F. and F. in regard to the ratio of large to small lymphoid cells. In further investigations he has had an opportunity to make studies on >400 employees of a new plant producing storage batteries. The workers had not previously worked in any trade involving Pb exposure. The proportion of stippled cells, the ratio of large lymphocytes plus monocytes to small lymphocytes and the urinary concentration of Pb were determined at intervals of ~6 wk. The 1st examinations took place after the employees had been working for several weeks in this factory. Great care had been taken to minimize the Pb hazard by suction exhaust ventilation and other precautions; but gradually there was an increase in the total Pb exposure either through increasing length of the exposure to a nonincreasing daily hazard or through exposure to increasing Pb concentration in the atmosphere. The results of many of the tests are recorded in tables.

Summarizing the results, the author says that absorption of Pb causes an increase in the ratio of monocytes plus large lymphocytes to small lymphocytes. In cases of Pb poisoning this ratio falls again to within the range of the ratio for nonexposed persons. If the ratio falls to <2.0, Pb poisoning is imminent, if not already present. Recovery from Pb poisoning is accompanied by a rise in the ratio to >2.0 in the early stages. In the later stages of recovery the ratio again falls to the range of nonexposed persons. In the new workers there is a direct correlation between the cell ratio and the urinary Pb concentration as exposure increases. The cell ratio is a valuable guide to the prevention and the diagnosis of Pb poisoning. At the present time no answer can be given to the question why there is an increase in this cell ratio in the presence of Pb. Various possibilities are discussed.

- 1246 Shiels, D.O., Thomas, W.C., and Palmer, G.R. (Dept. Health, Victoria, Australia): THE EFFECTS OF SODIUM CITRATE IN LEAD POISONING AND LEAD ABSORPTION: I. LEAD POISONING. II. LEAD ABSORPTION. Medical Journal of Australia 2:886-92 (Dec. 16); 922-8 (Dec. 23), 1950.

I. The effects of Na citrate (4-5 g tid) on uri-

nary Pb excretion (determined by modified Taylor's method (1925) and Shiels' method (1938)) of 10 Pb poisoning cases, illustrated in 3 tables, showed significantly increased urinary Pb excretion, complicated in 1 case by a Ca-rich diet which caused Pb retention in the bones. Before treatment, urinary Pb ranged from 0.08-0.36 mg/l; after treatment (1-2 days) from 0.11-0.38. In most cases, Pb values in urine returned to normal 10-20 days after the citrate treatment had started. The mean increase of the ratio of large lymphocytes plus monocytes to small lymphocytes after start of citrate therapy was 2.63. The highest value was not always reached on the same day after start of treatment. Thus, at a fixed time after start of therapy (10 days), the average increase in the ratio was 1.6. But all cases showed a significant rise shortly after commencement of citrate therapy. The effects of citrate therapy on the stippled cell count were not consistent in all cases, there having been a rise of the count in a few cases, but the majority showed a rapid fall. The counts returned to normal in periods ranging from 2 wk-2 mo. The effects of citrate therapy on symptoms are illustrated by a report of 4 cases. In general, the work confirmed the conclusions of Kety and Letonoff as to the value of Na citrate in the treatment of Pb poisoning.

II. On June 17, 1949, 48 previously nonexposed workers in a new battery factory were started on prophylactic Na citrate treatment (4 g/day). Not all employees were regular in taking the citrate. A group of workers was examined on June 28 (8 doses), another group on July 12 (18 doses; av 10). Five men had taken only 1 or 2 doses during that period. Examination of total stippled cell count showed a significant decrease from previous examinations before prophylaxis had started (1780 (av) stippled cells/million red cells as compared to 3856 on examination immediately prior to start of prophylaxis). The corresponding figures for coarsely stippled cells were av 154/million red cells as against 800 prior to prophylaxis. There was a marked decrease in the ratio of large lymphocytes plus monocytes to small lymphocytes between the 2 examinations (before and after prophylaxis), ie, from 6.06-3.05 (av).

The authors discuss the figures obtained for the same periods and levels by another method, ie, comparing the effects on the stippled cell counts and cell ratios for only those workers who took 75% or more of the doses (20 class A) with the results obtained from those who took less (16 class B). The mean decrease in stippled cells for A was highly significant (2200, SE 386); 19 showed a decrease. In B, 9 showed a decrease and 7 an increase (mean decrease 1200, SE 658.8 which was not significant). There was a larger fall in the av counts of coarsely stippled cells in B than in A but this was mainly due to 3 persons in B who showed fairly high counts initially. Statistically, the fall in counts was more significant in A (av 349 SE 116) than in group B (av 580, SE 225). The decrease in the "before" and "after" cell ratio was much greater for A (av 3.03, SE 0.644) than for B (av 1.61, SE 838). The latter decrease was thus not significant. Since the Pb hazard had remained fairly constant in the factory, the Na citrate prophylaxis is considered the factor in



lowering the cell ratio and stippled cell count.

- 1247 Sroka, K.H. (Singen/Hohentwiel, Germany): Zur Gesundheitsgefährdung durch organische Bleiverbindungen. (HEALTH HAZARDS OF ORGANIC LEAD COMPOUNDS.) *Ärztliche Wochenschrift* 5:1025-9 (Dec. 22), 1950.

The risk of TEL poisoning, symptoms, and treatment are discussed. In conclusion, the author mentions cutaneous or mucosal irritation caused by triethyl-Pb and from exposure to TEL and stresses the importance of strict hygienic precautionary measures in the Pb industry and their observance by the workers.

- 1248 Stringari, M., Bovelacci, F., and Pedinelli, M. (Soc. Organic Inorganic Ind., Trento, Italy): Prassi di un laboratorio aziendale contro la intossicazione piombo-etilica. (ORGANIZATION OF A LABORATORY FOR THE CONTROL OF TETRAETHYL LEAD POISONING.) *Rassegna di Medicina Industriale* 19:173-87 (July-Aug.), 1950.

From the legislative point of view, production of TEL and its products comes under the article of the Ministerial Decree of 1929 covering Pb compounds. The authors feel that this clause should be extended to state: Pb compounds, including the organometallic. They describe the medical and hygienic service of the TEL production plant, illustrating with photographs the building, examining rooms, the laboratory. The symptoms of excessive absorption of Pb and Pb poisoning and those of TEL poisoning are tabulated, as given originally by Jones (1935) and Midgley. In describing their activities, the authors present statistics of the number of visits made to various plant operations in the postwar years 1947-9, the number of cases of poisoning reported to the National Insurance Board, average body weight of TEL workers at time of employment and at later intervals, and cases suspended as a precaution. The clinical and chemical laboratory activities are next described; Pb in biological media is determined by the dithizone spectrophotometric method. The laboratory is also entrusted with the cleaning and repair of masks and of work clothing. (15 references.)

- 1249 Troisi, F.M. (Med. Insp., Ministry of Labor): Endarterite oblitterante in un fonditore di piombo. (ENDARTERITIS OBLITERANS IN A LEAD WORKER.) *Medicina del Lavoro* 41:197-202, (June-July), 1950.

This is a case report of endarteritis obliterans in a Pb worker, aged 45, who had been engaged for 22 yr on a night shift in the foundry of a newspaper printing establishment. Gangrene developed in the 5th toe of the right foot and resulted in toe amputation. A few days later vascular troubles and pain developed in the 5th toe of the left foot; this did not progress, however, and healed in a few months. Treatment included rest, foot contrast baths, ~2 quarts of milk daily, and pharmacological therapy. After recovery, the worker was placed on another job involving no exposure to Pb and until now (2-1/2 yr) no relapses have occurred. (19 references)

- 1250 Vigliani, E.C. (Univ. Milan, Italy): Récentes études sur le saturnisme en Italie. (RECENT STUDIES ON LEAD POISONING IN ITALY.) *Bruxelles-Médical* 30:1771-8 (Aug. 20), 1950.

This is a translation of the article published in *Medicina del Lavoro*. See Abstract No. 1253.

- 1251 Vigliani, E.C.: Estudios sobre Saturnismo en Italia. (STUDIES ON LEAD POISONING IN ITALY.) *Medicina del Deporte y del Trabajo* 14, No. 85:3118-30, 1950.

Pb poisoning among typographers seems to have so to speak entirely disappeared in North Italy and exists only sporadically in the cities of the central and southern parts of the country. In Sienna the death of a woman from Pb encephalopathy with convulsions and crises similar to eclampsia had occurred, and another one from hepatonephritis with coma, a syndrome which was accompanied by basophilic stippling. Pb colics were not influenced by intravenous Ca therapy but seemed to have been relaxed by spasmolytics. In a large automobile factory 63 cases of distinct intoxication were found among which several showed nervous, glandular (hyperthyroidism) manifestations and others intestinal or anemia. Alcohol seems to favor the increase of the Pb content in blood. Among new cases 30-70 µg Pb/100 ml of blood and 10-120 µg/24 hr urine were found. The Pb absorbed through the intestine is absorbed for the most part in the red corpuscles, less in the plasma and still less by the serum. The liver stores a large part of it and the subhepatic veins contain it to a lesser degree than the portal vein. Pb diffuses in the bile and it is the B portion which contains the largest proportion of it.

The author describes the spectrographic method of determination of Pb in the blood. The Pb content is at its maximum during the morning. In the urinary calculi a relatively large amount of Pb is found. In the urine Pb is found in the form of inorganic compounds. The anemia of Pb poisoning is of hemolytic type and the cellular resistance is in general somewhat increased, rarely diminished. The anemia is hypochromic in the course of Pb colics and during the phase of maximum cellular destruction but becomes hyperchromic during the reparative phase. The presence of basophilic granulations in the erythrocytes is of great importance in the diagnosis of Pb poisoning. The bone marrow is the seat of the formation of basophil stippled erythrocytes. The sedimentation rate is not accelerated except in the grave forms of Pb poisoning. Vigliani emphasizes the role of defence mechanism on the part of the kidney in the course of this poisoning. Although hypochlorhydria or achlorhydria are frequent in Pb poisoning, gastric ulcers are found not infrequently. Pb colics are essentially of spastic character. They are accompanied frequently by a more or less high hypertension and porphyrinuria. Vigliani considers that there are no specific weaknesses on the part of the extensor muscles because in the cases of diminution of chronaxia these had not been observed.

Certain authors consider that there is in general no direct relation between Pb poisoning and hypertension. Vigliani is clearly opposed to the



authors who deny the existence of renal sclerosis in Pb poisoning. The nephrotic changes (with severe albuminuria and cylindruria) observed in cases of grave Pb poisoning could be the origin of renal sclerosis. Two cases of obliterant endarteritis and changes in kidney attributable to Pb are reported. (From Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 12:365 (Abstracts), 1951)

- 1252 Vigliani, E.C.: Estudios sobre Saturnismo en Italia. (STUDIES ON LEAD POISONING IN ITALY.) Medicina del Deporte y del Trabajo 14, No. 86:3198-206, 1950.

Pb poisoning involves the endocrine glands and the thyroid gland in particular in the form of hyperthyroid syndrome with a picture which clinically approaches true Basedow. The progeny of persons poisoned by Pb can be affected but not necessarily. Vigliani cites the case of a woman with Pb poisoning who gave birth to a healthy child. He also cites a case of Pb poisoning in which the patient died after encephalopathy with convulsions and whose fetus after miscarriage on the 125th day had liver, spleen and reticular cells of the bone marrow filled with Pb dust.

The author then discusses porphyrinuria in detail. In his opinion, the porphyrins are distinguishable as 3 types, protoporphyrin, deuteroporphyrin and coproporphyrin. Porphyrin does not seem to be produced directly in the liver but seems to arise from a modification of hemoglobin formation. Porphyrinuria does not seem to exist in direct relation with Pb colic and can follow it.

The different methods of treatment are reviewed. It does not seem that the alkalizing measures or Ca administration have definitely acquired the right of being solely superior. The antispasmodics could be sufficiently effective in Pb colic. Na pyrocatechin sulfonate has been tried. BAL seems to have an influence on the general condition, especially on Pb anemia. It is well to administer disodium phosphate, liver extracts and vitamins B, C and PP. TEL causes a syndrome characterized by anorexia, nausea, irritability, insomnia, asthenia, hypotension, tremors. Rigid hygienic measures have markedly lowered the incidence of morbidity in workers of a TEL plant at Ravenna. At times the picture of the fatal cases of poisoning is reminiscent of that of delirium tremens or acute alcoholic crisis. At autopsy severe liver damage is found as well as cerebral hyperemia with pericapillary hemorrhages or fatty degeneration of the adrenal cortex, pancreatic changes, thyroid and kidney as well as degenerative lesions of the cells of the central nervous system. (From Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 12:366 (Abstracts), 1951)

- 1253 Vigliani, E.C. (Univ. Milan, Italy): Recenti studi sul saturnismo in Italia. (RECENT STUDIES ON LEAD POISONING IN ITALY.) Medicina del Lavoro 41:105-23 (Apr.), 1950.

Investigations published in the past 20 yr are reviewed, as is the founding of the Clinica del Lavoro of the University of Milan which, the author

says, was the first institution of its kind when it was established in March 1910 for the treatment of, and research in, industrial diseases. The study and prevention of Pb poisoning was among the first to be undertaken. The review encompassing 107 references extends over the following subjects: Hazardous operations; absorption and elimination of Pb; action of Pb on the different tissues and organs; treatment of Pb poisoning; TEL. Concerning the latter, lack of knowledge of the risk involved, and inexperience in production, led to the occurrence of many cases of poisoning, some fatal, when a factory was first established in Ravenna in 1937, and later, one at Trento. In Ravenna, 80% of the employees were affected. This was dealt with immediately, and correction of working conditions and in personal hygiene reduced the incidence in 1938 to 9% and 16% in 1939, when production reached a maximum. Incidence remained constant from then on around 10-12%/yr.

- 1254 Waldman, R.K., and Seideman, R.M. (Connecticut State Dept. Health, Hartford): RELIABILITY OF THE URINARY PORPHYRIN TEST FOR LEAD ABSORPTION. Archives of Industrial Hygiene and Occupational Medicine 1:290-5 (Mar.), 1950.

A study was conducted to examine the reliability of the semiquantitative porphyrin test of the urine of workers exposed to Pb. No false negative results were encountered in specimens of 116 Pb-exposed men. All specimens containing >0.15 mg Pb/l urine gave positive porphyrin reactions. There were 34 positive porphyrin reactions in urines with <0.15 mg Pb/l which seemed to indicate that the increased porphyrin excretion may actually be an early sign of Pb absorption. Only a small proportion of false positive reactions was obtained from control specimens from non-exposed workers.

The authors came to the conclusion that the semiquantitative porphyrin test of urine for Pb absorption is reliable as a screening test in places where a large number of workers are exposed to Pb. (From authors' summary.)

- 1255 Watson, C.J. (Univ. Minnesota Hosp., Minneapolis): THE ERYTHROCYTE COPROPORPHYRIN. VARIATION IN RESPECT TO ERYTHROCYTE PROTOPORPHYRIN AND RETICULOCYTES IN CERTAIN OF THE ANEMIAS. A.M.A. Archives of Internal Medicine 86:797-809 (Dec.), 1950. Human erythrocytes contain free erythrocyte coproporphyrin (ECP) in addition to the protoporphyrin (PP). In normal conditions the amount does not exceed 2 µg/100 ml of erythrocytes. The amount of ECP is significantly correlated with the reticulocyte percentage, especially in pernicious anemia during response to vitamin B<sub>12</sub> therapy. The slight but consistent lag of the ECP in the latter situation, as well as the lack of strict correlation between ECP and reticulocytes and different levels, indicates that they represent sequential or closely related phenomena in the same fundamental process. Characteristic patterns of PP and ECP concentration have been observed in certain of the commoner anemias. Pernicious anemia it relapse exhibits a low or normal PP and negligible or absent ECP. The observations on ECP indicate

that this value is a rather sensitive chemical index of the rate of hemoglobin synthesis in the bone marrow.

In Pb poisoning a complex situation was found to exist. The author studied 4 human cases since ECP was discovered. In these, hemoglobin was from 5.7-15.0 g/100 ml; reticulocytes 2.9-4.4%; PP, 211-1300 µg/100 ml; ECP, 1.5-58 µg/100 ml; urinary CP, 190-4000 µg/24 hr. The findings suggest that the severer the anemia, presumably the more serious the abnormality of the bone marrow, and the greater the increase of ECP. There was no apparent correlation of ECP with the increase of CP III in the urine; however, he considered that this may well be related to the ECP of the developing red cells in the bone marrow.

Rimington (1938) had proposed that Pb blocked the enzymatic formation of heme from Pb and Fe and that CP III formation was the result of this disturbance. In a figure the author agrees with earlier views except that he does not believe that this PP is then converted to CP and excreted. The derivation of the excessive type III CP in the urine is probably not from ECP in any considerable part, but derivation from the central nervous system as in poliomyelitis or from the liver as in "alcoholic" cirrhosis appears to be possible.

- 1256 Wilentz, W.C. (Nat. Lead Co., Perth, Amboy, N.J.): A MEDICAL VIEW OF THE LEAD PROBLEM. American Practitioner and Digest of Treatment 1:1248-51 (Dec.), 1950.

Despite a progressive decline in the incidence of fatal Pb poisoning in the last 40 yr, there are still many cases of temporary disability. This indicates a need not only for reevaluation of the problem, but also for an insistence on the use of available measures of control. Almost every type of Pb material encountered in industry can be handled with safety, if proper and adequate modern equipment for the protection of the health of the industrial worker is provided and used. Medical supervision is as necessary as ever and must be extended to include every person who works with Pb. Medical orders relating to exposure of employees must take preference over all others. Persons with Pb absorption and intoxication should recover with no resulting disability with modern methods of treatment. The entire therapeutic regimen should be directed toward overcoming the intestinal colic, correcting the resultant anemia, making the patient symptom-free with no disability, and returning him to gainful employment as soon as possible. All these requirements can be fulfilled by a Ca immobilization regimen that is simple and safe, shortens hospitalization and length of disability and gives certain results.

## 1951

- 1257 Anonymous: LONG ILLNESS OF POLICE OFFICER LEADS TO DISCOVERY OF LEAD EXPOSURE ON FIRING RANGE. Industrial Health Monthly 11:185-6 (Dec.), 1951.

The illness of a patrolman of a small municipality near Detroit led to the investigation by the Detroit Bureau of Industrial Hygiene of a shooting range used by the police department. This man had

been in charge of the range for 6 yr. Urinary Pb determinations on all police personnel who spent time at this range showed levels from 0.07-0.32 mg/l. The patrolman showing the highest value was successor to the one who was convalescing at home and thus spent a great deal of time instructing members of the force, cleaning up the range and molding bullets. Air determinations made around the various operations in the range showed the following: Bullet molding 1.5 mg Pb/10 m<sup>3</sup> air; removing of dross into can from Pb pot, 27.7; sweeping in room behind target, 48.6; during heavy shooting in shooting range, operator's breathing zone, 225.0-360.0. A series of requirements were made for the correction of the situation.

- 1258 Anonymous: SMALL PLANT IN TEXAS REPORTS THREE CASES OF LEAD POISONING. Industrial Health Monthly 11:96 (June), 1951.

During a plant survey of the Pb storage battery manufacturing industry in San Antonio, Texas, conducted jointly by engineers from the Texas State Department of Health, and the San Antonio Health Department, it was learned that 3 workmen in 1 plant had recently become ill with Pb poisoning. The plant continued the manufacture of batteries on a very reduced scale since, out of a total of 5 employees, 3 were so affected. One employee, the most severely ill, was under medical observation for 18 days. He was interviewed 45 days after discharge from the hospital and exhibited the characteristic wrist-drop at the time of the interview. He was 44 yr old and had worked in the battery industry for 23 yr. This was his 1st case of Pb poisoning. His duties at the time of his illness were burning groups, finishing, closing, and assembly. There were no provisions for local exhaust at any of the above-mentioned operations. The group burning was done in a corner of the plant where natural ventilation was negligible. An exhaust fan has since been installed at this location. Pb oxide from the dried plates was in evidence on the burning bench. The employee stated that he intended to resume his work as soon as he was able to do so. Another employee, 65 yr old, had worked in the battery manufacturing industry for 1-1/2 yr. He was only moderately ill and was back at work in a few days. His duties were of a general nature, including sweeping and cleaning. Spilled Pb oxides and dust were swept up from the wooden floor with a straw broom without any means being used to prevent the generation of dust. The 3rd sick employee was only moderately ill and after recovery did not report back to work.

- 1259 Anonymous: FILTRATION PLANT EMPLOYEES EXPOSED TO LEAD DUST IN SCRAPING PAINT OFF TROUGHS. Industrial Health Monthly 11:186-7 (Dec.), 1951.

The Bureau of Industrial Hygiene of Cleveland was requested to analyze the blood and urine from 3 hospital patients who were employees of the water filtration plant. They had been scraping tubercles and rust spots from steel washwater troughs on a rapid sand filter. The troughs had been painted with red Pb paint 6 yr previously and were being prepared for repainting. Since the work has been completed before the workmen (a total of 5) became too ill to work, arrangements were made at another

filtration plant to have the work performed under as nearly the same conditions as at the plant where the illnesses had occurred. Air samples taken while the power-driven brush was being used showed 229 mg Pb/m<sup>3</sup> of air sampled in the breathing zone of the brush operator. Air samples taken while the worker was handscraping and brushing on a relatively dry trough revealed 32.2 mg Pb/m<sup>3</sup> of air sampled. Scraping of a damp trough produced 2.4 mg/m<sup>3</sup>, and less vigorous scraping when dry, 63-73 mg. Although the men had respirators available, they did not use them. During the tests, it was found that respirators used by some of the men had leaked as streaks of red were visible around the nose and in saliva. Supplied air respirators, used during another test, would have been more satisfactory.

Because of this instance other workers for the city received health examinations. Blood and urine examinations showed that a high percentage of them had significant Pb absorption, although only 1 exhibited symptoms of Pb poisoning.

- 1260 Berger, K.E., and Lundberg, E.A. (Cerro de Pasco Copper Corp., Seattle, Wash.; La Oroya, Peru): *INTESTINAL VOLVULUS PRECIPITATED BY LEAD POISONING. REPORT OF FIVE CASES.* Journal of the American Medical Association 147:13-6 (Sept. 1), 1951.

The authors present these cases in support of their belief that intestinal volvulus may be precipitated by Pb poisoning, since to their knowledge this has not been mentioned in the literature. All 5 were workers in the Pb smelter, 20-54 yr old with 8 mo-7yr service, and all were Peruvian natives. The authors mention that as in the Baltic region, volvulus is a major cause (50%) of intestinal obstruction in Peru. All had been admitted with colicky abdominal pain of several days' duration, constipation, and muscular weakness in some; Pb gum line was seen in most, pallor, numerous stippled erythrocytes, and positive urinary coproporphin in 4. The 1st case admitted to the hospital had shown upon X ray a distended colon and was treated in part with neostigmine enemas; he was in poor condition so that an operation could not be considered although a cecostomy was performed. The patient died 2 days later with peritonitis and uremia. A volvulus of the sigmoid was confirmed at autopsy. In view of this experience, a more radical approach was undertaken. The other 4 patients recovered. Two cases required prompt surgical intervention for complete sigmoid obstruction, and immediate resection was successful. A small bowel case required only detorsion. Another sigmoid case underwent spontaneous detorsion during a diagnostic Ba enema. The role of plumbism in the precipitation of volvulus is discussed. In all cases, symptoms of gastrointestinal Pb poisoning preceded by a matter of days the more acute symptoms pointing to the onset of volvulus. (13 references)

- 1261 Bertha, H., Malissa, H., and Pohl, F. (Techn. Coll. Graz, Austria): *Mikrochemische Untersuchungen über die topische Verteilung von Spurenelementen im Gehirn.* (MICROCHEMICAL STUDIES ON THE TOPICAL DISTRIBUTION OF TRACE ELEMENTS IN THE BRAIN.)

Mikrochemie 36/37:989-96, 1951.

The results showed that: (1) In addition to the occurrence of biologically known elements (K, Ca, Na, Mg, P), all spectrograms of brains (60 test analyses on 4 brains) after various preliminary treatments, showed the presence of Al and Cu in the brain. No information was available, as yet, concerning the relative and absolute amounts of this occurrence in the separate regions of the brain. (2) The elements Pb, Zn (in Kjeldahl decomposition) Si, Sn, Sr, Ag, Be, and Ti appeared in the regions examined. Of these traces, Si appeared most frequently. (3) These findings agreed with those of Voinar and Rusanow who, in 1949, independent of the authors, reported on the occurrence of previously biological unknown elements in the brain, such as Ag, Al, Bi, Cr, Cu, Mn, Mo, Ni, Pb, Si, Sn, Ti, and V. (4) The determination of trace elements in the brain makes it likely that new neurobiological viewpoints will arise. (5) No definite conclusion could be reached as to whether these trace elements are functionally of specific significance for the central nervous system. The existence of special cells in certain regions of the brain indicated to the authors the possibility that special elements may also play a role for certain functions. (From authors' summary)

- 1262 Brezina, E. (Vienna, Austria): *Über einen angeblichen Fall von Bleivergiftung im Beruf.* (ON ALLEGED CASE OF OCCUPATIONAL LEAD POISONING.) Wiener Medizinische Wochenschrift 101, No. 5/6:86-7, 1951.

The author was asked to give an opinion on whether illness in typesetter was Pb poisoning; thereby compensable. Patient had been employed as typesetter during his youth, then had gone into another occupation, and at age 50, in 1946, had returned to typesetting. After several mo, he became suddenly paralyzed on one side. Case history mentions that Pb line was observed once, basophil stippling was never seen. Paralysis in region of the radial nerve, once observed, was interpreted to be not indicative of Pb poisoning in view of the other findings. However, most physicians believed this to be Pb encephalitis. One neurologist considered it a case of common apoplexy due to unspecific cause.

Typesetting involves only low Pb risks. In order to verify exposure, the air of a manual typesetting room was analyzed for Pb: average content 2 µg/m<sup>3</sup>. On the basis of an average intake of 10 l air/min (during light work) the worker would have inhaled only ~0.01 mg Pb/day, or over the 6 mo on the job, scarcely 2 mg. For this reason, no basis for compensation for Pb poisoning existed. The need of specialized training for the correct diagnosis of industrial diseases is emphasized.

- 1263 Brooks, A.L. (Gen. Motors Corp., Pontiac, Mich.): *AN APPRAISAL OF A URINARY PORPHYRIN TEST IN DETECTION OF LEAD ABSORPTION.* Industrial Medicine and Surgery 20:390-2 (Sept.), 1951.

At the Fisher Body Division, General Motors Corporation, there are ~150 men who are exposed to Pb dust or fumes in amounts ranging from 0-1.5 mg/10 m<sup>3</sup>, and ~30 men who are working in an atmosphere heavily laden with dust are believed

to be adequately protected by air hoods. All these men are examined every 30 days for objective and subjective signs, about every 90 days blood Pb analyses are done. Porphyrin tests are done on urine at every examination. On the basis of a total of 952 tests done on 249 men, the author's conclusions are as follows: "1. The porphyrin test is an easy, convenient one, requiring little skill or equipment or time. 2. Persons with no exposure are almost invariably negative. 3. Some persons with known exposure give a negative test at times, suggesting that there are certain factors as yet not understood which control excretion of this material. 4. As the degree of exposure increases, fewer urines will be negative. 5. All persons with definite evidence of intoxication, even though mild, have in our experience had strongly positive urines. 6. Porphyrin is found in the urine earlier than stippled cells in the blood following exposure. In this respect the test has the same advantage over routine smear examinations that is possessed by the basophilic aggregation examination. 7. Excessive porphyrin may be found in the urine long after disappearance of excessive blood Pb, suggesting damage to the hematopoietic system that is not readily repaired. 8. While not a conclusive test, this appears to be one that can well be used to supplement the other more widely known ones in indicating intoxication or excessive absorption. 9. The repeated finding of negative porphyrinuria tests is a reliable assurance that Pb poisoning is not impending."

- 1264 Connecticut State Department of Health, Bureau of Industrial Hygiene: CONNECTICUT USES NEW METHODS IN TESTING FOR LEAD. Industrial Hygiene Newsletter 11:41 (Mar.), 1951.

The study and control of industrial Pb poisoning continue to be a problem of major importance to the Bureau of Industrial Hygiene. In the past year 200 atmospheric samples were taken in 17 different plants and 375 body fluid samples in 13 different plants. New methods of investigation have been developed and are now finding application in this work. An important laboratory procedure is the porphyrin test, which permits the examination of many urine samples in a relatively short time for porphyrins, which are indicative of Pb absorption. A new method which employs a funnel-filter paper apparatus for determining concentrations of Pb dust or fume in the air breathed by workers, and the dropping Hg electrode for the quantitative determination of Pb in air and urine are now used. The MAC in air is  $0.15 \text{ mg/m}^3$ , whereas urine containing  $>0.15 \text{ mg/l}$  indicates Pb absorption. These procedures have been employed recently in a Connecticut plant where  $>100$  workers are potentially exposed to Pb. Before the institution of control measures 45% of the exposed workers showed  $>0.15 \text{ mg Pb/l}$  urine, and atmospheric concentrations of Pb reached  $1.83 \text{ mg/m}^3$ . The results of 25 air samples together with the above urine-Pb determinations served as a basis for control measures. After the control work is complete, another series of determinations for porphyrins and Pb in urine will be made, and a checkup air study will be made to determine the effectiveness of

control measures instituted.

- 1265 De Michelis, F. (Inst. Ind. Med., Turin, Italy): La protezione dell'apparato masticatorio nei lavoratori esposti al rischio saturnino. (Nota preventiva.) (PROTECTION OF THE MASTICATORY APPARATUS OF WORKERS EXPOSED TO LEAD. (PRELIMINARY NOTE.)) Rassegna di Medicina Industriale 20:296-302 (Sept.-Oct.), 1951.

Because of the effects of Pb on teeth, trials were instituted among workers exposed to Pb of the protective action which may be given by a tooth paste, "Saturno." The formula of this tooth paste is as follows: monopotassium (K) tartrate, 0.50 g, benzoic acid, 1 g, salicylic acid, 1 g, benzoic sulfimide, 0.05 g, paste, 100 g. The K tartrate has reputedly the property of rendering the Pb salts insoluble, thus preventing the absorption, and the other components act as antiseptics and anti-fermenting agents. The absolute absence of soaps which have the property of rendering the Pb in part soluble is a particular characteristic of this paste. While the author felt that it is too early to come to any definitive conclusions, a clear improvement in the local circulatory counts was demonstrable by a diminution of hyperemia of the gingival mucosa.

- 1266 De Michelis, F. (Inst. Ind. Med., Turin, Italy): La differenza quantitativa del piombo presente nelle tasche gengivali delle due arcate dentarie dei lavoratori esposti al rischio saturnino. (THE QUANTITATIVE DIFFERENCES OF LEAD IN THE GINGIVAL POCKETS OF THE TWO DENTAL ARCHES OF WORKERS EXPOSED TO LEAD.) Rassegna di Medicina Industriale 20:303-7 (Sept.-Oct.), 1951.

There is a decided difference between the Pb content in the gingival pockets of the 2 dental arches among workers exposed to Pb. Among 20 control subjects (age 32-60), the following values were obtained: in the upper arch, ranging from 35-60  $\mu\text{g}$ , in the lower arch from 56-81  $\mu\text{g}$ , with totals ranging from 104-140. In workers exposed to Pb, the corresponding figures were from 60-130 in 10 Pb grinders (age 22-60), 60-150 in 10 painters (age 20-50), 70-150 in 30 printers (age 22-45) in the upper arch, and 112-190, 90-180, and 140-218, respectively, in lower arch, with totals of 178-310, 180-325, and 218-343, respectively.

- 1267 Dérobert, L., Hadengue, A., and Le Breton, R.: Un cas peu banal d'intoxication saturnine. (LEAD INTOXICATION: UNUSUAL CASE OF ALIMENTARY ORIGIN.) Annales de Médecine légale et de criminologie, police scientifique et toxicologie 31:60-4 (Jan.-Feb.), 1951.

A case of oral Pb poisoning in a married couple due to the use of a salad bowl with a Pb-containing glaze is reported. The previous history of the 53-yr-old wife (Jan-Apr) included pains in the shoulders extending into the lumbar region, severe abdominal complaints, a slight icterus, Burton's line, slight paralysis of fingers, and a 3-wk febrile episode. Epigastric complaints increased in severity and examination by the authors (May 20)

established the diagnosis of Pb poisoning beyond doubt; since the patient's husband also had Pb poisoning, but to a mild degree, the cause was assumed to be ingestion. Treatment of the patient was by tricalcium phosphate (TP) 1 g/day orally combined with a single massive dose of 15 mg of vitamins D<sub>2</sub> and B<sub>1</sub> each. Blood tests (May) showed 90% Hb, 3,900,000 red cells, 208 stippled cells/100 leukocytes, and 0.55 g blood urea. Blood Pb levels, at first low, rose to 235 µg% (June). By July 1, the patient had improved greatly. Treatment with TP was continued (0.5 g/day). Although 2 mo later her condition had improved, the patient still complained of constipation and twitching of the skin. Numbness of her fingers was again present. Reflexes were normal.

On May 20, blood tests on the patient's husband (50 yr old) showed 98 stippled cells/100 leukocytes; on May 24, 112/100 leukocytes. His blood Pb level (June 12) was 86 µg/100. Physical examination was normal. He received a 1-mo treatment with TP; 2 1/2 mo later, his health was excellent.

Detailed investigations concerning the origin of these cases led to the conclusion that the amount of Pb dissolved by the glaze must have been considerable. Acid tests elicited 40 mg of Pb after 45 min contact with the bowl, and 118 mg after 24-hr contact. The bowl had been used daily for >1 yr. The severity of the wife's poisoning compared to that of the husband who at one time had been exposed to Pb at his place of work remained unexplained.

- 1268 Di Ferdinando, R. (Publ. Hosp. S. Salvatore, Pesaro, Italy): Neurite ottica saturnina da marocchino del cappello. (SATURNINE OPTIC NEURITIS DUE TO DYE IN SWEAT BAND OF HAT.) *Giornale Italiano di Oftalmologia* 4:344-52 (Sept.-Oct.), 1951.

Following a review of the literature concerning ocular disorders in Pb poisoning, the author presents the case of a 27-yr-old man who complained of progressive loss of vision. Ophthalmologic examination showed optic neuritis with intra- and retrobulbar inflammation, together with a chemical dermatitis of the forehead and parietal and temporal regions. There were no other clinical findings. Exposure to Pb present in the sweat band of a hat was held as the cause. Hematology revealed 3,750,000 red cells, 5400 white; hemoglobin 75%; basophils 1; Pb (Behrens and Taeger method), 121 µg (sic). Analysis of the hat band, a cotton-rayon fabric, coated with oil and dye to simulate leather, showed Pb in the scrapings and in the ash (no values are indicated).

- 1269 Di Porto, A. (Univ. Rome, Italy): Comportamento della trimetilamina urinaria in soggetti alla azione di composti del piombo. (BEHAVIOR OF URINARY TRIMETHYLAMINE UNDER THE ACTION OF LEAD COMPOUNDS.) *Policlinico (Rome) Sezione Pratica* 58, No. 15:453-7, 1951.

Urinary excretion of trimethylamine was determined in 14 cases (from the printing industry) of Pb poisoning with liver disorder and the results are tabulated for each worker with brief history of exposure, and clinical findings. The levels ranged from 1.75-6.45 mg% (24.02-70.47 mg/24 hr);

these were regularly higher than normal and in some cases with longest exposure were 3 times higher. In 57%, and to some extent in almost all cases, the hepatitis was accompanied by constipation. This points to the probability that this condition of the digestive system has a certain influence on the metabolism of methylated compounds. The findings agreed with those obtained in experimental Pb acetate intoxication in rabbits.

- 1270 Eriksen, L. (Univ. Oslo, Norway): A CO-PROPORPHYRIN CHROMOGEN EXCRETED IN NORMAL AND PATHOLOGICAL URINE. *Nature* 167:691-2 (Apr. 28), 1951.

In cases of acute porphyria fluorescence of ether/glacial acetic acid (E/GA) extracts of urine increased on standing at room temperature for 2 days. Since this might indicate formation of coproporphyrin (CP) from a chromogen extracted by E/GA, urines from 4 normal subjects and from 2 adults suffering from Pb poisoning were examined. The urines were extracted with E/GA by Fischer's method and the CP extracted with 0.1N HCl. The amount of CP was determined by the Rimington and Sveinsson method. The results, as tabulated, showed in normal urines preformed CP of 4.2-8.4 µg/100 ml; formed from chromogen, 6.6-15.2; in Pb poisoned, 378.4 and 100.9; 200.0 and 228.9. In the analyses with porphyrin adsorbed on Ca phosphate, the latter amounted to 382.4 and 92.7 µg/100 ml, and that formed from chromogen, 199.0 and 209.7 in the 2 Pb poisoned subjects. Porphobilinogen was not adsorbed on Ca phosphate when the method of Sveinsson, Rimington and Barnes was used, therefore the urines from the 2 Pb-poisoned cases were treated by the above method, since this also indicated formation from chromogen. The pH was adjusted to 5.0 and the solution was extracted with E/GA. Preformed CP and CP-chromogen were determined as above. A considerable part of the total CP was excreted as colorless CP chromogen.

- 1271 Fassbender, H.G. (Johannes-Guttenberg Univ., Mainz, Germany): Zur Pathogenese der Hämochromatose. (PATHOGENESIS OF HEMOCHROMATOSIS: LEAD POISONING AS A CAUSATIVE AGENT.) *Deutsche Medizinische Wochenschrift* 76:970-2 (Aug. 3), 1951.

Hemochromatosis, a rare disease of uncertain etiology, is generally believed to be familial. Mallory, in his animal experiments, based the disease on an impaired Cu metabolism, Petrides and Wild (1948) on the long-term, intensive contact with Cu and Pb in 3 of their patients without any recognizable genetic tendency. Rosenberg (1928) reported the disease in a printer as a result of 3 yr of Pb exposure, and according to Sheldon, the condition is due to an impaired Fe metabolism. In all such cases, as well as in the case reported by the author, the typical signs of Pb intoxication can be lacking or at least be less marked than usual. Lewin et al (1928) point out that absence of the cardinal symptoms of Pb intoxication is possible when there is a constitutional sensitivity of the liver parenchyma or of the capillary system. They observed severe liver impairment, including two fatalities, in Pb workers. Many

authors believe the basis of hemochromatosis to be an impairment of the Fe metabolism, pointing the way to bronze diabetes, an effect of long-term Pb exposure. Similarly, the effect of Pb upon the erythrocytes and the erythropoiesis and its intrusion into the porphyrin metabolism and disturbance of the heme synthesis should be considered as factors in the etiology of hemochromatosis.

The author reports the autopsy results of a 60-yr-old male who had worked as a tinner for ~34 yr and who died after a 2-yr illness, presenting a typical picture of classical hemochromatosis. While still alive, he had had complete loss of head and body hair, loss of all teeth and was noted for his bronze skin color. Findings included cirrhosis of the liver, cirrhosis of the pancreas, swollen lymph nodes, small pneumonic foci, chronic bronchitis, traces of an endocarditis and minimal arteriosclerosis of the pelvic aorta and arteriosclerotic scars in the kidneys. The spleen showed sparse lymph follicles, a wide sinus, a hyperplastic reticulum, and massive cellular hemosiderin stored in the sinus. The thickness of the adrenal cortex was striking, especially so the fascicula zone which was packed with sudanophil substances. The marrow was likewise extended. Hemosiderin was located in several subcapsular portions of the glomerular zone and to a much lesser extent in the marrow. In the kidney, hemosiderin was found in only a few epithelial cells of the Henle loop. The chest wall was rich in Fe-free pigment. The cardiac muscle contained a dense accumulation of pigment, the major portion of which contained Fe, a minor part of which was fatty.

In this case, the duration of contact with the industrial poison was unusually long, creating conditions coming quite close to those in long-term animal experiments. The author concludes that, in the presence of a certain constitutional disposition toward hemochromatosis, Pb was a significant factor in the development of the disease in this patient. The etiological role of Sn to which the patient had also been exposed is difficult to assess.

- 1272 Germek, O.A. (Univ. São Paulo, Brazil): Contribuição para o estudo dos meios capazes de traduzir as alterações primárias resultantes da ação do chumbo sobre o organismo humano. Consequências que daí decorrem para a profilaxia dessa intoxicação. (THE FIRST DETECTABLE CHANGES DUE TO THE ACTION OF LEAD IN THE HUMAN BODY. PROPHYLACTIC CONSEQUENCES.) Anais da Faculdade de Farmácia e Odontologia da Universidade de São Paulo 9:149-77, 1951.

The determination of urinary Pb in 113 workers of a storage-battery factory indicated exposure to Pb but was not a sure index of Pb poisoning. No correlation was found between urinary excretion of CP and the time of exposure to Pb. The author concludes that determinations of urinary CP and Pb should be expressed by their ratio to urinary creatinine excretion so as to relate them to the body mass. Determination of reticulocytes and basophilic stippling of red cells is necessary if urinary CP is increased.

- 1273 Gorrand, M.: De l'état actuel de la prophylaxie du saturnisme. (THE PRESENT STATUS OF THE PROPHYLAXIS OF LEAD POISONING.) Thesis, Paris, 1951, 38 pp.

The measures for the control of Pb poisoning in industry adopted by the Decree of December 11, 1948 are discussed. The preventive measures, as supplemented or modified since the Decree of July 10, 1913 are reviewed.

In the 1st chapter, the author groups the regulations as to improvement of work conditions, radical elimination of Pb by exhausts, etc. The 2nd chapter deals with the necessary precautions, for workers, and to the principal therapeutics to strengthen the defense mechanism or neutralize Pb in vivo. In the last chapter, the role of the industrial physician is emphasized: this extends not only to the early detection of intoxications but also to an effective surveillance either by himself or with the committee of hygiene and safety according to modern preventive measures. (From Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 13: 306 (Thesis Reviews), 1952)

- 1274 Hadengue, A., and Collin, M. (France): Etudes sur le taux de l'azotémie des ouvriers exposés au plomb. (STUDIES ON THE LEVEL OF BLOOD UREA IN WORKMEN EXPOSED TO LEAD.) Proceedings of the Society of Industrial Medicine and Hygiene. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 12:561-5, 1951.

Blood urea studies are described on 64 workmen exposed to greatest Pb hazard in an accumulator works; 33 had a pathological azotemia, defined as 50 mg or more of urea per 100 ml blood; only 11 showed values strictly within the normal range (<40 mg.). Nitrogen retention was not associated with hypertension or albuminuria, nor with increased age, since raised blood urea was seen particularly in the younger members of the group. Liver function tests were normal. No correlation could be found between punctate basophilia, and blood urea levels, both of which undergo considerable variation from week to week.

It is suggested that blood urea determinations should be part of the preemployment examination in the accumulator industry, and should be repeated annually as a measure of Pb intoxication.

- 1275 Hadengue, A., and LeBreton, R. (France): Un nouveau cas de Saturnisme hydrique. (A NEW CASE OF LEAD POISONING FROM DRINKING WATER.) Annales de Médecine Légale et de Criminologie 31:125-7, 1951.

A case of Pb poisoning in a farmer is presented, with symptoms consisting essentially of abdominal pains, loss in weight and mild anemia. The drinking water of the farm was found to contain 3 mg Pb/l. After the patient had ceased using this water for 1 mo, laboratory tests showed blood Pb to be 90 µg% and urinary Pb 0.5 mg/l. No stippled cells were seen. In 1949, 5 more persons with Pb poisoning were seen. Investigation revealed that use of Pb pipe was responsible for the Pb in the water. Although the use of Pb pipes has been

generally discontinued for use in water supplies for humans, it is still used for the water supplies for animals. The danger to domestic animals is discussed.

- 1276 Hadengue; Raymond (France): Remarques sur la nouvelle législation du saturnisme. (NOTES ON THE NEW LEGISLATION ON LEAD POISONING.) Médecin d'Usine 13:155-6 (Mar.), 1951.

Concerning the order of Dec. 12, 1948, which set forth recommendations for medical examinations to detect Pb poisoning, Hadengue made the following remarks: (1) Requiring determination of basophilic stippling is good, but the frequency of this determination should not be the same for all occupations. (2) The number of stippled erythrocytes (10/100 leukocytes, as specified) which leads to a suspicion of Pb poisoning is too low. (3) Because anemia is rare in chronic Pb poisoning, an annual blood count is sufficient, except in special cases. (4) Requirement of a blood Pb determination at the factory is premature; it should be done at a hospital or by an expert. (5) Pb poisoning from contaminated water, which is almost always overlooked, can lead to errors concerning the occupational origin of the absorption or the disorders observed. Raymond pointed out that laboratory investigations are useful in the following cases. (1) Examination of workers exposed to risk: determination of basophilic stippling/leukocytes is sufficient. (2) Detection of Pb absorption where it is not known, whether the worker is exposed to risk: blood Pb determination is necessary. (3) Detection of nephritis by determination of urea content in blood, Ambard constant, etc.

- 1277 Hammond, J.W.: HYGIENIC STUDY OF THE LEAD BURNING DEPARTMENT AT BAYTOWN REFINERY. Medical Bulletin, Standard Oil Company (N.J.) 11:223-5 (Apr.), 1951.

An investigation of the urinary Pb excretion of 6 Pb burners and helpers employed in refinery construction indicated that 4 were exposed to hazardous concentrations on the basis of a maximum urinary Pb concentration of 0.10 mg/l. Among the recommendations made for control of the hazard were greater use of local exhaustive ventilation and personal protective devices.

- 1278 Hardy, H.L., Bishop, R.C., and Maloof, C.C. (Div. Occup. Hyg., Massachusetts Dept. Labor Ind., Boston; US Vet. Hosp., West Roxbury, Mass.; Div. Occup. Hyg., Massachusetts Dept. Labor Ind., Boston): TREATMENT OF LEAD POISONING WITH SODIUM CITRATE. REPORT OF FOUR CASES. A.M.A. Archives of Industrial Hygiene and Occupational Medicine 3:267-78 (Mar.), 1951.
- Four cases of Pb poisoning, acute in 3 and chronic in 1, in which the patients were treated with Na citrate, are presented. The authors believe that the evidence accumulated leads to the following opinions: (1) Adequate oral doses of Na citrate will control the symptoms of Pb poisoning. (2) Studies of the Pb excreted in the urine in these 4 cases (studies of Pb excreted in the feces are

lacking) do not warrant the conclusion that Na citrate increases Pb excretion. (3) Studies of urinary coproporphyrin are presented. (From authors' summary)

- 1279 Herrmann, G. (General Hosp., Vöcklabruck, Germany): Chronische Bleivergiftung unter dem Bilde einer amyotrophischen Lateralsklerose. (CHRONIC LEAD POISONING WITH AMYOTROPHIC LATERAL SCLEROSIS.) Wien. Med. Wochenschr. 101:657, 1951.

In spite of a definite decrease, chronic Pb poisoning still makes up the major portion of industrial intoxications. From the literature it is evident that the pathological-anatomical bases of Pb poisoning are primary vascular manifestations with degenerative changes in the ganglion cells; however, secondary inflammatory changes can be found. The clinical symptoms correspond to the anatomic conditions: eg, saturnine encephalitis with seizures, choked disk, oculomotor paralysis with meningitis serosa, amaurosis and psychosis attributable to effects on the brain, paralysis of the various peripheral organs stemming from the spinal cord. Because of the scarcity of case reports, the author describes the case of a type-setter who repeatedly exhibited states of acute and subacute Pb poisoning during the performance of his job and who at the termination of his employment displayed a progressive picture reminiscent of muscular atrophy (neural) or amyotrophic lateral sclerosis; however, due to rectovesical affection, peculiar sensory disturbances and epileptiform attacks deviated from this aspect of the disease. Therefore the entire central nervous system, including the vegetative, was involved. (From Zentralblatt für Arbeitsmedizin und Arbeitsschutz 4:22 (Abstracts), 1954)

- 1280 Hesse, E., and Flöter, W. (2nd Med. Dept. Gen. Hosp. St. Georg, Hamburg, Germany): Über die Behandlung der Bleivergiftung mit Folsäure. (TREATMENT OF LEAD POISONING WITH FOLIC ACID.) Klinische Wochenschrift 29:232-3, 1951.

Experiments with rabbits show that folic acid is able to counteract a 6-fold lethal dose of Pb administered over a period of 30 days. Two clinical cases of Pb poisoning were treated successfully with folic acid. Vitamin B<sub>12</sub> and BAL showed no therapeutic effect.

- 1281 Iafanti, F. (Univ. Naples, Italy): Frequenza e forme di intossicazione saturnina nell'industria Napoletana. (FREQUENCY AND TYPES OF LEAD POISONING IN NEAPOLITAN INDUSTRY.) Folia Medica Naples 34:495-501 (Oct.), 1951.

The incidence of intoxication during the 3 yr 1948-50 was 7.1/1000, as reported to the INAIL. The symptoms were anemia, gastrointestinal disturbances with colic, neuropsychic reactions, various types of arteriosclerosis, and kidney disorders. Inability to work varied from 1-7 mo. Treatment consisted of vitamins, hypotensor substances, liver extracts, nicotinic acid, and often in administration of BAL. The latter seemed to be quite efficacious.

- 1282** Jiménez Díaz, C., Gilsanz, V., Linazasoro, J.M., and Tamames, C.: Un syndrome de paralysie radiale avec ictère et ses rapports avec l'intoxication saturnine. (PERIPHERAL PARALYSIS AND JAUNDICE AND ITS RELATIONSHIP TO LEAD POISONING.) Presse Médicale 59:1263-5, 1951.

This is the French translation of the following abstract.

- 1283** Jiménez Díaz, C., Gilsanz, V., Linazasoro, J.M., and Tamames, C.: (A SYNDROME OF RADIAL PARALYSIS WITH JAUNDICE AND ITS RELATION TO LEAD INTOXICATION.) Rev. clin. esp. 40-163-70, 1951.

The authors describe a series of 10 patients who suffered from a syndrome of acute abdominal pain of a colicky type associated with jaundice and sudden onset of unilateral and bilateral paralysis of the upper limbs. Patients with slight paralysis showed the typical radial palsy with the escape of the supinator, but when the paralysis was severe all the upper limb muscles were involved, and in 2 cases the lower limbs were also affected. All the patients were employed, or spent a great deal of time, in public houses or cafes, and the condition was caused by Pb poisoning due to drinking mineral water with a high Pb content. The differential diagnosis, clinical features, and pathology of the condition are discussed. Treatment includes the administration of Vitamins C and D and measures such as Ca injections and a diet rich in Ca to immobilize the Pb, as its elimination is almost impossible. (From British Journal of Industrial Medicine 9:87, 1952)

- 1284** Kehoe, R.A. (Univ. Cincinnati, O.): A CRITICAL APPRAISAL OF CURRENT PRACTICES IN THE CLINICAL DIAGNOSIS OF LEAD INTOXICATION. Industrial Medicine and Surgery 20: 253-9 (June), 1951.

"The diagnosis of Pb intoxication, as we shall deal with it here, is based upon a valid history of significant occupational exposure to Pb upon the presence of symptoms strongly suggestive of the effects of Pb absorption, and upon certain physical signs which characterize absorption of Pb or intoxication therefrom." This is a simple statement of the essentials of diagnosis, but many physicians disregard them, mainly from clinical ineptitude. The author urges the necessity of close attention to occupational history, duration and intensity of exposure, history of the illness, physical findings, and the clinical course. He especially condemns reliance on a single laboratory test, such as basophilic stippling and coproporphyrins in the urine, for a decisive diagnosis. Pb concentrations in the blood and urine are the most important laboratory determinations. Duplicate samples of blood should always be taken, with one or more properly prepared urine samples, so that the precision of the tests may be known. Postmortem diagnosis is always difficult, but when it is made, samples of a number of tissues must be taken. (12 references)

- 1285** Litzner, St.: Zur Klinik und Therapie der Bleivergiftung. (DIAGNOSIS AND TREATMENT

OF LEAD POISONING.) Ärztl. Dienst DB 12: 109, 1951.

The author points out that Pb poisoning has increased since 1948; however, the cases seen are not of the severity observed 23 yr ago. Pb absorption by inhalation of dust and fumes is most frequent and most dangerous. Individual susceptibility to Pb is discussed. Pb anemia can be confirmed if Hb content is <75%. Porphyrin determination for the diagnosis is not too reliable since values vary daily. Gastritis and gastric ulcers can be accepted as Pb sequelae in the presence of other Pb symptoms. The possibility of liver damage is discussed. Acute kidney damage was not observed, the contracted kidney also is to be viewed with caution. Damage to peripheral and central nervous system occurs seldom; however, occasionally the extrapyramidal system is attacked. The occurrence of Pb-Basedow is questionable. Angina pectoris, along with other Pb symptoms is admitted. (From Zentralblatt für Arbeitsmedizin und Arbeitsschutz 3:21, (Abstracts) 1953)

- 1286** McCord, C.P. (Ind. Health Conservancy Lab., Detroit, Mich.): THE PORPHYRINS. THE SIGNIFICANCE OF PORPHYRINS IN OCCUPATIONAL DISEASES. Industrial Medicine and Surgery 20:185-90 (Apr.), 1951.

The nature, chemistry, and distribution of the porphyrin group are reviewed. Porphyrins in human beings as an hereditary or congenital state are described. Porphyrins in Herbivora constituting devastating diseases are recorded. The numerous pathologic states in humans in which porphyrinuria has appeared, establish that this laboratory finding is conclusive as to no one disease, merely indicating idiopathic porphyria or, instead, impairment of the hematopoietic system. The occupational diseases in which porphyrinuria has been detected include those from Pb, Hg, As, Be, Se, P, sulfobenzene, aniline and some of its derivatives, chlorinated hydrocarbons but chiefly carbon tetrachloride. Firsthand observations suggest that significant urinary porphyrins are absent from apparently healthy industrial workers. The currently acceptable technique for detection is appraised. As to Pb intoxication or absorption, it is concluded that the presence of porphyrins in urine is not diagnostic; but as a screening procedure among Pb exposed workers, otherwise healthy, porphyrin detection constitutes a measure contributory to diagnosis. (17 references)

- 1287** Mainx, F., and Hauf, R. (Nordbaden Ind. Med. Dept., Karlsruhe, Germany): Bleivergiftung und Leber. (LEAD POISONING AND LIVER.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 1:54-8 (May), 1951.

Following a review of the literature on the title subject, the authors report their trial of "health prophylaxis" for workers exposed to risk of Pb poisoning by the administration of a liver extract. This was carried out on 22 workers of a Pb-recovery factory which had been seriously damaged during the war, where old batteries and scrap were processed giving rise to considerable risk; they had observed there a number of moderate to severe cases of Pb poisoning. The liver preparation was administered in a dose of ~100 g (in a



lemonade for flavoring) daily for ~3 mo. The weight, urinary coproporphyrin (CP) (de Langen and ten Berg method), stippled cells, liver function, hemoglobin and Pb gum line were followed periodically. The results showed an improvement in the general condition of the workers and a distinct decrease in CP elimination. In addition, no new cases of manifest Pb poisoning occurred. Since the value of milk as a preventive of Pb poisoning is under question, the authors recommend that workers be given the liver extract in its place. (26 references)

- 1288** Masoero, A., and Possevini, V. (Municipal Hosp., Turin, Italy): Osservazioni su alcuni casi di colica saturnina. (OBSERVATION OF A FEW CASES OF COLIC DUE TO LEAD POISONING.) *Folia Medica* (Naples) 34:57-72 (Feb.), 1951.

The reflexes of the sympathetic nervous system of 5 patients with Pb colic were studied. Exaggerated excitability of the autonomic nervous system was observed in all cases. Anatomical and physiological observations indicate that colic due to Pb poisoning is caused by the direct action of Pb on the fibers of the visceral sympathetic nervous system. This action consists of a definite increase in the tone of the autonomic nervous system and is more readily observed in constitutionally vagotonic persons. (12 references)

- 1289** Nicolai, W. (Giessen, Germany): Bleiben-zinvergiftung und Oberkiefercarcinom. (TETRAETHYL LEAD POISONING AND CARCINOMA OF UPPER JAW; REPORT OF A CASE.) *Archiv für Ohren-, Nasen- und Kehlkopfheilkunde* 159:394-7, 1951.

The case described is that of a 51-yr-old man who in 1940 had worked for 6 mo at an airport as a filling station attendant. The records indicated that he had incurred Pb-gasoline poisoning. In discussing the case, it is pointed out that such attendants are in the habit of starting the flow of gasoline by sucking the hose by the mouth. In the case discussed, the mucosa was thus exposed to gas consisting of hydrocarbons of the methane series as well as of the aromatic series and to TEL (0.6-1.2 vol%). This chronic irritation led to loss of all teeth. The patient wore plates from 1943 on, which caused increased pain, especially in the upper jaw. In 1949 the patient stopped wearing plates and underwent several incisions in the left upper jaw for abscesses. In 1950, upon admission to the hospital, diagnosis of malignant tumor was made. In spite of resections and X-ray (2800 µg) therapy new metastases formed and the patient died 1/2 yr later.

The author states that constant chemical irritation and damage led to predisposition. Subsequent irritation from the plates (mechanical pressure and chemical irritation from the plate material) contributed to cancer formation.

- 1290** Pinho, B. d.: (TEN CASES OF ACUTE LEAD POISONING CAUSED BY WATER.) *Bull. Centre belge Ét. Document. Eaux* 1951, No. 11:57-9.

Some cases of Pb poisoning occurring in a small town near Lisbon were traced to the water supply.

The wells from which the supply is obtained were deepened to increase the yield, and the water became more acid (pH 4.5) and dissolved the protective layer which had previously been deposited on the Pb pipes. The use of lime, Na silicate, or Na carbonate to neutralize the water was investigated and it was decided that Na carbonate would be easiest to apply. The water is also disinfected with Javel water. Regular analyses show that no Pb is now present in the water. (From *Water Pollution Abstracts* 26:Abstr. No. 363, 1953)

- 1291** Rejsek, K.: (HAZARDS OF LEAD POISONING IN PRINTING PLANTS.) *Pracovní lékařství* 3:29-33 (Mar.), 1951.

The author summarizes the results of examinations of 920 employees of printing shops coming into contact with Pb. He examined most of these patients himself, taking into consideration observations from 1931 to the first half of 1950. In some cases in which the diagnosis of Pb poisoning had been made, a revision in the light of present laboratory methods and the present experiences in the evaluation of the clinical picture and the individual laboratory tests led to the decision that the original diagnosis of Pb poisoning had been incorrect. All these faulty diagnoses dated from the time before 1945. The author then discusses the incorrectness of placing importance on various neurological and vascular syndromes found in workers with a Pb risk in the absence of other evidence of poisoning. He further analyzes the work hazards in printing shops and brings as evidence determinations carried out by Roubal and his co-workers. These determinations also point to the fact that today there is no longer a Pb poisoning hazard in printing shops. (From *Archives of Industrial Hygiene and Occupational Medicine* 4:514 (Abstracts), 1951)

- 1292** Saulay, J.A.H.: A propos d'un infarctus du myocarde survenu au cours d'un accident paroxystique de saturnisme (Colique de plomb). (MYOCARDIAL INFARCT IN THE COURSE OF PAROXYSMAL ATTACK OF LEAD POISONING (LEAD COLIC).) *Th. méd.*, Paris, 1951, 97 pp.

The thesis is listed by title only. (From *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 13:305 (Thesis Reviews), 1952)

- 1293** Seifert, P. (Inst. Leg. Med., Heidelberg, Germany): Bleivergiftung und Laboratoriumsbefunde. (LEAD POISONING AND LABORATORY FINDINGS.) *Zentralblatt für Arbeitsmedizin und Arbeitsschutz* 1:99-102 (Sept.), 1951.

In summarizing his discussion, the author states that basophilic granulations in the erythrocytes exceeding 9000/million can, by exclusion of certain other pathological conditions, ie, pernicious anemia, be considered as confirmation of Pb poisoning. Their absence, however, in no way excludes a possible Pb poisoning. Porphyrinuria which exists in 100% of all such cases can serve as a diagnosis of Pb poisoning. However, positive porphyrin findings in the urine are not definite proof of Pb poisoning since other pathological

conditions and poisonings are accompanied by porphyrinuria. Porphyrin determinations are an ideal aid in serial examinations of persons exposed to Pb since porphyrinuria tends to appear as the 1st sign of Pb poisoning. While Pb content of feces gives only a measure of oral Pb absorption during the past 24-48 hr, a Pb content of >0.2 mg/l in urine always points to Pb poisoning. There is, however, no quantitative relationship between Pb content of urine and that of the blood. The presence of more or less large quantities of Pb in urine only indicate a higher Pb absorption. A better evaluation of the urinary Pb findings can be accomplished if the specific gravity of the urine is considered. The most definite criterion of Pb poisoning is the blood Pb content. A modification of the dithizone method is described. In all questionable cases the finding of Pb in blood gives definite proof. The Pb content of blood can also be used for the control of therapy. In a series of 25 normal persons, an average of 71 µg% was found by the author; in 17 Pb poisoning patients, a range of 103-390 µg% was found. A healthy human subject who took a single dose of 50 mg Pb (1000 µg/kg body weight) as Pb acetate showed an increase in blood Pb on the 2nd-3rd day and reached a maximum of 366 µg% after the 5th day. After 10 days the normal value (70 µg%) was slightly exceeded; it was reached on the 20th day. (From Schwarz: Thesis, Heidelberg, 1951) (17 references)

- 1294** Soprana, C. (Univ. Padua, Italy): Su di un caso di atrofia ottica da piombo a manifestazione tardiva. (Importanza della mobilitazione del piombo nella diagnosi clinica di pregressa intossicazione saturnina). (A CASE OF OPTIC ATROPHY DUE TO DELAYED LEAD POISONING. (IMPORTANCE OF MOBILIZATION OF LEAD IN THE CLINICAL DIAGNOSIS OF PAST LEAD POISONING.)) *Medicina del Lavoro* 42:187-91 (May), 1951.

A 70-yr old workman had been employed on a farm until age 33; then he became a mechanic and at age 41 entered a factory, where he was employed on transport, on maintenance and in the melting and other handling of Pb. He was exposed to risk of Pb poisoning during 6 mo of each year and worked in the open air the rest of the time. He noticed some weakness of eyesight at age 46, to which he paid little attention. He was pensioned in February 1950 and 9 mo later his eyesight failed rapidly. Optic nerve atrophy was found on both sides but no cause for this atrophy could be demonstrated by either clinical or laboratory examination. As recommended by Maugeri, 10 ml of a 10% solution of Mg sulfate were then injected intravenously on 3 successive days to mobilize any Pb which past absorption may have caused to become deposited in the bones and other tissues. Porphyrinuria set in within 24 hr of the 1st injection, and this strongly supported the view that the optic atrophy was a late result of past Pb poisoning.

- 1295** Tara, S., and Bouillot, J. (France): L'indoxylurie des saturnins. (Note préliminaire). (INDOXYLURIA IN LEAD POISONING. (PRELIMINARY NOTE.)) Pro-

ceedings of the Society of Industrial Medicine and Hygiene. *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 12:543-4, 1951.

Based on the observations of Heitz-Boyer, who found a definite relation between intestinal stasis and increased indoxyluria, the authors examined 192 Pb workers to determine their urinary indoxyl content (method of Grigaut). Of these, 182 workers (94%) showed above normal indoxyl excretion (normal 10 mg/l); 128 (66%) showed values >20 mg/l, and 77 (40%) >30 mg/l. The authors considered a value >20 mg/l as a warning sign and recommended preventive examinations in industries where Pb is used.

- 1296** Vacher, J.: Les éléments figures du sang dans le saturnisme. (THE FORMED ELEMENTS OF THE BLOOD IN LEAD POISONING.) Thesis, Paris, 1951.

The substance of the thesis, as revealed by the summary (abstractor's note: the latter only could be seen) is contained in the publication by Desoille, Tara and Vacher; See Abstract No. 1329.

- 1297** Vigliani, E.C., and Zurlo, N. (Ind. Clinic L. Devoto; Res. Lab. I.N.A.I.L., Milan, Italy): THE EFFECTS OF BAL ON THE METABOLISM OF LEAD AND ON THE SYMPTOMATOLOGY IN LEAD INTOXICATION. *British Journal of Industrial Medicine* 8:218-25 (Oct.), 1951.

Twenty-seven patients with occupational Pb poisoning were treated with low doses of BAL. The average blood Pb value was 122 µg/100 ml before treatment. Injection of 2-5 mg of the compound/kg of body weight caused an immediate reduction of blood Pb. In 8 hr the value had dropped to 50 µg/100 ml but had risen to 115 µg/100 ml in 24 hr. Injection of BAL caused a sharp increase of urinary Pb in the first few hours, after which the concentration rapidly diminished though it was maintained above pretreatment values for 24 hr. The average total amount of Pb disappearing from the blood was 2.1 mg 3 hr after injection. The amount excreted in the urine for the same period averaged 0.4 mg. Pb was also determined in the bile and gastric juice. It was found that BAL has little effect on the elimination of Pb in bile; the results on gastric juice were not conclusive: while in 1 patient there was an increase, in 1 there was none; in 3 the quantity eliminated in this fluid was roughly parallel with the fall in blood Pb concentration. This indicates that the principal effect of BAL is not deleading as ordinarily defined but rather a transferring of Pb from blood and certain organs to other organs, probably mainly to the skeleton. Damaging effects could be produced if the Pb were to accumulate in the nervous system. Final judgment of the suitability of dimercaprol for treatment of Pb poisoning is not possible until further work has been done. The value of the deleading effect may be small when unfavorable effects due to disturbance of internal Pb distributions are considered.

- 1298** Watson, C.J. (Univ. Minnesota Hosp., Minneapolis): PORPHYRIN METABOLISM AND PORPHYRIA. *Lancet* 1:539-42 (Mar. 10),

1951.

The review of the classification, urinary excretion of porphyrins and relation to hemoglobin synthesis in various disease states, including Pb poisoning, and the features governing porphyria, is summarized by a recently proposed biosynthesis of porphyrins (Neuberger et al, 1950). This postulates an initial synthesis of uroporphyrin III; this porphyrin might be a physiologic precursor but not demonstrable owing to speed of reaction. It might be anticipated that it would be found in certain conditions, such as Pb poisoning which are characterized by excessive coproporphyrins III, since there is reason to believe that these excesses are due to an enzymatic disturbance in the synthesis of hemoglobin. (~40 references)

- 1299 Whitaker, P.J.: THE ABSORPTION, EXCRETION AND RETENTION OF INGESTED LEAD BY HUMAN EXPERIMENTAL SUBJECTS; A STUDY OF LONG-TERM EXPERIMENTS ON THE LEAD METABOLISM OF HUMAN PERSONS SUBJECTED TO NORMAL AND INCREASED LEVELS OF INGESTION. Dissertation, University of Cincinnati, 1951, 41 pp.

A series of 6 long-term experiments on the metabolism of Pb of 4 adult subjects were studied. Certain conclusions regarding Pb metabolism at normal or incidental levels of ingestion and at abnormally high levels of ingestion (up to 10 times the normal or incidental level) were reached, as follows:

Each of 2 subjects, while taking a normal diet of his own choosing, ingested ~0.25 mg of Pb daily in food and beverages and eliminated ~0.25 mg of Pb daily in feces, and ~0.03 mg Pb in urine (av 0.03 mg/l). Over the period of ~1 yr on such diet, each subject eliminated more Pb from his body in the feces and urine than was ingested in his food and beverages, the excess output over intake being ~10 mg, in both instances.

Each of 4 human subjects to whom Pb was administered orally in doses of 0.3, 1.0, 2.0, and 3.0 mg/day, respectively, eliminated less Pb from his body in urine and feces than was ingested in food and beverages. The rate and the amount of Pb thus retained depended mainly on the rate of ingestion (dose/day) and the duration of the period of administration, but it varied also with other less obvious factors, among which, apparently, was a seasonal factor. Each of 3 human subjects, while taking 1.0, 2.0, and 3.0 mg of Pb daily in addition to that contained in his food and beverages, demonstrated an irregular but progressive increase in the urinary and blood Pb concentrations during the period of Pb administration, with a progressive decrease in these concentrations for some time after the discontinuance of the administration of Pb. After discontinuance, Pb retention was slowly lost via the urine, and in 2 instances, associated with higher dosages, via the alimentary tract as well. The rate of such loss varied with the rate at which the Pb had been retained in the body.

None of these human subjects showed clinical signs or symptoms of Pb intoxication at any time, despite the fact that amounts varying from 110-118 mg of Pb had been retained in the bodies of 2 of the subjects during periods of 2 and 4 yr

respectively, while 55 mg Pb had been retained in the body of another subject during a period of 4 mo. The quantitative significance of these amounts can be realized more satisfactorily on the background of the available evidence which indicates that the normal American adult, with no occupational exposure to Pb, has ~120-180 mg Pb in his tissues as the result of his normal intake of Pb in food and beverages over periods of many years. (The author notes at the end of the thesis that previously unreported results were given in some detail although the experimental data were summarized.) (22 references)

- 1300 Worms, R., Pequignot, H., and Albahary, C. (Paris, France): Colique saturnine avec trouble isolé du métabolisme porphyrique. (LEAD COLIC WITH OCCASIONAL DISTURBANCES IN PORPHYRIN METABOLISM.) Proceedings of the Society of Industrial Medicine and Hygiene. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 12:541-3, 1951.

A 45-yr-old man who started work in a storage battery plant 10 mo earlier was hospitalized for abdominal pains, accompanied by nausea, headaches, chills, constipation, and delirium. Clinical examination in August showed no Burton line, occasional red-colored urine, 75 µg Pb/100 ml blood, 1462 coproporphyrin/24 hr, no basophilic stippling, no uroporphyrin or porphobilinogen in urine, 2,640,000 red cells, and 1706 coproporphyrin/24 hr and 3,440,000 red cells in October. After treatment with atropine and strychnine, since alcoholism was first suspected, the patient returned to work. In December he showed 4,625,000 red cells and 604 µg free erythrocyte protoporphyrin/100 ml. The authors pointed to the inconsistency in the clinical signs of Pb poisoning but the extreme production of porphyrins which continued after the disappearance of signs, and the disturbance of porphyrin metabolism and the normal values for basophilic stippling and Pb content of blood, in this case, and concluded that "the diagnosis of Pb poisoning should not always be expected to be supported by complementary examinations."

- 1301 Wyss, V. (Inst. Ind. Med., Turin, Italy): Il dosaggio spettrografico del piombo in denti di individui normali e di individui esposti al rischio saturnino. (SPECTROGRAPHIC DETERMINATION OF LEAD IN TEETH OF NORMAL INDIVIDUALS EXPOSED TO LEAD.) Rassegna di Medicina Industriale 20:40-7 (Jan.-Feb.), 1951.

The results of the determination of Pb in the teeth of 14 normal individuals and of 12 workers in metallurgical and printing trades are reported. Although Pb was present in the teeth of all persons examined, the mean quantity of Pb was 27 µg/g of dental ash in normal persons, and 58 µg/g of ash in metal workers. An explanation of this difference is given. The results are compared with those reported by other authors and found to be in accord. A comparison of the quantities of Pb in the bone and in other parenchymatous tissues shows that teeth as bone have the function of storing Pb circulating in the blood. (40 references.)

- 1302 Wyss, V. (Turin, Italy): Il dosaggio spettrografico del piombo in denti di individui normali e di individui esposti al rischio saturnino. (SPECTROGRAPHIC DETERMINATION OF LEAD IN TEETH OF NORMAL SUBJECTS AND IN INDIVIDUALS EXPOSED TO THE RISK OF LEAD POISONING.) Bulletin and Proceedings of the Lombardy Association of Industrial Physicians. *Medicina del Lavoro* 42:304-5, 1951.  
See preceding abstract.

- 1303 Wyss, V. (Inst. Ind. Med., Turin, Italy): L'apparato dentario nei lavoratori del piombo. (THE DENTAL APPARATUS AMONG LEAD WORKERS.) *Rassegna di Medicina Industriale* 20:108-50 (Mar.-Apr.), 1951.

The author tried to determine the extent of damage to teeth in workers exposed to Pb. He examined 215 metal workers who served as controls, 289 engaged in typographic trades (stereotypists, linotypists, compositors, etc) and 71 engaged in various Pb trades (soldering, wire drawing, laminating, etc). The results as tabulated show that in operators who are exposed to Pb particularly after the 3rd decade of continuous work, the condition of their teeth is much worse than in controls and that this is reflected in a large distribution of periodontal lesions. Thus in workers having a seniority of 40 yr or more against 29.7% in controls there were 71.3% of Pb workers who had very bad teeth. In highly exposed workers the dental lesions, especially periodontitis, appeared earlier and affected the greatest part of the subjects. The author believes that the explanation of the phenomenon lies in the spastic action that Pb exerts on the periodontal circulation. These effects are slow, but the daily repetition of them alters the local development producing a regressive periodontitis and facilitating the multiplication of bacteria. The author proposes that (1) this disease contracted in a particular type of work be considered as an occupational disease; (2) in the interests of indemnity and prevention that the possibility of furnishing dentures and the provision of medical and surgical treatment on the part of the Institute of Underwriters be considered. (24 references.)

- 1304 Zavarella, F. (Univ. Milan, Italy): Paralisi saturnina degli arti superiori insorta un anno dopo la fine dell'esposizione al piombo: prolungamento doloso dell'intossicazione o mobilitazione eccessiva di piombo da medicinali? (LEAD PARALYSIS IN UPPER ARMS ONE YEAR AFTER REMOVAL FROM EXPOSURE TO LEAD. FRAUDULENT PROLONGATION OF THE INTOXICATION, OR EXCESSIVE MOBILIZATION OF LEAD BY DRUGS?) *Medicina del Lavoro* 42:97-106 (Mar.), 1951.

A middle-aged man worked for 4 yr in the repair shop of a railway carriage works where he brushed-painted vehicle parts with an anti-rust preparation containing red Pb. The parts were handled for fitting before the paint had dried and much soiling of skin and clothes resulted from this. Hygienic conditions in the workshop were said to be otherwise unsatisfactory: a low standard of personal cleanli-

ness, meals taken in the workshop with dirty hands, etc. After working there for 2 yr, this man developed an attack of characteristic Pb colic. Frequent recurrences during the next 2 yr compelled him to give up the job in March, 1949. There was a further attack in May, an attack of exudative eczema of the scalp and face in September and another attack of Pb colic the following January (1950) when he was treated with I and BAL. The patient seemed to get worse, "blue line" more marked, severer colic, a subicterus, Pb present in the urine, blood and general condition deteriorating. It was suspected that Pb was perhaps being taken intentionally because the acute episodes seemed to occur after the patient's wife had visited him in hospital, from which he was being discharged at the end of March, 1950, to be placed on a tonic treatment at home. There was some improvement for a few days and he then developed paralysis of both upper limbs, affecting the cervical and the superior brachial nerves. After initial sharp pains, a rapid wasting of the shoulder and arm muscles set in without any serious loss of sensory functions and with some subsequent partial recovery of the paralysis. The cerebrospinal fluid showed little, if any, abnormality. In the absence of signs of renal or circulatory involvement, and with no further exposure to the Pb risk, it was expected that the general condition would improve, but the hopes of any rehabilitation of the upper limbs were very slight. (18 references.)

- 1305 Zavarella, F., and Ferrigno, D. (Univ. Milan, Italy): Sul rischio saturnino nel lavoro di cementazione di isolatori per elettrodotti. (LEAD POISONING IN THE MANUFACTURE OF INSULATORS FOR CARRYING ELECTRIC CABLE THROUGH WALLS OR OTHER CASINGS.) *Medicina del Lavoro* 42:161-7 (May), 1951.

Where electric cables, some of which carry current with very high voltages (as much as 50,000), have to pass through the metal casing of transformers or through the walls of power stations the cables are insulated in a porcelain duct which is encased in metal. The joint between porcelain and metal surfaces is made using a paste of litharge, or Pb monoxide, and glycerin. This is mixed by hand in a metal tray as required by the workman and it sets within 1 hr or so. Dried surplus paste is then scraped or sand-papered off the insulator, and Pb dust is raised both at this stage and when the paste is being mixed.

In a Milan factory where these insulators are made, 6 workmen have been employed at handling the litharge cement over the period 1932-50; only small quantities were used before the war and no manifestations of Pb poisoning were noted. In recent years, the consumption of litharge on this work in this factory has increased 10-fold and all 6 men involved were either suffering from Pb poisoning or showed signs of considerable Pb absorption; 2 have had to be admitted to hospital. Clinical and laboratory findings are given on each of the 6 men. The authors believe that much of the Pb absorption has been by inhalation, and this is known to act more rapidly than when Pb is ingested. They recommend a number of preventive measures including efficient exhaust means for the immediate removal of

the dust raised at the point of work, if a safer substitute cannot be devised to take the place of the litharge paste.

## 1952

- 1306 Anderson, A., and Nyström, Å.: Under-sökning av 50 arbetstagare exponerade för blybensin. (AN EXAMINATION OF 50 WORKERS EXPOSED TO TETRAETHYLLEAD CONTAINING GASOLINE.) Svenska Läkartidningen 49: 2772-5 (Nov. 7), 1952.

While the poisoning provoked by TEL probably depends in the main on its content of Pb, the clinical picture is not that of ordinary Pb poisoning, but is dominated by symptoms referable to the central nervous system such as insomnia, nightmares, headache, giddiness, restlessness, anxiety, convulsions and muscle twitching. This is so presumably because TEL is an effective solvent of lipoids and therefore has a marked affinity for the central nervous system. While workers concerned with the industrial production of TEL may well be exposed to high concentrations of it and therefore run a serious risk of poisoning by it, there is some doubt over the risk run by workers whose contact is less intimate, for example chauffeurs, car mechanics, and employees at filling stations. Accordingly, 50 such workers, including 12 drivers of tank vehicles, for the most part employed for >5 yr, were subjected to an ordinary clinical examination, a searching blood examination, testing for porphyrin and (in 12 cases) for Pb in the urine. All these tests were more or less negative, and the conclusion is drawn that apart from occasional acute discomfort arising from direct contact with TEL, it is not likely to affect seriously persons coming into contact with it under the conditions mentioned. (From Bulletin of Hygiene 29:193, 1953)

- 1307 Aston, E.R. (Pennsylvania Dept. Health, Harrisburg): DENTAL STUDY OF EMPLOYEES OF FIVE LEAD PLANTS. Industrial Medicine and Surgery 21:17-20 (Jan.), 1952.

Dental examinations of 1,161 employees of 5 plants engaged in making storage batteries, where the concentration of Pb in the air far exceeded the accepted MAC of 0.15 mg/m<sup>3</sup>, revealed the liability of these workers to dental and oral injuries in addition to the well-known Pb or "blue" line on the gums. The Pb line was present in some cases not only in the buccal and anterior areas of the molar and canine regions, but also on the lingual anterior surface of the mandible. Small bluish or stippled areas also appeared above the gums. Deposits of calculus containing concentrations of Pb ranging from 0.0011 to 0.0053 part/100 occurred under the gingival edge, forming a black line resembling the Pb line. The mucosa of the cheek and mandible showed, in some workers with long exposure to high concentrations, a characteristic bluish tint. Resorption of the alveolar process was attributed to a chemical reaction due to the presence of PbO rather than to natural or dietary conditions, and gingivitis to the action of H<sub>2</sub>S formed by putrefaction of food, and of Pb salts. No accumulation of Pb in the dentine was found.

In addition to the Pb risk, storage battery

workers are exposed to the hazard of acid mists and of the Pb carried by these mists. These affect the enamel, causing discoloration and dissolution. Actual defects of tooth structure, including caries, were not greater than in non-Pb workers.

The author suggests a scheme for maintaining a higher degree of oral hygiene in Pb workers. This comprises the establishment of a dental health service, sponsored by the management and providing preplacement and annual periodic examinations; palliative treatment (no wholesale extractions and only temporary fillings for the relief of pain), and a dental health educational program.

- 1308 Balzano, I. (Inst. Ind. Med., Naples, Italy): Intossicazione cronica da piombo e alterazioni dell'orecchio interno. (CHRONIC LEAD POISONING AND CHANGES IN THE INTERNAL EAR.) Rassegna di Medicina Industriale 21:320-2 (July-Aug.), 1952.

Sixteen persons of 18-50 yr were examined for auditory malfunctioning after exposure to Pb vapors. Some of these persons were suffering from occupational Pb poisoning, and others had never shown clinical symptoms of it, but had been in contact with Pb vapors for several years. The presence of Pb in the urine of the latter indicated latent Pb poisoning. None of these persons had ever suffered from auditory disturbances, although 11 showed slight hypoacusis. The results of functional acoustic tests clearly indicated an auditory defect of varying intensity in Pb poisoning. Low tones up to 512 cycles transmitted by air were normally perceived by almost all persons, while medium sounds (512, 1024, 2044 cycles) were less perceptible, and high tones hardly perceptible. Almost the same perception was noted in the bone conduction. This hypoacusis forms rather slowly, and even after many years of exposure to Pb, these persons retained their auditory functions. The author concludes that persons with congenital auditory malfunctioning should, therefore, be kept as far as possible from Pb vapors.

- 1309 Battigelli, M. (Univ. Florence, Italy): Nota sulle attività desaminative e ureopoietica nel saturnismo. (NOTE ON THE DEAMINATIVE AND UREAPOIETIC ACTIVITY IN LEAD POISONING.) Rassegna di Medicina Industriale 21:265-9 (July-Aug.), 1952.

Seven Pb workers were chosen for these tests. All of them showed initial symptoms of Pb poisoning: obstinate constipation, frequent colic, marked asthenia and mild anorexia. Average blood Pb was 80 ug%. There was anemia of hypochromic type with marked anisopoikilocytosis. No granulobasophilia was observed. α-Amino N and urea of the blood were determined after fasting 12 hr, by intravenous(iv) injection of 10 ml of 10% amino acid solution (modified Frame, Russell and Wilhelmi method was used for analysis). For controls, healthy subjects of same age, who, however, were also exposed to Pb risk, were used. Blood samples were taken before injection and at 30-min intervals thereafter. The average values were 8.2 mg% amino acid N in healthy subjects and 6.77 mg% in those with Pb

poisoning. There was an initial increase in Pb poisoned subjects, with subsequent leveling off, and an initial decrease in normal subjects, with subsequent return to normal. The urea N rose gradually and constantly in Pb poisoning, while in the normal state there were alternate rises and falls in the level. The author concluded that the amino acid metabolism in Pb poisoning proceeds more slowly than in the normal state, indicating a deficiency in the utilization of amino acid by the tissues. Insufficient material is available, however, to permit of definite conclusions.

- 1310 Belknap, E.L. (Milwaukee, Wis.): EDTA IN THE TREATMENT OF LEAD POISONING. *Industrial Medicine and Surgery* 21:305-6 (June), 1952.

EDTA was used in the treatment of 3 industrial cases of severe Pb intoxication, 1 of encephalitis, the 2nd with Pb colic and secondary anemia, and the 3rd without symptoms though with marked evidence of Pb absorption and marked anemia. The sources of Pb absorption were, in the 1st case, accidental exposure for several months to inhalation of Pb arsenate in baling scrap paper for a junk concern. He was not supplied with respirator of any kind, since neither employer nor worker were aware that the dust evolved as he tramped the paper down in the baler was Pb dust. The 2nd developed from cutting painted steel with a torch in the repair of boats down deep in the hold without respirator or exhaust protection. In case 3, heavy Pb absorption was incurred through pouring brass in foundry without protection. All these cases had marked gingival Pb lines and stippled cells of >20,000/million red cells. Under treatment with EDTA all 3 patients improved symptomatically. Their Pb absorption improved objectively as seen by disappearance of Pb line, marked reduction of stippled cells, and sharp drop of porphyrin excretion. The author concludes that the quantitative study of Pb in urine is somewhat complicated after the use of EDTA because with this material the union of the Pb and the chemical is so tight that special analytical methods have to be worked out. A note of warning is made that until further clinical studies have been made, the use of EDTA be restricted.

- 1311 Belknap, E.L., Foreman, H., Hardy, H.L., and Shipman, T.L.: THE USE OF Ca EDTA IN CASES OF LEAD INTOXICATION. *US Atomic Energy Commission Document No. AECU-2426*, 1952, 6 pp.

Clinical experience to date in the use of Ca ethylenediaminetetraacetate (Ca EDTA) in cases of Pb poisoning are summarized and a dosage schedule based on toxicity studies in animals is presented.

- 1312 Bergsman, A. (Serafim Hosp., Sweden): Fall av opticusneurit som enda symtom vid blyförgiftning? (A CASE OF OPTIC NEURITIS AS THE ONLY SYMPTOM IN LEAD POISONING.) *Nordisk medicin* 48:1277 (Sept.), 1952.

A 44-yr-old actor who had suffered from a sudden progressive impairment of eyesight for ~1 mo was hospitalized with suspicion of a brain tumor. History showed that he did not smoke, used very little alcohol, but was on a very strict diet for

the last years because of a long-standing intestinal catarrh. Since clinical neurologic and laboratory findings permitted no definite diagnosis, the possibility of poisoning was investigated. It was found that for ~1/2 yr the patient had been using 3-4 times/day an old electric teapot, the bottom of which was poorly repaired with solder; analysis showed it to contain 27% Pb, and water boiled in the kettle for 10 min contained 1 mg Pb. It was calculated that the patient had ingested ~3 mg Pb/day for 6 mo. Diagnosis of Pb poisoning appeared to be justified, especially since laboratory findings included stippled erythrocytes, increased urinary porphyrins, moderate hypochromic anemia and leukocytosis, although urinary Pb was generally normal. It was also considered possible that the signs of poisoning had been aggravated by dietary hypovitaminosis. EEG's taken shortly after admission showed signs of encephalopathy which later disappeared under appropriate treatment (not stated). He recovered completely and his vision improved.

- 1313 Bersworth Chemical Co. (Framingham, Mass.): THE VERSENES FOR EXACTING CHEMICAL CONTROL OF CATIONS IN SOLUTION. *Technical Bulletin No. 2*, 4th ed., 1952, 102 pp.

This is a manufacturer's pamphlet describing Versenes (EDTA) and their applications. Appended is a summary of toxicity data. The acute toxicity of EDTA varies with the species of animal, rapidity of injection and the route of administration. For rapid (15 sec) intravenous (iv) injection the LD<sub>50</sub> ranges from 30-100 mg/kg death being produced by hypercalcemic tetany due to the chelating action of EDTA on the systemic Ca. EDTA has been given to humans by the iv route by injections over several hours. Up to 12 g of material was given in this way over a period of 2 days with no toxic manifestations. Over 60% of the EDTA appeared in the urine as the Ca complex. The compound does not appear to have cumulative toxicity. Subcutaneously (sc) administered, the hypocalcemic action is slow. There is a moderate amount of percutaneous absorption as demonstrated in humans. The ointments and solutions containing 5% of EDTA showed no primary irritation when patch tested on a group of children and adults. Three per cent and lower solutions are without irritation when used for irrigation in the kidney, bladder, or in the rectum for anemia. Oral administration to animals at 19% or less of total food intake had no effect on the growth of animals for a period of 3 mo, nor up to the level of 0.5% for 1 yr and 0.25% for 2 yr. The toxic effects observed at high levels of EDTA feeding have included diarrhea, anorexia, general inactivity, loss of healthy appearance of the fur and evidence of dehydration. At necropsy no significant changes were observed.

CaNa<sub>2</sub>EDTA when tested in mice, rats, pigeons, rabbits, dogs and humans is without the acute hypercalcemic toxicity shown by EDTA. The LD<sub>50</sub> iv ranged from 1500 mg/kg-3000 mg/kg. In man doses ranging up to a total of 200 g over periods up to 20 days for this quantity produced no evidence of toxicity. Cutaneous application to humans in solutions or ointments of up to 15% CaEDTA was without evidence of primary irritation. By oral administration its toxicity was ~1/3 of EDTA.

MgNa<sub>2</sub>EDTA has a toxicity similar to that of EDTA; iv infusion of 0.5 g to a series of 8 patients showed marked hypotensive effect but no toxic reactions. On the basis of experiments the degree of detoxification achieved by EDTA is as follows: Pb, detoxification 3.3, Be, 4.0, Cu, 4.0, Ca, 9.5, Co, 21, Ni, 38.

- 1314 Braff, A.F., Lynn, D.O., and Wurl, O.A.: FATAL LEAD POISONING SIMULATING POLIO-MYELITIS. US Armed Forces Medical Journal 3:1353-7, 1952.

In the case reported fatal Pb poisoning was confused with bulbospinal poliomyelitis. The patient, 23 yr old, had been on duty with the Navy for 4 mo and had been ill for 3 wk. He had progressive paralysis involving all extremities and a marked pain in his back and the muscles of his thighs. Twenty-four hours prior to admission he had had difficulty in swallowing and dyspnea. He was placed in a respirator, but died 2 days later. Chemical analysis of the blood post mortem revealed a Pb content of 0.5176 mg/100 ml. Microscopic sections of the brain and spinal cord indicated a toxic type of encephalomyelopathy rather than an infectious process. The patient had been employed as a welder and pipe fitter for 4 mo. He had worked on galvanized and sheet metals and had, therefore, been exposed to fumes of Pb, Zn, and As. During his 4 mo in this occupation he had a poor appetite and his intake of food had been small. No fresh milk had been available. Prior to recall to active duty, he had done electrical work, the exact nature of which was unknown. The authors note that the diagnosis of Pb poisoning predominantly affecting the nervous system depends on a high index of suspicion and a history of exposure to Pb. The demonstration of abnormal concentrations of Pb in the blood or urine is proof of the absorption of excessive quantities into the body.

- 1315 Brugsch, J. (Klinik der Charité, Berlin, Germany): Über die Bedeutung der Isomerenuntersuchung des Harnkoproporphyrins bei Bleivergiftung. (SIGNIFICANCE OF THE ANALYSIS FOR ISOMERS OF URINARY COPROPORPHYRIN IN LEAD POISONING.) Zeitschrift für die Gesamte Innere Medizin 7:378-80, 1952. Coproporphyrin type III was found in the urine of 3 patients with Pb poisoning. A 4th patient with toxic cutaneous porphyria excreted in addition uroporphyrin type III. (14 references)

- 1316 Buess, H. (Univ. Basel, Switzerland): Geschichtliches und Aktuelles zur Frage der Schwermetallvergiftung. (HISTORICAL AND CONTEMPORARY CONTRIBUTIONS TO THE PROBLEM OF HEAVY METAL POISONING.) Schweizerische Medizinische Wochenschrift 82:1301-7, 1952.

The 1st part of this review traces the history of heavy metal poisoning from the time of the Peloponnesian War (440 BC) up to the classical studies on Pb poisoning of Tanquerel des Planches. New developments in Switzerland were stimulated by the "Regulations on the Prevention of Lead Poisoning" of May 19, 1942, introduced by the Swiss Accident Insurance Institution, which provided information

on routine methods for established standards in industrial hygiene. The value of porphyrin excretion and serum Pb determinations is discussed, and illustrated by accounts of 2 cases of Pb intoxication. Acute Hg poisoning in 9 workmen in a cleaning and paint works is described. The cause was traced to deposition of fine Hg droplets in the fur covering the wall of a drier, which, on being fired by one of the workmen, led to rapid volatilization of the Hg. The victims suffered from severe nausea, headache and shortness of breath, followed by muscular rigidity, and rheumatoid manifestations. Gastrointestinal disturbance was marked, and in 1 case gastritis and duodenitis persisted 3 mo later. A number of cases of chronic chrome poisoning have been observed in recent years from Ca bichromate dust. These have shown gastrointestinal lesions, with ulceration in stomach and duodenum. The pathogenesis and clinical aspects by poisoning by chromium (bichromate), Pb and Hg are discussed.

- 1317 Butler, E.J. (Radcliffe Infirmary, Oxford, England): CHRONIC NEUROLOGICAL DISEASE AS A POSSIBLE FORM OF LEAD POISONING. Journal of Neurology, Neurosurgery and Psychiatry 15:119-28, 1952.

The author reviews the literature concerning the possibility of an association between Pb poisoning and disseminated sclerosis and certain other chronic diseases of the central nervous system. He concludes that any evidence in favor of this hypothesis is purely circumstantial but shows the need for further work on the subject. This paper describes such work.

Using a new absorptiometric "dithizone" micro-method (not yet published), he determined the Pb content of various body fluids in patients as follows: 56 miscellaneous chronic neurological conditions; also of tissue from 5 autopsies. Comparison was made with 2 small groups, one of which might have had unusual exposure to Pb, the other composed of cases of definite Pb poisoning. It was found that patients with disseminated sclerosis showed no significant difference from those with other neurological diseases as regards their urinary excretion of Pb and its concentration in the blood, cerebrospinal fluid and tibial cortex, which in all cases were within the normal limits. Patients with confirmed Pb poisoning were studied for comparison and showed that an abnormally high urinary Pb excretion and coproporphyrin (CP) is maintained long after clinical remission and the disappearance of hematologic changes. The CP excretion of the 2 groups of neurological patients was not significantly different and with a few exceptions was within the normal range.

Injection of neurological patients with BAL consistently produced an increase in urinary Pb excretion (2-4-fold). This response in terms of increased Pb excretion bore no apparent relation to the diseases studied, nor did its magnitude indicate the presence of abnormal amounts of Pb in circulation and soft tissue.

The Pb content of necropsy samples of tissue, including brain and spinal cord from subjects with disseminated sclerosis showed that Pb was not responsible for the lesions and that there had been no mobilization of Pb from the skeleton.



The authors conclude that the reported studies do not support the view that Pb plays a part in the etiology of disseminated sclerosis and certain other chronic diseases of the nervous system. (35 references)

- 1318 Castellanos, M., and Mila, F. (Dept. Nervous, Mental Dis., Cuba): Sobre un caso de parálisis general desencadenada por intoxicación saturnina; discusión de la profilaxis y de la legislación indispensable. (GENERAL PARALYSIS PRECIPITATED BY LEAD INTOXICATION; DISCUSSION OF PREVENTION AND NECESSARY LEGISLATION; CASE.) Medicina Latina 11:123-9 (July-Sept.), 1952.

This case of general progressive paralysis which remained asymptomatic until symptoms of Pb intoxication suddenly appeared is published because of its points of interest which include a resemblance of Pb intoxication to syphilis, the absence of any Cuban publication concerning chronic occupational intoxication with neuropsychiatric symptoms, the great medico-legal importance of the case, and the need for prevention and indemnification in Cuba.

The history is that of a 45-yr-old printer in whom vomiting, epigastric pains, anorexia and diarrhea began ~3 mo earlier at which time he received "injections." His blood Pb level was 100 µg. A dental surgeon had extracted all his teeth. About 2 weeks before consultation, he became restless, depressed, anorexic, aggressive and suicidal. There was a syphilitic chancre of 10-17 yr ago, treated with Salvarsan and Bi. The man had also suffered head injuries in an automobile accident.

Upon admission, speech was markedly dysarthric. He exhibited trembling in his extremities and hypochromic spots on both of his hands. His walk was uncertain. His abdomen, fundi, EEG were normal, and hematogram essentially so, with no basophilic stippled cells. An examination of his reflexes was made. He was treated without success with penicillin, and then with a complete course of BAL. The latter appeared to improve the symptoms in the 1st 5 days, but thereafter the condition remained the same. At the end of treatment, his family took him home.

There were 3 etiologic causes: Syphilis, trauma, and Pb intoxication. The first 2 were not definitely established. In assessing the role of Pb intoxication, the sudden onset of symptoms (anorexia, colic, vomiting, diarrhea) and subsequent neurologic symptoms, Pb gum line (not seen by the authors), the necessity of extracting all his teeth, discovery of 100 µg Pb in the blood and finally, his mental depression and aggressive behavior with gross mental deficiency are interpreted, on the basis of patient's history of 15 yr of Pb work, to be signs of Pb intoxication rather than general progressive paralysis. The case is discussed at length in the light of the international medical literature on Pb intoxication. The authors conclude by recommending legislation and other measures for the protection, education and indemnification of workers in the Cuban Pb industry. (36 references)

- 1319 Castellino, N. (Univ. Naples, Italy): Tecnopatie ed emopatie. (OCCUPATIONAL AND BLOOD DISEASES.) Folia Medica 35:497-536

(Sept.), 1952.

This is the first of a series of reviews by the faculty of the Institute of Occupational Medicine of the University of Naples, of which this author is Director, of research performed under the auspices of the INAIL. The review on the blood disorder extends over the endogenous and exogenous pathogenetic factors (syndromes, heredity, individual characteristics) in hemorrhagic diseases, diseases of historeticular and lymphatic diseases, of the leukopoietic tissue, erythrocytopoietic tissue, physical and mechanical factors of occupations, toxic states interfering by inhibition of cellular respiration, of metabolic processes, and by changes of fundamental biologic function. Effects exerted by Pb and TEL are included in the review.

- 1320 Chernikov, A.P.: (INDUSTRIAL INTOXICATION WITH LEAD AND ITS PREVENTION.) Fel'dsher i Akusherka 1952, No. 2:14-8.

A brief account is given of the common sources of Pb poisoning in industry. Clinical symptoms are described, as are the usual therapeutical methods (Fe preparations, liver extract, glycerophosphates, vitamin C, and rest in anemia; atropine and Na sulfate and Mg sulfate enema and intravenous Ca chloride and Na hyposulfite in Pb colic; thiamine and strychnine in polyneuritis). Usual preventives are personal and working cleanliness. (From Chemical Abstracts 46:4700, 1952)

- 1321 Collier, M. (Pau, France): Paralysie de l'accommodation d'origine saturnine; sympathèse oculo-digestive. (ACCOMMODATION PARALYSIS DUE TO LEAD POISONING; OCULO-DIGESTIVE SYMPATHESIS.) Revue D'Oto-Neuro-Ophthalmologie 24:446-8 (Oct.), 1952.

A relatively rare case of bilateral ophthalmic paralysis due to Pb poisoning is described. A 44-yr old painter and plumber presented with visual disturbances (both distant and near vision) of several months' duration. Despite correction, his distance vision deteriorated. Other symptoms were nervousness, irritability, muscular spasms and hemorrhoids, many of them bleeding. The patient was in the habit of drinking at least 2 l of wine daily and consumed 1 package of tobacco per day. Previously he had had gastrointestinal complaints with cramps and vomiting without visual disturbances; these complaints were interpreted as "Pb colic." He had handled Pb salts without any special precautions.

Laboratory findings confirmed the toxic origin of patient's condition, induced by Pb. The urine was positive for heavy metal; 2 reticulofilamentous blood cells/field; anemia; leukopenia. No stippled basophilic cells. A milk-fruit-and-vegetable diet prescribed by the author caused the patient's vision to improve for periods of 1/2-1-1/2 hr after meals. He was advised to change his job, and wine and tobacco were prohibited. After 1 mo, the patient's right vision did not improve. His near vision may have improved sufficiently for reading. Patient has not been seen since.

- 1322 Collin, M.A.: Etude sur l'azotémie des ouvriers exposés au plomb dans l'industrie



moderne. (STUDY OF AZOTEMIA IN WORKERS EXPOSED TO LEAD IN MODERN INDUSTRY.)

These Méd. Paris, 1952, 58 pp.

Systematic examinations have revealed the fact that frequently there is a discrete, latent azotemia in workers exposed to Pb in the storage battery industry, even though no associated clinical signs may be present. At times elevated and persistent levels of stippled cells were encountered at the same time. However, there were no associated disorders of liver function. This hyperazotemia is probably the expression of very slight acute intoxication which passes unnoticed, and it develops toward the time of recovery. The value of the determination of hyperazotemia is emphasized. If hyperazotemia persists over several examinations, the worker must be removed from exposure. The author believes that from the legal point of view it would be well to make urea determinations mandatory at preplacement and yearly examinations and strongly advisable in cases of hypertension or renal disorders. (From Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 14:205 (Thesis Reviews), 1953)

- 1323 Dart, E.E. (San Lorenzo, Calif.): CORRELATION BETWEEN PORPHYRINURIA AND THE BASOPHILIC AGGREGATION TEST. *Industrial Medicine and Surgery* 21:91-2 (Feb.), 1952.

Two hundred and fifty-four simultaneous tests for urinary coproporphyrin (CP), using de Langen and ten Berg's method, and the stippled cell (SC) test by McCord were performed on 61 subjects. The results were divided into 3 groups for SC: (1) normal, 0-0.9%; (2) questionable increases, 1.0-1.4%; (3) definitely increased,  $\geq 1.5\%$ . For CP, those showing 0-2+ were grouped together to indicate normal or very little increase, and  $\geq 3+$  to indicate distinctly abnormal. It was noteworthy that 86% that had a normal SC count also showed normal or slightly increased CP, whereas 90% of those with definitely increased BS had markedly abnormal CP.

The observations are summarized as follows: Porphyrinuria in subjects having exposure to Pb is interesting because it occurs as a metabolic disorder. The study of porphyrin metabolism may well lead to a clearer understanding of the pathology of Pb poisoning. The determination of urinary CP is of value in the medical control of exposure to Pb because it is simple to perform; with a little coaching and experience and \$15 worth of equipment, an industrial nurse can readily do the routine testing, and the results obtained appear to be comparable to those found in other screening tests commonly used in Pb industries. The determination of urinary CP should never replace Hb determinations, basophilic aggregation counts, careful physical examinations, and other commonly employed procedures to ascertain the clinical status of the patient. It also cannot replace analysis of urine and blood for Pb content in establishing the diagnosis of Pb absorption or poisoning because it is not pathognomonic of Pb absorption.

- 1324 Davis, W.S., and Smith, J.N. (Bur. Sanitation): LEAD POISONING. *Journal of the Medical Association of the State of Ala-*

bama 22:166-8, 1952.

The history and causes of Pb poisoning are discussed briefly. Industrial exposure is by far the greatest cause. In most cases Pb enters the body by inhalation, and in some cases by way of the gastroenteric tract. Certain organic Pb compounds such as TEL may penetrate the skin, but this is not of great significance in industry. The distinction between evidences which point to Pb absorption and those which mean poisoning are discussed. Poisoning is present only when the subject has colic, palsy, encephalopathy or is anemic due to Pb absorption. Characteristic symptoms of acute and chronic poisoning are given. Precautionary measures have greatly reduced industrial Pb poisoning in recent years.

- 1325 Del Magno, A., Niccoli Vallesi, R., and Pieruccini, R. (Univ. Florence, Italy): (SUBMAXILLARY STONES: MICROSTRUCTURE AND CHEMICAL COMPOSITION.) *Boll. malattie orecchio, gola e naso* 70:1-45, 1952.

In submaxillary calculi (phosphate concretions) Pb was among the absent elements. (From Chemical Abstracts 48:2224, 1954)

- 1326 De Michelis, F. (Inst. Ind. Med., Turin, Italy): Il dosaggio del piombo nelle tasche gengivali dei lavoratori esposti al rischio saturnino. (THE DETERMINATION OF LEAD IN GUM POCKETS OF WORKERS EXPOSED TO LEAD.) *Rassegna di Medicina Industriale* 21:77-85 (Jan.-Feb.), 1952.

Using spectroscopic methods, the author has estimated the total Pb content in tissue material which he removed from each of 70 patients, who required treatment for periodontal disease. This surgical operation entails stripping the actual gum pocket, curetting with a sharp spoon where the base of each tooth has been laid bare and trimming the alveolar edges. For spectroscopic examination, the analyst pooled all the material removed from each case in these processes of extirpation, curetting and trimming.

Ten patients worked at filing Pb, 3 having followed this occupation for 12-18 mo, 4 for 5-10 yr and 3 for >10 yr. Ten patients were white-Pb painters, 3 for 12-18 mo, 5 for 5-10 yr and 2 for >10 yr. Thirty others were linotype operators, of whom 8 had been so employed for 12-18 mo, 10 for 5-10 yr and 12 for >10 yr. The other 20 individuals in this series were ordinary patients who had not been exposed to abnormal Pb absorption. Listed in tabular form are the age, general state of health, depth of the gum pockets and quantity of Pb found in each case; in the case of the Pb workers, the tables show the period of exposure to Pb. The control series showed Pb values of between 104 and 140  $\mu\text{g}$ ; the Pb workers, 178-350  $\mu\text{g}$ ; the Pb filers being generally at the lower end of this range and the linotype operators at the upper end. The Pb values increased with seniority at the job.

From his observations the author concludes that the periodontal lesions which are encountered in Pb workers are mainly due to the direct action of this metal and he urges that they be scheduled among the occupational diseases for which compensation is payable.

- 1327 DeMorsier, G., and Chesni, Y. (Neurol. Serv. Geneva Cantonal Hosp., Switzerland): Sclérose multiple chez deux frères peintres en bâtiments. Considerations sur le rôle étiologique possible du plomb. (MULTIPLE SCLEROSIS IN TWO PAINTERS (BROTHERS). LEAD AS THE POSSIBLE ETIOLOGICAL AGENT.) Schweizerische Medizinische Wochenschrift 82:443-5, 1952.

In 2 brothers aged 42, very similar symptoms on the part of the nervous system of the type of multiple sclerosis appeared sporadically with remission. There was slight rachitic hyperalbuminuria, tendinous hyperreflexes of pyramidal type, abolition or diminution of abdominal skin reflexes, disturbance on the part of sphincters, of coordination, mystagmus, etc. There was no history of sclerosis in other members of the family. In both cases, exposure to Pb had been of long duration. No positive signs of Pb poisoning were found, but a tooth extracted from 1 of them showed qualitatively a higher than normal Pb content. It seemed plausible to incriminate Pb. Since MS is believed by some to be of allergic nature, the Pb is thought to have acted not directly, but by antibody reaction in a sensitized organism, and would be thus 1 of many possible allergens.

- 1328 DeRenzi, S., and Ricciardi-Pollini, R.: Sull'impiego di sieroalbumina in compresse cheratinizzate nella prevenzione delle intossicazioni da piombo. (Nota preventiva). (THE USE OF SERUM ALBUMIN IN KERATINIZED TABLETS FOR THE PREVENTION OF LEAD POISONING. (PRELIMINARY NOTE).) Medicina del Lavoro 43:276-7 (June-July), 1952.

The authors propose the use of blood protein in keratinized tablets, instead of milk, for the prevention of Pb poisoning. They discuss the theoretical experimental basis of the method and report on the first practical results.

- 1329 Desoille, H., Tara, S., and Vacher, J.; Albahary, C. (France): Importance de la surveillance hématologique systématique des ouvriers exposés à l'intoxication saturnine. (THE IMPORTANCE OF SYSTEMATIC BLOOD EXAMINATIONS OF WORKERS EXPOSED TO LEAD.) Proceedings of the Society of Industrial Medicine and Hygiene. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 13:59-61; discussion 61-5, 1952.

A statistical study was made of hematologic findings in all (354) cases of Pb poisoning reported to the occupational disease section of the Social Security (Paris region) since its creation in 1951, and compared them to systematic examinations carried out in a printing shop with a low risk of Pb poisoning, and in a storage battery plant with considerable risk. Results showed that (1) severe anemia is rare, but mild anemia either preceding or following manifestations of Pb poisoning (acute, colic; chronic, nephritis, neuritis, hypertension) is frequent (48% <4,500,000 red cells); the average globular value is 0.98, and modifications of size, shape and color are constant; (2) in at least 1/3 of the cases examined by the Social Security, the number of stippled

erythrocytes was <5%; (3) there were no abnormalities of white corpuscles or platelets. The authors recommend that a periodic investigation be made of the number of red corpuscles, clotting reaction, globular value, and number of stippled erythrocytes to detect Pb poisoning. They do not understand why the Ministry of Labor in specifying tests for periodic examinations limited hematologic tests to counts of stippled cells. On the other hand, another decree provides for compensation for Pb poisoning anemia confirmed by several tests.

In the discussion, Albahary presented results to show that counting the number of red and white corpuscles to detect Pb poisoning was not realistic because (1) it takes longer and is more difficult than determining stippled cells; (2) a low red-cell count is not a sign of presaturnism but of confirmed saturnism; (3) anemia rarely reveals a case of Pb poisoning that is not already indicated by the usual methods of diagnosis (fatigue, pallor, granulobasophilia, hyperazotemia); (4) a determination of blood urea is preferable because the principal danger of chronic Pb poisoning is to the kidney.

- 1330 Fimiani, R., and Colapietra, F. (Univ. Naples, Italy): Intossicazione collettiva saturnina per ingestione di polvere di piombo mescolata a farina. (MASS POISONING BY LEAD FOLLOWING INGESTION OF LEAD-CONTAINING FLOUR.) Folia Medica (Naples) 35:323-43, 1952.

Two hundred persons were involved in the mass poisoning. Case reports are here presented and discussed for 31 who suffered acute poisoning (15 female and 16 male, 8 <20 yr old, 14 20-40, and 9 >40). In all illness began with colic. Constipation was recorded for 24, Burton's line in 5, stomatitis in 12, and liver enlargement in 22. Other findings included Pb in urine, porphyrinuria, hypochromic anemia, no basophilic stippling, slight lymphocytosis. There was no definite disturbance of the cardiovascular system. (18 references)

- 1331 Floris, M., Muntoni, S., and Cau, A. (Inst. Ind. Med., Cagliari, Italy): Sulle anemie saturnine. (LEAD ANEMIA.) Rassegna di Medicina Industriale 21:33-48 (Jan.-Feb.), 1952.

The authors studied 15 workers who had been exposed to Pb for various periods of time; 10 of them, 30-50 yr old, had worked from several months to several years in the Pb foundry in Cagliari and had exhibited mild toxic signs; 5 had worked a longer period of time in various operations with Pb exposure, and had had attacks of colic necessitating removal from work. Hematologic findings, including Pb levels, substantiated this differentiation. The following criteria were examined, the findings tabulated and analyzed: Hb, red and white counts, stippled erythrocytes, reticulocytes, globular value, differential; erythrocytometric formula; Hb exchange; cellular resistance; myelograms. Curves and graphs are presented for each case.

On the basis of these findings, the authors conclude that the anemia is normochromic and

normocytic anemia due to inadequate regeneration of erythrocytes. (17 references.)

- 1332 Frank, O., Lachnit, V., and Neumayr, A. (Med. Univ. Clinic, Vienna, Austria): Der Einfluss von Vitamin B<sub>12</sub> auf die Bleiporphyrinurie. (INFLUENCE OF VITAMIN B<sub>12</sub> ON LEAD PORPHYRINURIA.) *Acta Haematologica* 8:42-52 (July-Aug.), 1952.

The increased elimination of coproporphyrin (CP) III in the urine of patients with Pb poisoning is a constant and early symptom which is of considerable importance in the diagnosis. Pb porphyrinuria also presents a therapeutic problem, since it is the cause of a number of symptoms that accompany Pb intoxication, particularly colic and neuritic symptoms. (Schreuss and Carrie, 1933; Vannotti, 1938). Liver extracts and the components of the vitamin B complex have been used extensively in the treatment of Pb porphyrinuria. The favorable effects produced with this treatment induced the authors of this report to try vitamin B<sub>12</sub>. They present observations on 11 patients whose occupations involved exposure to Pb. One of them who showed the full clinical picture of Pb intoxication was hospitalized. Before treatment, their urinary Pb was 222.3-902.4 µg/24 hr. The hospitalized patient who, 8 days before admission had suffered cramps in the epigastric region and pains in legs, presented a marked Pb line in gums, signs of liver dysfunction, subicteric sclera, 76% Hb, 2% reticulocytes, 7/1000 stippled cells, 575 µg CP/24 hr, but normal urinary Pb (11.2 µg/l). He was treated with 15 µg vitamin B<sub>12</sub> for 9 days, which brought marked improvement subjectively. The 10 who received ambulatory treatment were given 30 µg of vitamin B<sub>12</sub> twice weekly by intramuscular injection. The elimination of CP in the urine was determined at weekly intervals. It was found that treatment with vitamin B<sub>12</sub> normalized urinary CP or prevented its excessive elimination which accompanies the mobilization of Pb. The effect depends on the dose and on the measures taken to prevent further intake of Pb.

The authors consider that even if exposure to Pb-containing materials continues, it is possible with intermittent vitamin B<sub>12</sub> therapy to obtain a normal porphyrin excretion. The effect of vitamin B<sub>12</sub> on Pb porphyrinuria is believed to be the result of its catalytic action on Hb synthesis, especially on the ribonucleotides, and of its protective action on the liver. (37 references)

- 1333 Fullerton, J.M. (Bermondsey and Southwark Hosps., London, England): VALUE OF HAEMATOLOGY IN DIAGNOSIS OF CHRONIC PLUMBISM. *British Medical Journal* 2:117-9 (July 19), 1952.

Hematologic examinations were carried out on 2 groups of Pb workers. From the results, presented in tabular form for comparison, the author concludes that the presence of stippled cells (SC) does not seem to be related to type of work or duration of exposure. Hypochromia is common where exposure is heavy and is usually accompanied by SC. The red cell count should be taken as a guide to the general health of the worker, and if anemia is present he should be removed from exposure to toxic agents. Decreased red cell fragility has

been reported in cases of Pb absorption. A hyperplastic normoblastic marrow is described. Estimations of total Pb in urine of 6 workers showing SC indicated that those with greatest hematological changes had the highest urinary Pb levels.

The author concludes that the results suggest that there is still a definite risk of occupational anemia in the Pb worker in England, although there appears to be no direct relationship between duration of exposure and degree of anemia; therefore, individual idiosyncrasy to Pb exposure may be presumed to play a large part. He recommends a stricter hematological control of Pb workers and suggests that piecework should be abolished in Pb industries where undue haste and carelessness might lead to Pb poisoning.

- 1334 Fusco, M. (Univ. Naples, Italy): Il comportamento del QT in alcune intossicazioni professionali. (THE QT INTERVAL OF THE ELECTROCARDIOGRAM IN SOME OCCUPATIONAL INTOXICATIONS.) *Folia Medica* (Naples) 35: 978-90, 1952.

Following a review of the literature on the title subject, the author reports his findings in 30 cases of Pb poisoning, 10 of carbon disulfide, 10 of benzene, and 10 of acetone poisoning. In the Pb cases, a lengthening of the QT interval was found in 25, in 15 of whom the lengthening was pronounced while in 10 the values were within normal limits. Generally, however, a decisive lengthening was not observed, and there was a tendency to return to around normal values. (48 references)

- 1335 Ghosh, P.K., Chakraborty, M.K., and Rao, M.N. (All-India Inst. Hyg. Public Health, Calcutta, India): A STUDY OF THE OCCUPATIONAL LEAD HAZARD IN TWO ELECTRICAL ACCUMULATOR INDUSTRIES. *Indian Medical Gazette* 87:114-7 (Mar.), 1952.

The authors studied the Pb hazard in 2 electrical accumulator factories, one modern and up to date, and the other primitive and unsanitary. The blood and urine of 55 exposed workers and 10 control cases were examined for Pb concentration as well as the environmental air. The blood was also examined for percentage of basophilic cells. There were no cases of Pb absorption in the 1st factory, while in the 2nd nearly every 3rd worker examined was absorbing Pb in pathologic amount. A comparison of the results shows that the Pb hazard can be controlled by scientific prophylactic methods. (From Chemical Abstracts 46:11507, 1952)

- 1336 Gillon, J.J. (France): Suite de la discussion sur le saturnisme. Contribution à l'étude de la valeur relative de certains examens de laboratoire dans le dépistage du saturnisme. (CONTINUATION OF DISCUSSION ON SATURNISM. RELATIVE VALUE OF LABORATORY EXAMINATIONS IN THE DIAGNOSIS OF LEAD POISONING.) *Proceedings of the Society of Industrial Medicine and Hygiene. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 13:198-202, 1952.

The author determined the average values and standard deviations of A, the number of erythrocytes; B, number of stippled erythrocytes; C, blood urea

content as well as the correlations between them. Twenty-five workers in a printing shop, most of them working there for many years, showed values for A, 4,000,000; B, 1.46%, and C, 0.46 with correlations of A/B = 0.07 and A/C = 0.03. Workers in a storage battery plant were divided into 2 groups (working >5 yr and <2 mo) and examined for A and B; 69 workers (>5 yr) showed for A, 4,296,000, and B, 1.70; correlation A/B = -0.36, and 33 workers (<2 mo) showed A, 4,420,000 and B, 1.67, correlation A/B = -0.51; 146 subjects showing signs of Pb poisoning showed A, 4,050,000, B, 60.3/100 leukocytes and 1205/100 erythrocytes, C, 0.45; correlations were A/B per 100 leuk = -0.410, A/B per 100 eryth = -0.38, A/C = 0.280, C/B, per 100 leuk = 0.21, C/B per 100 eryth = 0.23.

The authors concluded that: a decrease of red cells is the most constant sign of Pb poisoning. The relative variations are much smaller in this test, thus abnormal results are of greatest significance. Of the 3 tests studied, there was a close association between anemia and appearance or increase of stippled erythrocytes. It does not seem to matter whether numbers of stippled cells refer to erythrocytes or leukocytes. Stippled cell counts are more significant in Pb-poisoned workers than in the on-the-job workers who are simply under surveillance, as well as in recently-employed workers than in older workers. Urea determination is of great interest in the detection of Pb poisoning, particularly in persons with weak kidneys. In printing trades, there was no correlation among the different results.

- 1337 Graziani, G.; Sessa, T. (Univ. Naples, Italy): *Enzimi e tecnopatie. Parte Prima. Fisiopatologia generale. Parte Seconda. Applicazioni cliniche e terapeutiche. (ENZYMES AND INDUSTRIAL PATHOLOGY. I. GENERAL PHYSIOPATHOLOGY. II. CLINICAL AND THERAPEUTIC APPLICATIONS.)* *Folia Medica (Naples)* 35, No. 9:537-71; 572-651, 1952.

In Part I, Graziani reviews the physiology of enzymes and the mechanism of toxic action of Pb, benzene, carbon disulfide, P, carbon tetrachloride, As and Se, cyanides, CO, and methemoglobin-producing substances. Pb produces porphyrinuria and inhibits codehydrase. The greater disturbance in oxidation-reduction processes is mainly revealed in the inhibition of hemoglobin synthesis, which leads to anemia, an increase in serum Fe and porphyrins. Pb also blocks intracellular sulphydryl compounds, especially glutathione.

Part II. By following the classification set up by Castellino, Sessa summarizes his review as follows: The coenzyme is blocked in the case of Pb by inhibition of codehydrase I and II; by the action of carbon disulfide on the thiazole ring of thiamine; the sulfonamides by blocking p-aminobenzoic acid. The inactivation of apoenzyme is due in the case of heavy metals by precipitation of the protein component of dissociable enzymes or by fixation of groups necessary for the union of coenzyme with the substratum. Also the oxidants (H<sub>2</sub>O<sub>2</sub>) paralyze groups containing SH. The toxic substance may combine with the activator of an enzyme, as F inhibits the enzyme action of Mg. Pb produces a deficiency of nicotinamide. The fixation of toxic substances on organs is a consequence

of their affinity to enzymes. Resistance is an expression of the oxidation-reduction potency of the organism. The parallelism of clinical symptoms and enzyme inhibition is discussed.

- 1338 Grobdorfer, K.: (MALIGNANT NEPHROSCLEROSIS DUE TO CHRONIC INDUSTRIAL LEAD POISONING.) *Mitt. Oest. Sanit. Verwalt.* 53: 247, 1952.

That advanced chronic nephritis is now rarely found in Pb workers is largely due to the statutory measures adopted for their protection. Each of the 3 patients whose cases are here recorded had prolonged industrial exposure to Pb, and during the early years medical supervision was quite inadequate. Two of the men were employed in the recovery of Pb from the gases evolved from the roasting ovens, hearths and blast furnaces of a Pb works. The fumes were led through pipes 40 cm (16 in) in diameter threaded with a high-tension cable whereby the dust, consisting of metallic Pb, Pb oxide, and Pb sulfide, was ionized and deposited on the inner wall of the piping and on the cable itself, to be knocked off later. Exposure was severe. One man had been employed here continuously for 16 yr, and the other for 22 yr except for an interval of 2 yr following an acute attack of Pb poisoning. The symptoms of hyperpiesis eventually caused each of these men to consult his doctor, the blood pressure being 240/120 mm Hg in the one and 250/160 mm Hg in the other. At this stage their conditions were very similar, with headache, backache, defective vision (due to albuminuric retinitis), slight anemia (though no stippled cells could be found), and albuminuria, the urine containing a few erythrocytes, leukocytes, and epithelial cells. One man carried on at light work, his working capacity being reduced by 75%, and 1 yr later his condition showed little change. The other had 2 attacks of epileptiform convulsions and died within 1 yr of diagnosis. At necropsy there was marked hypertrophy of the left ventricle of the heart and the changes typical of an intracapillary glomerulonephritis, many of the glomeruli being completely hyalinized and obliterated, while the arterioles were markedly sclerotic, the vasa afferentia alone escaping this change. It could not be determined whether the primary change had been a glomerulonephritis or a capillary injury due to the toxicity of Pb. The 3rd man, aged 44, had been employed for 25 yr at a Pb-paint factory on the various processes (which are described) in the production of white Pb (2 PbCO<sub>2</sub>.Pb(OH)<sub>3</sub>), which, although almost insoluble in water, is sufficiently soluble in the body fluids to be toxic. He suffered recurrent attacks of acute Pb poisoning in 1927, 1930, and 1934. In 1938 an increase was found in the number of stippled erythrocytes in his blood, and severe hypertension with cardiac insufficiency developed. By December, 1949, his heart was dilated, his joints were swollen, and he had constant albuminuria. He died from uremia in February, 1950. His death was attributable to failure to recognize that his recurrent attacks of acute intoxication indicated a susceptibility to Pb which required his removal from contact with the metal at an early stage. These 3 cases emphasize the importance of regular and thorough

medical supervision of all Pb workers, and of their removal from hazard at the first suspicion of warning symptoms related to the urinary system. The issue may be fatal without the appearance of other classic signs of Pb intoxication. (From British Journal of Industrial Medicine 10:215, 1953)

- 1339** Hadengue, A., and Collin, M. (France): La valeur de la numération globulaire dans le dépistage du saturnisme à l'usine. (THE VALUE OF BLOOD COUNTS IN THE DIAGNOSIS OF LEAD POISONING IN INDUSTRY.) Proceedings of the Society of Industrial Medicine and Hygiene. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 13:66-8, 1952,

The authors studied 175 workers in a storage battery factory for 9 yr. Stippled cell count was determined every 1-6 mo, depending on exposure, with follow-up every 8 or 15 days if values were >15-20%. Blood counts were determined every 6 mo or once a yr. No serious cases of Pb poisoning were found. Workers showing elevated stippled cell counts were shifted in jobs before anemia could develop. The authors concluded that in spite of its lack of specificity, stippled cell counts still represent the best diagnostic test. Indications for performing this test are: (1) at preemployment examination, to avoid exposing a subject with a latent blood disorder to Pb; (2) in the presence of a prolonged and considerable Pb absorption, manifested by a high and persistent content of basophilic stippling; (3) in the presence of a high azotemia or any clinical sign which can be connected with Pb.

- 1340** Hammond, J.W., Taylor, G.T., and Pipkin, R.W. (Humble Oil & Refining Co.): COPROPORPHYRIN DETERMINATION AND URINARY LEAD RELATIONSHIP. EXPERIENCES IN AN INDUSTRIAL HYGIENE LABORATORY. American Industrial Hygiene Association Quarterly 13: 163-5 (Sept.), 1952.

A modification of the rapid method for determination of coproporphyrin (CP) in freshly voided urine described by Johnson and Whitman is used for screening urine specimens to select those that should be examined for Pb by the chemical method and as a check for errors in the chemical determination of Pb in spot samples. This method is also used to detect methyl chloride poisoning. Among employees having no known exposure to toxic materials, 5.3% showed at least a trace of CP, 2.3% moderate or greater excretion. Among 161 employees having potential Pb exposures, CP was found in 14.5% of the tests; 7.5% showed more than moderate excretion. In general, as the urinary Pb values increased, so did the CP values: of those showing >0.12 mg Pb/l, 76.2% had increased CP; at 0.16 mg Pb/l, 100% showed CP increase.

- 1341** Harrold, G.C., Meek, S.F., and Padden, D. A. (Ind. Health, Hyg. Safety Serv., Detroit, Mich.): A COPROPORPHYRIN III TEST AS A MEASURE OF LEAD DAMAGE. II. CONSIDERING LEAD DUSTS OF RELATIVELY LARGE PARTICLE SIZE. A.M.A. Archives of Industrial Hygiene and Occupational Medicine 6:24-31

(July), 1952.

Since the authors felt that there had been a misinterpretation of their conclusion in their 1st evaluation of the role of urinary porphyrins (CP) in Pb poisoning (1948) they reexamined the conditions surrounding the taking of samples and performing the tests on urines involved in that report. In the past 2 yr they performed analyses of CP, Pb in urine, and other criteria of excessive exposure, on 315 cases. For CP, the deLangen method was used. The exposures to relative coarse Pb oxide were in metal finishing operations, soldering, etc. Ages were from 17-73 yr; in 1 group of 27 (18-43 yr) exposure time was an av 12 mo 11 days. The authors' conclusions were as follows: The CP test for Pb damage, using a simplified technique which may be adapted to the needs of the physician's office or to large-scale industrial screening programs, is reliable. The correlation of positive results and Pb-in-urine values >0.15 mg/l, while very good in certain kinds of Pb exposure, is not perfect and does not need to be perfect. The positive deviations due to other disease manifestations or chemicals, while real, are so small as to be negligible in a screening technique and, in fact, provide the physician with added data to use in evaluating any other disease manifestations in the individual.

Samples may be shipped for considerable distances with no great loss in CP content, but when possible they should be analyzed within 6 days and should not be exposed unnecessarily to heat or light. The CP test, while a very early test for damage from Pb, does not indicate high Pb exposure of the individual as soon as urinary Pb determinations do. This indicates the need for both tests to be used wherever possible. There are indications that in mixed exposures to various Pb dusts there will be variable correlations with the Pb-in-urine values but that correlations are very much better if Pb excretion values up to 0.2 mg of Pb/l of urine are used rather than the 0.15 mg/l generally used. The urinary CP test indicates damage equally well whether it relates to workers newly exposed for period of <6 mo or to workers who have been exposed up to 40 yr.

The correlations established in this paper refer in the main to relatively coarse Pb compounds readily soluble in human lung fluid and blood serum. Some exposures were mixed, in that Pb fumes were included to some extent. Certain types of Pb-fume exposure introduce problems which place them in a special class, which are considered in another paper.

- 1342** Heidenpriem, C., and Breustedt, H. (Med. Dept. Unterharz. Mine & Foundry Works, Oker, Germany): Vorbeugende Untersuchungen auf Bleigefährdung. (PREVENTION OF LEAD POISONING.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 2:189-94 (Nov.), 1952.

The incidence of Pb poisoning in industry has declined in the later years of World War II, especially in the years thereafter until 1949. Technical improvements are not wholly responsible; part of it is attributable to the fat-poor diet, which tends to prevent absorption of Pb. The pH of the tissue fluids also influences Pb absorp-

tion; a greater ingestion of vegetables and bulk as well contributed to the decline of Pb cases. With a return of a richer diet, increasing numbers of poisoning are anticipated. A preventive program was undertaken toward the end of 1949 by the management of the Unterharzer Berg- und Huttenwerke. The relative values of the early diagnosis based on stippled cell counts and urinary porphyrin elimination are discussed. These tests were carried out at 3-mo intervals on workers exposed to Pb and the results are tabulated according to the different occupations. Average porphyrin values were given for 322 foundrymen (16.3  $\mu\text{g}\%$ ) 220 workers in other factories (9.7  $\mu\text{g}\%$ ), and 25 young people <18 yr (4.0  $\mu\text{g}\%$ ). After removal of values >25  $\mu\text{g}\%$ , the averages were 12.2, 7.7, and 4.0  $\mu\text{g}\%$ , respectively. Comparisons were made between the porphyrin values and the basophilic stippling in foundrymen. In the groups up to 30  $\mu\text{g}\%$  porphyrin, the positive and negative blood findings were practically the same. Only in groups >30  $\mu\text{g}\%$  were there more cases of positive stippled cells than negative. Of 19 cases of Pb poisoning found in 1951, 12 had porphyrin values >25 $\mu\text{g}\%$ . Due to preventive blood and urine studies, use of protective masks and technical changes, there was a decrease in the number of recognized Pb diseases from 50 in 1950 to 34 in 1951. The authors note that simultaneous determination for albumin, sugar and urobilinogen facilitates the diagnosis of individual cases. (35 references.)

- 1343 Henderson, L.L. (Urbana, Ill.): JAUNDICE DUE TO LEAD POISONING. A.M.A. Archives of Internal Medicine 89:967-9, 1952.

A 24-yr-old man was admitted to the hospital because of severe abdominal cramping that had begun 2 wk before with loss of appetite the day he began painting the outside of his house. Aside from slight yellow tinting of sclerae, marked pallor of face, moderate elevation of erythrocyte sedimentation rate, red cell count of 3,890,000 with 12.2 g Hb/100 ml, laboratory and radiologic findings revealed nothing startling. Nine days after admission, the jaundice had subsided, but erythrocyte count had fallen to 3,410,000 and Hb to 10.75 g, and Fe therapy was begun. When questioned further, 1 wk later when stippled cells (SC) were evident, it was learned that he had spent 3-4 hr of his spare time daily for 5 wk removing the old paint from his entire house with an electric hand sander. Analyses of blood and urine at the Kettering Laboratory, Cincinnati, showed 0.08 mg Pb/100 g and 0.075 mg/l, respectively. By the time the patient was discharged 11 days later, SC were still seen; 1 mo later erythrocyte count had risen to 4,110,000 with 12.2 g Hb, and SC were rare; blood showed 0.05 mg/100 g which, although at the extreme upper limit of normal, indicated that the man had no occupational exposure to Pb in the interim. (His work was that of automobile parts clerk.)

The author considers that the jaundice was apparently hemolytic, probably resulting from increased friability of the erythrocytes, caused by the direct action of Pb on the cell surfaces. He points out that the intoxication was incurred outside the usual hazardous industries, yet involved prolonged severe exposure to Pb in its most dangerous form. With the increasing tendency for the

home handy man to attempt all kinds of repair jobs without knowledge of adequate protection, such cases are likely to become more frequent.

- 1344 Insausti, T., and Casté, H.G. (Argentina): Las polineuritis como infortunio del trabajo. (POLYNEURITIS AS AN OCCUPATIONAL ACCIDENT.) Dña Medico (Buenos Aires) 24: 1052-8 (July 14), 1952.

The authors review the clinical features of polyneuritis in occupational diseases caused by exposure to As, Hg, Pb, carbon disulfide, aromatic hydrocarbon solvents, and brucellosis.

- 1345 Kehoe, R.A. (Univ. Cincinnati, O.): EXPERIMENTAL INHALATION OF LEAD BY HUMAN SUBJECTS. Occupational Health 12:161 (Oct.), 1952.

The experiment described is the 1st of a series of long-term investigations of the influence of chemical composition, concentration, and size of particles of Pb compounds inhaled by human subjects.

The experimental procedures were based on those used previously in balance experiments in which the intake, output, absorption, elimination, and accumulation of ingested Pb were determined by daily observations over prolonged periods of time.

The preliminary observations in the present experiment, with 1 subject, extended over a period of 9 mo, after which exposure to air containing particles of Pb dioxide of the median size of 0.05  $\mu$  and in the average concentration of 0.075 mg/m<sup>3</sup> was instituted for 7 hr/day on 5 days/wk. The results for the preliminary period and the period of exposure (Jan. 20, 1951-Jan. 20, 1952) at which time an approximate equilibrium appeared to have been reached. The experiment continues in order to put such appearance to the test, but the data have not been examined in detail beyond the last date indicated above.

The results were as follows: During the period of respiratory exposure, the Pb concentration in the blood rose from the original mean level of 0.026-0.043 mg/100 g over the period of ~20 wk and stabilized at or near that level. The urinary Pb output rose from 0.032-0.059 mg/day in ~10 wk, continued irregularly upward and then diminished, the apparent peak in an artificially smoothed curve being not far from 0.070 mg at the end of 20 wk. The Pb accumulated in the tissues during the period of 1 yr, as a consequence of the experimental inhalation of Pb, amounted in all probability to ~11 mg, being not <9 mg nor >18 mg.

Obviously the conditions of exposure were entirely safe during the experimental period, and it seems apparent that no risk of Pb poisoning would be incurred from the continuation of such exposure over an indefinite prolonged period.

- 1346 Kench, J.E., Lane, R.E., and Varley, H. (Nuffield Dept. Occup. Health, Univ. Manchester; Manchester Royal Infirmary, England): URINARY COPROPORPHYRINS IN LEAD POISONING. British Journal of Industrial Medicine 9:133-7 (Apr.), 1952.

The excretion of Pb and porphyrin by 7 bath enamelers was studied immediately after considerable exposure to Pb for 3-6 mo. All showed signs of Pb poisoning (anemia, constipation, abdominal

pains). (Although withdrawn from exposure, 4 subsequently returned to work without knowledge of the works manager.) The following were determined: hemoglobin (Hb) (MacFarlane et al, 1948), stippled cells (Lane, 1949), urinary Pb (Kench, 1940) and porphyrins (Rimington, 1942; Nicholas and Rimington, 1949; Chu, Green and Chu, 1951). These were performed on days 1-6, 26-120, and 60-127 of the study. After 120 days, there was an average gain of 3.7 g Hb/100 ml blood; stippled cells decreased from 2000-13,000/million erythrocytes to 1-3000/million. Mean values of urinary Pb and coproporphyrin (CP) concentrations reached normal limits at 55 and 133 days, respectively. Chromatography of the porphyrins after 130 days showed 30% CP I (normal 1.6%) and 70% CP III and after 330 days CP I was 28%. No uroporphyrin was found.

The authors suggest that CP I and III are synthesized independently. CP I is associated with proliferation of marrow cells as distinct from CP III, which is linked with the formation of Hb within the cells. (19 references.)

- 1347 Kőppich, F., Feleș, N., and Herșcovici, A. (Acad. Romanian Rep., Cluj): Cercetări asupra aspectului medical al saturnismului cronic profesional. B. Dinamica clinică și etapele de dezvoltare a saturnismului cronic profesional. (MEDICAL ASPECTS OF OCCUPATIONAL CHRONIC LEAD POISONING. B. CLINICAL DYNAMICS AND STAGES IN THE DEVELOPMENT OF OCCUPATIONAL CHRONIC LEAD POISONING.) Academia Republicii Populare Romine, Filiala Cluj, Studii Cercetări Stiint 3, No. 1/2:355-69, 1952.

In the development of chronic Pb poisoning, 4 periods were observed. In the 1st, (3-6 mo) workers who have not been exposed previously to Pb show the following symptoms: headaches, anorexia, loss of weight, hepatomegaly, and urobilinogen in urine. In the 2nd period (from 6-12 mo) an adaptation takes place and a slight regression of the phenomena in the 1st period. The 3rd period (1-10 yr) represents the stage of chronic Pb poisoning with acute abdominal pains and with various nervous and vascular symptoms. The period beyond 10 yr is characterized by encephalitis and nephritis.

- 1348 Kőppich, F., Herșcovici, A., and Feleș, N. (Acad. Romanian Rep., Cluj): Cercetări asupra aspectului medical al saturnismului cronic profesional. A. Simptomatologia clinică. (MEDICAL ASPECTS OF OCCUPATIONAL CHRONIC LEAD POISONING. A. CLINICAL SYMPTOMATOLOGY.) Academia Republicii Populare Romine, Filiala Cluj, Studii Cercetări Stiint 3, No. 1/2:339-54, 1952.

Clinical and laboratory tests were carried out on 285 workers employed in the extraction of Pb and on 40 workers not exposed to Pb inhalation for control. One group showed positive signs of Pb poisoning, a 2nd, probable signs and a 3rd no signs. The chronic signs were particularly associated with nervous and vascular disturbances and to a lesser extent with the digestive. The subjective symptoms were: dizziness, physical weakness, arthralgia, myalgia, paresthesia, and impotency. The objective symptoms are: gingival

lesions, hepatomegaly, arterial hypertension, hematuria and urobilinogenuria.

- 1349 Koutseff, A., Gilly, G., and Nicolai, G. (Toulon, La Seyne, France): Rétinopathie saturnine non accompagnée d'hypertension artérielle. (RETINOPATHY IN LEAD POISONING NOT ASSOCIATED WITH ARTERIAL HYPERTENSION.) Bulletin des Sociétés d'Ophtalmologie de France 1952:348-56 (March).

The case presented is that of a solderer (47 yr old), seen in 1951, afflicted with retinopathy, not associated with arterial or nephritic hypertension. On examination it was shown that the central vision of the right eye was 2/50 which could not be corrected by glasses, while the vision of the left eye was 6/5. The findings are described in some detail which included deeply pigmented fundus. History revealed that he was born in Sardinia and had come to France at age 18. He had started work with his father, at age 9, in a blacksmith shop and had continued such work, then with a blow torch and then as a solderer since 1939. In 1945 he had his first attacks of colic, headaches, etc, and in 1947 was compensated for Pb colic for a period of 40 days. In his work he was also exposed to a great deal of noise and had noticed increasing deafness. When seen by the authors the findings were as follows: distinct Pb line of gums; slight signs of deficient liver function. Blood findings were within normal limits, and no basophilic stippled cells; urinalyses and kidney function tests pointed to kidney damage; there was also an abnormal amount of porphyria in urine, and high urinary Pb level (90 µg/l).

The results of auditory examination led the authors to consider deafness to be due either to an intoxication or a trauma. They were in favor, however, of an exogenous intoxication on the basis of the distinct osseous deficit and the absence of a real auditory scotoma which occurs only in cases of traumatic deafness in the 4096 zone. Based on clinical observations the authors excluded an infectious origin. They conclude that the damage to the optical nerves and those of the retina, and the intrinsic muscles (diminution of accommodation, weak medicinal mydriasis) forms part of the clinical picture of Pb intoxication as does the damage to the cochlear nerves and to kidney. All these lesions are caused by the sclerotic changes of the capillaries as a result of angiospasm caused by Pb. Treatment was by removal from Pb exposure, medical follow-up of liver, kidney, and cardiovascular function, vitamins, iodides, vasodilators. In closing the authors quote Van der Hoeve's remark "In cases of ocular paralyzes or visual disorders of unknown origin, Pb poisoning must be kept in mind."

- 1350 Ležovic, J. (Stomatol. Clinic SU, Bratislava, Czechoslovakia): Hodnotenie popoľavého lemu a jeho výskytu pri otrave olovom. (HALO SATURNINUS AND ITS SIGNIFICANCE IN LEAD POISONING.) Lekarsky Obzor 1:45-51 (May), 1952.

As determined in 2 battery factories, the gingival Pb line was seen in 9% of the workers. The differentiation from other paradental conditions is emphasized, as is respiratory protection in excessive

exposure to Pb.

- 1351 López de Azcona, J.M., Santos Ruiz, A., and Dean Guelbenzu, M. (Inst. Physiol. Biochem. of Spain, Madrid): (TRACE ELEMENTS IN NORMAL AND PATHOLOGICAL HUMAN TISSUES. I. UTERUS.) Rev. españ. fisiol. 8:13-8, 1952.

Spectrographic analysis of uterine ash showed Pb, among other elements, at ~0.001% (but absent in 2 out of 16 specimens). (See Santos Ruiz for Part II) (From Chemical Abstracts 47:3454, 1953)

- 1352 McCord, C.P.: LEAD POISONING FROM CANDLES. Industrial Medicine and Surgery 21:92 (Feb.), 1952.

To the unusual sources of Pb poisoning may be added candles used in households and in churches. To furnish longer burning life, some manufactures introduce wicks containing a slender core of Pb wire, or at least some low-melting metal wire. The flame temperature is sufficient to melt and partially evaporate the metal.

- 1353 Maggi, A.L.C., and Meerooff, M.: Hepatoesplenomegalia en un saturnismo crónico. (HEPATOSPLENOMEGALY IN CHRONIC LEAD POISONING.) Revista de la Asociación Médica Argentina 66:349-54 (Oct.-Nov.), 1952.

The case described is that of a 60-yr-old worker who after 1-1/2 yr exposure to Pb exhibited a typical picture of chronic Pb poisoning: typical radial paralysis, colic, Burton's line, discrete anemia with anisocytosis and poikilocytosis, increase in porphyrins in urine, and stippled erythrocytes. The clinical, laboratory and radiologic findings which led to the final diagnosis of hepatosplenic cirrhosis, due to Pb exposure, are described in detail.

- 1354 Mongelli Sciannamed, N. (Univ. Bari, Italy): Il saturnismo in una industria fittile pugliese: Rilievi clinici. (SATURNISM IN THE TERRA COTTA INDUSTRY OF APULIA; CLINICAL STUDY.) Folia Medica (Naples) 35, No. 8:433-48, 1952.

The case of a 46-yr-old glazer of pottery for 15 yr is described, who had suffered repeatedly with Pb colic, and more recently with frequent joint pains which were not relieved by iodine therapy. About 3 mo before admission he suffered an attack of dyspnea which was followed by precordial and epigastric pain lasting for several days. He showed severe anemia, typical Kussmaul respiration, frequent vomiting attacks, typical gingival Pb line, numerous conjunctival hemorrhages, noteworthy hyporeflexia and agitation. Laboratory tests showed no stippled cells, but noteworthy hyperazotemia, and an anuria which made it impossible to obtain a urine sample. His condition became aggravated and he died 3 days after admission. This observation led the author to examine 9 workers of the pottery 15-22 yr old, all of whom were exposed to or handled Pb glaze for 3-10 yr. In discussing the cases, the author states that the 1st case was a typical chronic Pb-induced kidney lesion. In 7 of the young workers kidney involvement was evident by a higher azotemia than normal; 7 of them also showed urobilinuria, all exhibited

anemia as well as anisopoikilocytosis and mild polychromatophilia; 4 showed stippled erythrocytes; all had gingival Pb line and presence of Pb in blood, and some, in saliva (qualitative findings). Radiology showed Pb lines of the long bones and/or osteoporosis in all but 3. (77 references)

- 1355 Mongelli Sciannamed, N. (Univ. Bari, Italy): Osservazioni radiologiche sull'apparato scheletrico di giovani saturnini cronici. (RADIOLOGIC OBSERVATIONS ON THE SKELETAL APPARATUS OF YOUNG PERSONS AFFECTED BY CHRONIC LEAD POISONING.) Rassegna di Medicina Industriale 21:281-309 (July-Aug.), 1952.

Changes in the radiologically visible skeletal apparatus of 9 young persons 15-22 yr old, at work for 3-10 yr, suffering from chronic Pb poisoning are described. These changes essentially consisted of radiopaque bands near the metaphysis of still growing bones. Other frequent findings were diffuse microlacunar osteoporosis, vertebral malformations, and regional heteromorphisms. The results of the X-ray study are discussed and divided into biochemical, histologic, X-ray studies, etc., and numerous illustrations are given. Particularly the case histories showed that also in chronic Pb poisoning of persons of more advanced age, X-ray study may reveal the existence of skeletal changes due to Pb poisoning. (140 references.)

- 1356 Müller, J(an) (Inst. Occup. Physiol., Pathol., Hyg., Prague, Czechoslovakia): Hodnocení laboratorních znaků otravy olovem. (THE EVALUATION OF LABORATORY FINDINGS OF LEAD POISONING.) Pracovní Lékarství 4:51-64 (Mar.), 1952.

The laboratory findings on employees of a Pb-battery plant are discussed. The methods employed were: determination of Hb level, of the stippled cell count, of the porphyrin level in urine, and of the blood-Pb level.

It was found that none of these methods gave results that could be used as a measure of individual exposure or in itself as proof of Pb poisoning; also, that the best measure of exposure of a group of workers in a workshop is the average number of stippled cells. This method is recommended for the estimation of Pb hazards in workshops, in addition to the usual methods used in hygienic surveys. Figures which can be used for the estimation of the degree of the exposure are given. Surprising at first was the fact that blood Pb levels could not be used as a measure of exposure, and the reasons for this are given. The mutual relationships between the results of individual laboratory methods were studied, and conclusions were made for their correct evaluation. Women were found to have greater sensitivity to Pb, and the reasons for this were shown to be a Hb level which on the average was lower than in men, and perhaps a greater vulnerability of their blood-forming organs. It was stressed that up to now little is known of the factors influencing clinical Pb poisoning and that the final evaluation of individual cases still depends on a good knowledge of the degree of exposure, case history, clinical picture, and laboratory findings. (From author's English summary)



- 1357 Okhnyanskaya, L.G., and Ginzburg, D.A. (Acad. Med. Sci., USSR): (THE OLFACTORY-HUMORAL REFLEX IN LEAD AND MERCURY POISONING.) *Fiziol. Zhur. S.S.S.R.* 38:105-10, 1952.

The olfactory-humoral reflex is defined as the change of the biological activity of blood (test with isolated frog heart after stimulation with thymol or oil of rosemary; the blood is taken from a normal subject, then repeated after inhalation of the olfactory irritants). Workers with Pb or Hg poisoning showed enhanced olfactory-humoral reflex, ie, the blood activity rose after stimulation. In the case of Pb the reflex varied inversely with the gravity of the poisoning and the frog heart test showed a decrease of amplitude and frequency of the heart beat. In Pb colic the effect was greatly increased. Coating of the nasal mucosa with procaine leads to disappearance of the reflex. (From Chemical Abstracts 46:6751, 1952)

- 1358 Oltramere, M.: Deux cas de saturnisme chez des tailleurs de pierres. (TWO CASES OF LEAD POISONING IN STONEMASONS.) *Ztschr. f. Unfallmed. u. Berufskrankh.* 45:282-88 (Dec. 15), 1952.

Some 50 yr ago it was customary in Switzerland for many stone-built houses to be coated with layers of white Pb. The author describes Pb intoxication contracted by 2 stonemasons in the process of renovating such buildings. The workmen, aged 61 and 52 yr respectively, had been in this occupation for a few months but the onset of poisoning was associated with the recent introduction of mechanical drills. Each showed pallor, abdominal colic, muscular spasms, constipation, anorexia, insomnia and nervousness. Diagnosis in the first case was rendered more difficult owing to a history of cranial injury, which was thought at first to be responsible for the patient's nervous symptoms and vomiting. Pb line was present in one patient. Clinical and laboratory findings for the 2 men were respectively: Blood pressure, 170/100, 140/75; red cell count, 3.22 and 3.5 millions/mm<sup>3</sup>; hemoglobin, 61, 70%; punctate basophiles, 7100 and 6500 (large granules)/million red cells; blood urea, 50, 44 mg/100 ml; blood Pb, 140, 122 µg/100 ml; and urinary coproporphyrin concentration, 1350, 450 µg/24 hr. The patients were treated with sedatives and saline purgatives, and, in addition in case 1, intravenous Ca therapy, with excellent clinical response. However, marked tremor remained in both hands in the 1st patient, which the author ascribed to the aggravating effect of Pb intoxication on the preexisting encephalopathy. The hazards of this occupation are discussed, and poisoning in these instances is ascribed to combination of 3 factors: 1. high Pb content of material being worked (>36% Pb); 2. increase of dust due to mechanical grinding; 3. inefficient masks. Appropriate steps are described to prevent a recurrence of plumbism in such workmen. (From Bulletin of Hygiene 28:353, 1953)

- 1359 Parkinson, E.S., and Cholak, J. (Univ. Cincinnati, O.): PROBLEMS IN THE ANALYSIS OF URINARY COPROPORPHYRIN III. *American Industrial Hygiene Association Quarterly*

13:158-62 (Sept.), 1952.

The value of the determination of CP in borderline cases of Pb poisoning or as a measure of early absorption is not yet known and requires further study involving the establishment of accurate normal base levels by the use of precise and specific analytical methods. The method of Schwartz et al, with some modifications, was investigated to determine the variations which affect accuracy and specificity of analysis. The distribution of CP in spot samples of urine of individuals with no unusual Pb exposure (10 ml of a single voidance) showed a mean of 0.101 mg/l (range 0.04-0.16) for women and 0.168 mg/l (range 0.04-0.26) for men. However, spot sampling is open to error ( $\pm 30$ - $\pm 40\%$ ) because of diurnal variations in urinary concentrations of CP. Although large amounts of CP are excreted in the urine of persons suffering from Pb poisoning, no appreciable increases occur with the absorption of small to moderate quantities of Pb, and for this reason the value of the test for the recognition of potentially dangerous exposure to Pb seems dubious. For the detection of incipient cases of Pb poisoning, it appears to be a helpful supplementary procedure. (17 references)

- 1360 Pernis, B. (Univ. Cagliari, Italy): Sulla presenza e sul significato del piombo nel liquor. (THE PRESENCE OF LEAD IN SPINAL FLUID, AND ITS SIGNIFICANCE.) *Medicina del Lavoro* 43:251-8 (June-July), 1952.

The Pb content of the cerebrospinal fluid in normal subjects and in Pb poisoning cases (including a case of Pb encephalopathy) was determined by polarography and spectrography.

In the cerebrospinal fluid of normal subjects, Pb was either absent or present in minimal amounts, always <18 µg/100 ml; in Pb poisoning cases in which the central nervous system was not impaired the cerebrospinal fluid showed a Pb content either equal or slightly superior to that found in normal subjects. (In 4 cases Pb ranged from 8-22 µg in the presence of 60-150 µg in blood.) In the fluid of a case of acute Pb encephalopathy, Pb was found in much larger amount (44 µg; 125 µg in blood). It diminished, however, considerably after the nervous symptoms had disappeared. The author considers it probable that, at least in cases similar to the one observed (with mainly psychic symptoms) the impairment of the central nervous system is caused by the direct action of Pb on the nerve cells of the brain cortex. (24 references)

- 1361 Pestel, M. (Paris, France): Traitement du saturnisme. (TREATMENT OF SATURNISM.) *Presse médicale* 60:1831, 1952.

In acute Pb poisoning by ingestion the classic treatment is that of gastric lavage with 2% sulfuric acid solution. BAL is indicated particularly in Pb encephalopathy. Although numerous therapies of Pb colic have been proposed, the classic and useful ones are cataplasms of linseed meal with laudanum, hot baths at 45°. Sedation with belladonna is preferred. This could be supplemented with antipyrine. Acetylcholine rapidly relieves certain persistent colics, as do spinal injections of novocaine. On the day following the attacks, sulfured honey remains the classic

treatment. The various modern methods used in the fixation, mobilization and elimination of Pb are also briefly discussed. The latter should depend upon the condition of the patient: degree of intoxication, cardiovascular state, etc.

- 1362** Pinto, S.S., Einert, C., Roberts, W.J., Winn, G.S., and Nelson, K.W. (Denver, Colo.): COPROPORPHYRINURIA. STUDY OF ITS USEFULNESS IN EVALUATING LEAD EXPOSURE. A.M.A. Archives of Industrial Hygiene and Occupational Medicine 6:496-507 (Dec.), 1952.

The quantitative urinary coproporphyrin (CP) determination was studied in relation to the clinical symptoms produced by increased Pb absorption and compared with a number of other commonly used laboratory procedures. (The method of Schwartz et al was used.) Evidence is presented which indicates the urinary CP determination is more promising than any other screening test in picking out those members of a Pb-exposed group who need further medical studies.

In this group of 124 persons who worked in a Pb smelter, the quantitative urinary CP III excretion ranged from 5-736 mg/100 ml of urine. No evidence of hypertension resulting from prolonged exposure to atmospheric Pb was found.

- 1363** Piredda, P. (Univ. Cagliari, Italy): Le alterazioni bucco-dentarie nei lavoratori di una fonderia di piombo in Sardegna. (BUCCODENTAL CHANGES IN WORKERS IN A LEAD FOUNDRY IN SARDINIA.) Rassegna Medica Sarda 54:232-60 (July-Aug.), 1952.

Following a review of the literature on the oral and dental manifestations and diseases in exposure to Pb, the author presents briefly case histories and a tabulation of clinical findings of Pb in blood and coproporphyrinuria of 55 Pb foundry workers. The exposure of the workers is also described as to the percentage content of Pb and other elements contained in the raw material handled by them, and the types of exposures in the various operations in the foundry. In summary, he states that the gingival Pb line constitutes a sign of alarm as to presence of Pb intoxication. In addition he had found that in workers with long exposure to Pb, the paradental disorders were followed by loss of teeth and that the Pb line had disappeared in the edentulous. In the cases followed by him, Pb levels in blood were within normal limits (20-60 µg%) in 33 cases; however, it was higher than normal in 19 cases. Higher levels were found in workers affected with renal damage. Coproporphyrinuria was variable and did not correlate with blood Pb levels. (37 references)

- 1364** Portheine, F. (Inst. Hyg. Ruhr area, Gelsenkirchen, Germany): Zur Frage des quantitativen Bleinachweises im Blut. (Gleichzeitig ein Beitrag zu der Arbeit von G. Schrader 1950). (QUANTITATIVE ESTIMATION OF LEAD IN THE BLOOD (WITH REFERENCE TO THE WORK OF SCHRADER).) Klinische Wochenschrift 30:83-5, 1952.

The author discusses the opinion of Schrader (1950) that levels of 100 µg Pb/100 ml of blood

are not pathological, and that 300 µg are so to be regarded, even when unaccompanied by clinical symptoms. He states that traces of Pb, originating from food and water, are to be found in any blood sample; that any marked intake of Pb from inhalation, swallowing or skin absorption, is invariably followed by increased levels of Pb in the body fluids, even if no pathological sequelae are immediately recognizable; and that on the amount and duration of this intake and the susceptibility of the tissue cells depend the injurious effect of Pb on the various tissues, ie, bone marrow, smooth muscle, central nervous system. He points out that, according to Koelsch (1946) pallor, blue line on the gums and stipple cells, while indicating an excessive intake of Pb, do not warrant a diagnosis of Pb poisoning unless other symptoms are present.

During 1949 and 1950 a large number of determinations of Pb in the blood of Pb workers, most of whom had definite symptoms of Pb poisoning, were undertaken. The dithizone method was used and the author recommends specially the use of Pb-free 30 ml venules for taking and transport of blood samples. The values found reached 100 µg/100 g of blood in only ~5% of the workers examined. They were from 0-40 µg in ~45%; 40-60 µg in ~27%; 60-80 µg in ~15%, and 80-100 µg in ~8.5%.

Other authorities, particularly Kehoe (1949) have postulated ~80 µg as a dangerous level, and the author agrees with this rather than with Schrader's suggested 100 µg level.

- 1365** Raule, A., and Morra, G. (Univ. Milan, Italy): Prime ricerche sulla funzionalita' gonadotropica preipofisaria negli intossicati da piombo. (PRELIMINARY INVESTIGATIONS OF PREHYPOPHYSEAL GONADOTROPIC FUNCTIONING IN LEAD POISONING.) Medicina del Lavoro 43:261-5 (June-July), 1952.

Prehypophyseal gonadostimulin eliminated in the urine was determined in 12 cases of Pb poisoning, following the method of Varney and Koch. In 8 cases insufficient urinary elimination was found which appeared to be related to the intensity of Pb absorption and the gravity of the clinical picture of poisoning.

The authors advance the hypothesis that insufficiency of the prehypophyseal gonadotropic secretion represents a deviation of the prehypophyseal substances, in response to the toxic stimulus of the Pb, as occurs in the general adaptation syndrome. (19 references)

- 1366** Read, J.L., and Williams, J.P. (McGuire Veterans Admin. Hosp., Richmond, Va.): LEAD MYOCARDITIS: REPORT OF A CASE. American Heart Journal 44:797-802 (Nov.), 1952.

A 39-yr-old man, who had worked with Pb storage batteries for 10 wk with no form of protection, complained of abdominal pains, nausea, anorexia, and a dull ache in the midsternal region. Examination showed a Pb line, 3.2 million red cells, 8.7 g Hb, 9800 leukocytes, marked basophilic stippling, normal blood electrolyte and chemical values, and 0.525 mg Pb/24 hr urine. The EKG revealed changes which were discussed by the authors in terms that the marked depression of the con-

duction system and T wave abnormalities in this case with a gradual return of a normal EKG, paralleling his clinical improvement under treatment (Na citrate, Ca lactate, Ca gluconate and Na phosphate), suggested a toxic depression of the conduction tissue with toxic changes in the myocardium as the result of Pb poisoning. A review of the medical literature since 1916 indicated that this was the first reported case.

- 1367** Rejsek, K., and Vaňa, V. (Dept. Occup. Med., Charles Univ., Prague, Czechoslovakia): LEAD POISONING AND PROTOPORPHYRIN IN THE BLOOD CELLS. *Medicina del Deporte y del Trabajo* (Buenos Aires) 16:4692-4700, 1952.

See Abstract No.1241

- 1368** Ricklin, W.: Beitrag zur Bewertung des Bleigehaltes im Blut. (ESTIMATION OF LEAD CONTENT OF BLOOD.) Dissertation, University of Zurich, 1952; *Zeitschrift für Unfallmedizin und Berufskrankheiten* 45:141-58 (June 15), 1952.

The author considers estimation of the amount of Pb in the blood the most reliable means of determining whether contact with inorganic Pb, above the normal physiological intake has occurred. This does not hold for organic Pb compounds such as TEL, since these are rapidly absorbed and fixed by lipid-rich organs.

In an attempt to determine whether there is a critical threshold of Pb in blood, above which the toxic effect of inorganic Pb becomes manifest, 3 groups of estimations were made:

(1) Normal: The Pb content of normal blood is usually from 20-30 µg%, with an upper limit in the author's opinion, of 40 µg%, and 50 µg% clearly elevated. Even a transient exposure to Pb may raise this level, as was shown in a group of 6 technicians who showed an average content of 39 µg%, probably from contact with Pb acetate in the laboratory. In 18 Zurich traffic bureau officials the blood Pb levels were 17-35 µg% (av 24). (2) Pb workers: In 60, the average level was 75 µg% (40-170 µg%). From analysis, it was seen that duration has no effect on the average level, indicating that neither progressive accumulation of Pb in the blood nor increased Pb excretion, in the sense of an active detoxication, takes place. The highest average values (109 µg%) were found in a group of workers handling moist Pb oxide, involving much contamination of the hands and possible ingestion; a group exposed to Pb dust in the process of re-pairing and soldering showed 89 µg%; solderers wearing masks and exposed to Pb vapor, 63 µg%.

Blood examinations for anemia and stippled erythrocytes (SE), showed anisocytosis and poikilocytosis in practically all the workers, and increased SE in 40-60% of those with a blood Pb content of 60 µg% and over; there was, however, no direct proportional relationship since 4 cases with the highest blood Pb level (112-170 µg%) showed no increased SE. Clinical symptoms (pallor and "blue line") appeared to be similarly related to a minimal blood Pb level; when the threshold value was passed the symptoms showed no increased incidence. They were not present when the level was <60 µg% but were present in about 1/3 of those workers with

levels >60 µg%. Subjective symptoms (chiefly colic) were present in so few workers that no statistical conclusions could be drawn.

(3) Manifest Pb poisoning: Estimation of the Pb in blood in cases of acute Pb poisoning showed that the levels were highest during the most acute stage, falling with clinical improvement but showing considerable individual variation, due, the author suggests, to individual idiosyncrasy. In general, acute symptoms developed during the early months of exposure; with long duration the blood Pb level may rise as high as 170 µg% without further toxic manifestations. This the author regards as evidence of an acquired tolerance to a high Pb content of the blood, and he suggests that a rapid rise is more conducive to intoxication than a gradual increase.

In a review of the most recent literature on the pathogenesis of Pb intoxication, the author describes the circulation of Pb in the organism, the toxic effects of Pb, stressing its action on the enzyme systems and inhibition of the cellular activity of erythrocytes, and the individual predisposition to Pb poisoning.

- 1369** Saita, G., Fiocchi, F., and Cattaneo, E. (Univ. Milan, Italy): Diametro e volume globulare, indice di sferocitosi, indice di saturazione nell'anemia saturnina. (ERYTHROCYTE DIAMETER AND VOLUME, SPHEROCYTE INDEX, SATURATION INDEX IN LEAD ANEMIA.) *Medicina del Lavoro* 43:99-114 (Mar.), 1952.

The study described encompassed the determination in 41 cases of Pb anemia of: red cell diameter and erythrocytometric formula, red cell volume, spherocytic index, and saturation index. The cases studied were: 14 of Pb poisoning in the acute stage; 8 in the remission phase; 9 in the initial phase with latent evolution, and 10 in the chronic phase. As summarized by the author, apart from a few negligible exceptions, the results obtained could be classified as follows: Pb poisoning in the initial phase of latent evolution proved to be normocytic and normochromic; in the active phase the anemia was, for the most part, normocytic, though many cases showed a tendency to macrocytosis and macroplasia; sometimes it was normochromic, though more frequently hypochromic, due to true hypochromia (reduced hemoglobin saturation) and this condition was in general more marked in cases in which the fall in red cells was less significant; in chronic Pb poisoning the anemia was in approximately half of the cases normocytic and normochromic, in the other half, macrocytic and hypochromic. The spherocytic index of the cells did not, on the whole, show any significant deviation from the normal in the 4 groups under observation. The erythrocytometric formulae revealed a more marked anisocytosis than is normally the case.

The more frequently noted occurrence of normocytosis together with normochromia, despite considerably deep-seated hemopoietic disturbances, may be explained by various forms of intermingling and reciprocal fractions in course of the various factors regulating erythropoiesis (availability of hemoglobin, proliferative activity, rapidity of maturation, medullary threshold); the hypochromic

macrocytosis often noted in active Pb poisoning is related to a 2-fold mechanism: macrocytosis due to erythroformative disturbances, caused by strong medullary stimulation and regenerative macrocytosis due to lowering of the medullary threshold and the passage into the circulation of elements which have not reached complete maturity. The hypochromic macrocytosis often found in chronic Pb poisoning may, in its turn, be interpreted as macrocytosis proceeding from erythroformative disturbances caused by medullary inhibition, in the presence of insufficient utilization of hemoglobin. (27 references)

- 1370 Santos Ruiz, A., Dean Guelbenzu, M., and López de Azcona, J.M. (Inst. Physiol. Biochem. of Spain, Madrid): (TRACE ELEMENTS IN NORMAL AND PATHOLOGICAL HUMAN TISSUES. II. OVARY AND VAGINA.) Rev. españ. fisiol. 8:49-51, 1952.

Among 10 elements determined in the ash of ovaries and vagina, 0.001-0.01% Pb was found. (From Chemical Abstracts 47:3454, 1953)

- 1371 Santos Ruiz, A., Dean Guelbenzu, M., and López de Azcona, J.M. (Inst. Physiol. Biochem. of Spain, Madrid): (TRACE ELEMENTS IN NORMAL AND PATHOLOGICAL HUMAN TISSUES. V. DISCUSSION OF RESULTS OBTAINED IN FOUR EARLIER NOTES.) Rev. españ. fisiol. 8:207-15, 1952.

Semiquantitative spectrographic analyses were made for metals in the ash of normal and pathological human uterus, ovary, vagina, stomach, breast, thyroid, placenta, and hydatid cyst. The mean concentrations of Pb in the ash, and the frequency with which it was found were  $10^{-4}$ - $10^{-5}$ , 93.5%. The duodenal cap contained less ash than any other tissue. The analytical technique is discussed. (From Chemical Abstracts 47:7085, 1953)

- 1372 Schroeder, W.: CHANGES FOUND IN BLOOD AND HEMATOPOIETIC FUNCTION IN CHRONIC LEAD-EXPOSED PAINTERS. Am. J. Med. Technol. 18:195-8, 1952.

Of 76 painters exposed to Pb paint products, 17 showed elevated urine-Pb concentrations and 5 revealed toxic granules in the neutrophils. In the last 5, the urinary Pb was elevated in 4 but normal in 1. The urinary Pb concentration and blood picture showed improvement 6 mo after the painters were removed from exposure to Pb. (From Industrial Hygiene Digest 17:362, 1953)

- 1373 Shiels, D.O. (Ind. Hyg. Section, Dept. Health, Victoria, Australia): THE TREATMENT OF LEAD POISONING BY THE INTRAVENOUS ADMINISTRATION OF SODIUM THIOSULPHATE. Medical Journal of Australia 1:879-82, 1952.

Mount Isa, Victoria, was in 1935 the largest single Pb mine in the world. The author describes 16 cases of Pb poisoning studied there in 1934-1936, and 2 recent cases seen in Melbourne. All were treated with intravenous thiosulfate (30 grains in a few ml water on alternate days). For some this was the only treatment, in others the colic was controlled at first with  $\text{CaCl}_2$  or Ca gluconate intravenously for 1 or more doses.

There was a rapid improvement in the clinical condition of the majority of patients, although in a few 7-10 days elapsed before the patient felt improved. Men were removed from Pb hazard, but it was the opinion of the medical board of 3 that Na thiosulfate treatment had a beneficial effect on recovery from Pb intoxication. The clinical condition was also assessed in terms of the ratio monocytes and large lymphocytes/small lymphocytes, which increased with clinical improvement. There was a statistically highly significant increase in the ratio shortly after commencement of thiosulfate injections. The number of injections required to bring about a really satisfactory condition of well-being varied from 2 or 3 to a dozen or so, and recurrence of symptoms without further exposure was then very rare, whereas it was common after Ca therapy.

- 1374 Shiraishi, A. (Univ. Tokyo, Japan): (CONCENTRATION OF REDUCED GLUTATHIONE IN THE BLOOD OF LEAD-POISONED PERSONS.) Nisshin Igaku 39:478-83, 1952.

Concentrations of reduced glutathione in the blood of 100 Pb workers were investigated together with clinical diagnoses. Lowering of the concentration of glutathione in the blood was closely related to the degree of Pb symptoms. (From Chemical Abstracts 48:7821, 1954)

- 1375 Simonin, C., Chaumont, A.J., and Meniel, M.: Discussion sur la valeur des signes biologiques du pré-saturnisme en rapport avec certaines industries. (DISCUSSION ON THE VALUE OF BIOLOGIC SIGNS OF EARLY LEAD POISONING IN CERTAIN INDUSTRIES.) Proc. Meeting Société de Médecine et d'Hygiène du Travail de Strasbourg, Oct. 25 and Nov. 29, 1952.

For effective prevention of Pb poisoning, one should not await the first clinical signs, but look for all the anomalies which could precede them. At the meeting, Chaumont presented a report on systematic determination of the degree of azotemia, and Meniel discussed the value of granulobasophilia in the determination of Pb absorption. The frequent disagreement and the irregularity in time at which findings in the same person may be indicative of the risks are emphasized. Examples are given. It has not been demonstrated that an accurate determination of Pb in urine and blood provides a test for diagnosis of Pb poisoning that is superior to stippled cell counts. However, it has value only if the samples of blood are taken under rigorous precautions and the staining and counting of the erythrocytes are done by a qualified and experienced technician. (Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 14:167-8, 1953)

- 1376 Sirven, R.H., Navarret, E.E., and Macias, L.L. (Med. Clinic, Argentina): Saturnismo cronico. - Intoxicación insolita. (CHRONIC SATURNISM: UNUSUAL POISONING.) Revista de la Asociación Médica Argentina 66:311-2 (Aug.-Sept.), 1952.

This case of poisoning in a woman living in a boarding house was caused by her use of a powder which was found to consist of Pb and Ca carbonates

for toothbrushing. When admitted to the hospital, she stated that for 2 yr she had suffered from dyspepsia, epigastric pains and vomiting 2 or 3 times a week, but could not relate this to meals. While hospitalized for progressive anemia which had begun in the past few months, paresthesia in extremities developed and 3 epilepsy attacks occurred. The clinical findings included hemolytic anemia, polychromatophilia, anisocytosis, reticulocytosis, increased urobilin in urine and in blood; stippled erythrocytes; gingival Pb line; polyneuritis with paralysis of arms; mental confusion; 325 µg Pb/100 ml in blood, 225 µg/100 ml in urine.

Treatment was with 20 g bicarbonate/day to combat acidosis; iodides and BAL to induce mobilization of Pb; blood transfusions for the treatment of anemia; vitamins B and C for polyneuritis, and electrotherapy for paralysis.

- 1377 Smith, J.E., Lewis, B.W., and Wilson, H.S. (City Dept. Publ. Welfare, St. Louis, Mo.): LEAD POISONING. A CASE FINDING PROGRAM. American Journal of Public Health and the Nations Health 42:417-21 (April), 1952.

Since February 1946, the Laboratory Section of the St. Louis Division of Health has provided a routine service for the quantitative determination of Pb in blood and since August 1948, of Pb in urine. The authors point out that scanty reporting of Pb poisoning is probably due to lack of uniform, clear-cut criteria of diagnosis, lack of understanding that Pb absorption does not necessarily indicate existence of Pb poisoning, and lack of familiarity with the disease on the part of physicians in general. Also, Pb poisoning is not reportable when it occurs outside work. In the decade before 1946, there were 123 diagnoses of Pb poisoning in the St. Louis hospital with 9 deaths; in the 5 yr since 1946, there were 153 diagnoses with 7 deaths. In a systematic 2-yr (1949-51) study, 266 blood samples and 224 urine samples were taken from 279 persons for Pb determination. These showed 103 to have Pb poisoning (50 nonoccupational, in children 8 mo-7 yr and 53 occupational), and 176 other diseases. Blood Pb values were 0.078-0.540 mg% (median 0.170) for those with definite diagnosis of Pb poisoning, and 0.002-0.079 (median 0.033) for other diseases. The corresponding urine values were 0.050-0.722 mg/l (median 0.205) and 0.002-0.199 (median 0.045).

- 1378 Soprana, C., and Grosser, G.: (FIRST RESULTS OF THERAPY OF SATURNISM WITH SODIUM PYROCATECHOLDISULFONATE.) Atti soc. med-chir. Padova 30:195-9, 1952.

In a few cases of Pb poisoning anemia and changes in blood constituents were controlled by treatment with 1-2 g/day of 10% solution of Na pyrocatecholdisulfonate in cycles of 10-20 days. (From Chemical Abstracts 48:11640, 1954)

- 1379 Tara, S., Delplace, Y., and Cavigneaux, A.: Saturnisme et festivités. (CHRONIC LEAD POISONING AND FESTIVITIES.) Ann. med. leg. 32:56-8, 1952.

In the course of a systematic investigation of workers exposed to Pb, it became apparent that particularly in January there was a frequency of

symptoms of poisoning with attacks of colic and increased Pb elimination, while in September, these manifestations were observed only seldom. This is illustrated graphically.

The authors discuss the etiology of this peculiar occurrence. They are disposed to connect it with the inclination of French workers to celebrate holidays in January, since the bonuses are paid at the end of the year. Pb is stored principally in the liver. When another poison, such as alcohol, acts on this organ, the stored Pb will be mobilized, so that it becomes excreted to a greater extent and will lead to symptoms of Pb poisoning. (From Deutsche Zeitschrift für die Gesamte Gerichtliche Medizin 41:206 (Abstracts), 1952)

- 1380 Tara, S., Truhaut, R., and Raymond (France): Au sujet du taux de l'azotémie des ouvriers exposés au plomb. (DETERMINATION OF AZOTEMIA IN WORKERS EXPOSED TO LEAD.) Proceedings of the Society of Industrial Medicine and Hygiene. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 13:204-7; discussion 207-8, 1952.

The value of azotemia in the diagnosis of Pb poisoning is critically discussed. The difficulties of the methods for determining blood urea and the possibility of variable results depending on the pretesting conditions are pointed out. Therefore, the idea of preventing Pb poisoning on the basis of blood urea determinations is purely an illusory one, accompanied by risk of making a false diagnosis and giving rise to countless compensation claims with all resulting social consequences.

In the discussion, R. Truhaut questioned Tara's over-concern and Raymond recommended: (1) at the preemployment examination, the doctor should perform a clinical examination, and determine the blood count, basophilic stippling and blood urea; (2) at periodic visits, he should perform a clinical examination and stippled cell counts, where risk of Pb poisoning is significant, a blood count and blood urea determination, when it is judged necessary to confirm a diagnosis.

- 1381 Tompsett, S.L. (Western General Hosp., Edinburgh, Scotland): BONE AND TOXIC MATERIALS. British Journal of Nutrition 6, No. 4:423-6, 1952.

The discussion covers bone seekers such as radioactive metals, F, and in greater detail, Pb. In regard to the latter, it is pointed out in the paper that Pb is present in measurable quantities in "normal" tissues which is almost entirely derived from the diet, ~0.5 mg/day. It seems to be deposited preferentially in the skeleton, more so in the femur and tibia than in the rib or vertebra; in the leg bones it has been observed to increase with age. In the soft tissues, age has no effect. Diseases having a gross effect on the skeleton may mobilize the Pb deposited under normal conditions and produce increase of Pb in blood but no coproporphyrinuria and no symptoms of intoxication. The probability, however, is that the release will be slow; however, in persons with a history of abnormal exposure to Pb, the results of such diseases are more serious. A case of sub-acute lymphatic leukemia, with a history of abnor-

mal Pb exposure has been reported in which symptoms of Pb poisoning appear to have been precipitated by the disease.

- 1382** Troisi, F.M. (Med. Factory Inspector): *Sindrome anginosa da saturnismo. (ANGINA PECTORIS IN LEAD POISONING.)* Rassegna di Medicina Industriale 21:217-21 (May-June), 1952.

The patient, 56 yr old, was employed from 1919 in a railroad car shop, where he painted cars with brush or spray gun, occasionally scraped off old paint layers. In 1935, at 41, he began to suffer mild and transient attacks of angina pectoris which gradually became more intense and prolonged. However, he continued in his occupation, until in 1950, at age 56, he was forced to discontinue work. On the basis of his occupation, the heart disease was attributed to Pb exposure. In 1941 during a stay in a hospital for observation, blood examination showed some stippled erythrocytes. In 1950 urinalysis showed presence of Pb (no values are given).

- 1383** Ulrich, H. (Strasbourg, France): *Résultats d'une année de dépistage du saturnisme dans le cadre d'un service interentreprise. (DETECTION OF LEAD POISONING BY AN INDUSTRIAL HEALTH SERVICE OVER A ONE-YEAR PERIOD.)* Médecin d'Usine 14:370-6 (July-Aug.), 1952.

Of the 48 plants controlled by the author's health service, there were 14 in which 1-2 workers were exposed to Pb. The following people, who were exposed to Pb, were investigated: 11 painters, 14 workers (Pb cutters or those preparing paints and varnishes from Pb), 4 printers, 24 welders (4 women), 2 ceramists handling Pb oxide, 36 glass decorators (15 women and 9 <18 yr old). Medical examination showed no albuminuria, no Burton line, and generally good health. Hematologic examination of 21 workers showed 14 with anisocytosis and polychromatophilia, 7 with a red cell count of 3.5-4 million, 5 with <3.5 million, 13 with a hemoglobin content of 62-77%, 24% with basophilic stippling of 2-10/100 leukocytes. Intoxications were mainly caused by poor personal hygiene, smoking on the job, etc. Case histories of 2 patients whom the author reported to have Pb poisoning are described.

In closing, the author feels gratified that the management has installed improvements in working conditions to eliminate exposure.

- 1384** Walker, G., and Boyd, P.R. (Middlesex Hosp.; Assoc. Ethyl Co. Ltd., London, England): *TETRAETHYL LEAD POISONING. REPORT OF A NON-FATAL CASE.* Lancet 263:467-9 (Sept. 6), 1952.

The report concerns a 26-yr-old gasoline storage tank cleaner employed in 1949. Though well protected otherwise, he often did not wear the positive-pressure air-line respirator on the job. He worked 35 hr/wk with frequent short daily rest periods in the open air. Examined once in '50 and early '51 by local doctors, he was found healthy with no signs of Pb absorption. History, compiled with the aid of his diary showed him to have started developing signs of damage to the central nervous system early in '51 which progressed in severity

until he was admitted to the authors' hospital upon suggestion of his co-workers. Examination revealed signs typical of TEL poisoning. Among the various tests performed examination of the blood showed no basophilic stippling, the corrected urinary Pb levels in 4 analyses from March 15-April 23 were 0.36, 0.24, 0.23, and 0.21 µg/l. Some of the changes, as discussed, were: X ray showed the liver shadow to be dense, which may have been due to the presence there of Pb; the electroencephalogram conformed with those reported in the literature on the early stages of TEL poisoning (Hill and Parr, 1950) which suggested that TEL causes in man generalized suppression of cortical activity, with appearance of nonspecific slow wave activity. Treatment was entirely conservative: bed rest, encouragement of fluid intake, barbiturates, and Na amytal at night. After 3 wk vacation, following discharge, he felt well but still required a hypnotic at night. Brief reports of 2 similar cases and mention of 3 other men with minor symptoms but no physical signs are given.

- 1385** Watanabe, G., and Yana, T. (Niigata Univ., Japan): *(DISTRIBUTION OF LEAD IN BLOOD. I. DISTRIBUTION OF LEAD BETWEEN PLASMA AND CORPUSCLES IN BLOOD OF LEAD WORKERS. II. SEASONAL FLUCTUATION OF THE DISTRIBUTION OF LEAD IN BLOOD. III. THE DISTRIBUTION OF LEAD IN BLOOD CELLS.)* Igaku to Seibutsugaku (Med. and Biol.) 22:114-7; 179-82; 247-50, 1952.

I. Bloods taken from 109 workers exposed to Pb were separated into blood cells and plasma, and Pb was determined in both fractions according to Tompsett. The distribution of Pb in blood cells and in plasma, expressed as  $\bar{x}$  and  $\bar{y}$ , respectively, by the equation:  $\bar{y} = 21.43 \bar{x}^{0.486}$ , showed Pb to be more abundantly distributed in blood cells than in plasma.

II. In summer Pb is present more abundantly in plasma than in winter. The distribution of Pb in summer (at noon temperature ~25°) and in late fall (~10°) can be expressed by the following equations: in summer,  $\bar{y} = 39.27 \bar{x}^{0.302}$ ; in late fall,  $\bar{y}' = 21.58 \bar{x}'^{0.484}$ , in which  $\bar{y}$  and  $\bar{y}'$  represent the concentrations of Pb in blood cells and  $\bar{x}$  and  $\bar{x}'$  those in plasma, respectively. A possible mechanism for these fluctuations is discussed.

III. Isolated blood cells from 25 ml blood obtained from workers in a storage-battery factory were hemolyzed with 9 volumes of distilled water, and the solution was shaken vigorously with an equal volume of ether. Aqueous (containing hemoglobin) and the supernatant (containing stroma) layers were separated cautiously, and ether was evaporated off from each. The amount of Pb was much larger in the fraction containing stroma (mainly red blood cell membrane) than in the solution containing hemoglobin, and can be expressed by  $\bar{y} = 1.1\bar{x} - 4.1$ , in which  $\bar{y}$  and  $\bar{x}$  are, respectively, the amounts of Pb (in µg) of hemoglobin and stroma fractions from the 25 ml of blood. (From Chemical Abstracts 46:10394, 1952)

- 1386** Watanabe, G., Miyoshi, Y., and Yana, T. (Keio-Gijuku Univ., Japan): *(STUDIES ON LEAD POISONING IN FACTORY. PART IV. ON THE CALCIUM AND ANORGANIC PHOSPHORIC ACID*

AMOUNT IN SERA OF LEAD WORKERS.) *Journal of the Science of Labor* 28:763-8, 1952. The Pb content in whole blood, serum, urine, and the serum Ca and P of 96 workers in a Pb refinery were measured in November 1950. Arithmetic mean in whole blood was 61.6  $\mu$ g/100 ml (2.5-237.5  $\mu$ g). Serum Ca levels of this group was  $9.78 \pm 0.052$  mg/100 ml (7.84-11.02 mg), and this value was lower than the mean of healthy Japanese. Serum inorganic P was  $3.64 \pm 0.073$  mg/100 ml (2.02-5.63 mg). Statistical evaluation showed that there was a reverse correlation between Pb in whole blood and serum Ca content ( $r = -0.46 \pm 0.081$ ). The inorganic P in serum of Pb workers did not show any significant variations, but the correlation coefficient was  $0.30 \pm 0.093$  between the serum Ca and inorganic P.

### 1953

- 1387 Ahlmark, A. (Bertil Lönnerberg, Stockholm, Sweden): En hñlsundersökning av 110 elektrosvetsare med långvarig arbetsanamnes. (CLINICAL EXAMINATION OF ONE HUNDRED TEN WELDERS WITH MORE THAN FIVE YEARS' CONTINUOUS WELDING EXPERIENCE.) *Nordisk Hygienisk Tidskrift* 1953, No. 11/12:238-49.

An account is given of the results of a clinical examination of 110 welders who had for 5 yr or longer been engaged in electrowelding. The majority of the welders stated that the work with "basic" electrodes often caused a marked irritation in the throat and respiratory passages, which is attributed by the authors to the effect of F's in the fumes (no absorption of F was shown to occur). With certain "neutral" electrodes, eye trouble was the chief complaint. Effects of Pb, Pb poisoning, and Zn "ague" had occurred in several cases. In 1 case poisoning with nitrous gases was observed. The only important objective findings that might have been ascribed to welding fumes and gases were considerably heightened residual quotient evident in spirometric examinations, and emphysema varying in degree from mild to pronounced. All these workmen had been welding for 20 yr or longer. The cases observed are considered to motivate further examinations of welders with specially prolonged working history. In 67 of the welders impairment of hearing to a greater or lesser degree was found, due to the fact that the majority of the workers examined were employed in mechanical workshops that were often very noisy. (From author's summary)

- 1387a Ambrosio, L. and Mazza, V. (Univ. Naples, Italy): Aspetti dell'immunità naturale nelle intossicazioni professionali. (NATURAL IMMUNITY IN OCCUPATIONAL INTOXICATION.) *Folia Medica* (Naples) 36:589-631, 1953.

Since toxic substances often inhibit production of antibodies and lower resistance to infections, the serum lysozyme content was compared in healthy persons, diabetics, and workers exposed to Pb and 2 solvents. In the diabetics and exposed groups a decrease in the enzyme was associated with decreased counts of neutrophil polynuclear cells and reticuloendothelial system disorders. Thus, such workers are more subject to infections than the normal.

- 1388 Aring, C.D., and Trufant, S.A. (Univ. Cincinnati, O.): EFFECTS OF HEAVY METALS ON THE CENTRAL NERVOUS SYSTEM. In Merritt, H.H., and Hare, C.C., ed.: *Metabolic and Toxic Diseases of the Nervous System. Proceedings of the Association for Research in Nervous and Mental Disease*, December 12 and 13, 1952. Baltimore, Williams and Wilkins Co., 1953, pp. 463-74.

Since Pb is almost the only heavy metal that often involves the central nervous system, the bulk of this chapter is devoted to a review of Pb as related to the nervous system, Pb encephalopathy in the adult, and in children; incidence of Pb poisoning in children (a table is included showing incidence in children as recorded in the Kettering Laboratory); Pb myelopathy and neuritis; cerebrospinal fluid in Pb encephalopathy; diagnosis of Pb poisoning; laboratory diagnosis; Pb content of tissues (shown also in a table for fatal TEL intoxication, fatal inorganic Pb intoxication in an adult and children, and in cases not exposed to Pb); concept of varying susceptibility; pathology; therapy; use of BAL; use of EDTA; other heavy metals (Hg, Cu, Mn, Tl) and the central nervous system.

- 1389 Aub, J.C., Butler, A.M., Byers, R.K., Foreman, H., Hardy, H.L. (Chairman), Harrison, H.E., Kissin, B., Maison, G.L., Rubin, M., and Shipman, T.L.: USE OF CALCIUM ETHYLENEDIAMINETETRAACETATE IN TREATING HEAVY-METAL POISONING. REPORT OF A CONFERENCE HELD AT MASSACHUSETTS GENERAL HOSPITAL. *A.M.A. Archives of Industrial Hygiene and Occupational Medicine* 7:137-47 (Feb.), 1953.

As discussed by Foreman, ethylenediaminetetraacetic acid (EDTA) is known commercially as versene, sequestrene and nullapon. It combines with metal ions to form non-ionic water-soluble complexes or chelates and therefore might be useful in the mobilization of heavy metals from the bones. Rubin discussed the effect of EDTA on the excretion of Pb in animals (rabbits) and presented was an experience with EDTA in the treatment of a 3-yr-old child with acute Pb poisoning. Of interest in this case was the fact that the original neural involvement, which subsided with the EDTA therapy, had not recurred at examination 1 yr later. Similar results were reported in 2 patients also suffering from acute Pb poisoning. Maison reported on the toxicity of EDTA and the results of a series of studies on CaEDTA, tolerated without fatalities, are presented. The laboratory tests on the efficacy of EDTA in the therapy of animal Pb poisoning proved to be unsuccessful because of the vagaries of the Pb poisoning.

Kissin spoke on the other clinical uses of EDTA. The conference concluded with a series of comments on the topics presented.

- 1390 Baker, W.H. (Boston, Mass.): THE USE OF MONOCALCIUM DISODIUM ETHYLENE DIAMINE TETRA-ACETIC ACETATE (CaEDTA) IN THE TREATMENT OF ADULT LEAD INTOXICATION. *Proceedings of the Central Society for Clinical Research. Journal of Clinical Investigation* 33:916-7, 1954.

Recently a new chelating agent,  $\text{CaNa}_2\text{EDTA}$ , has

been introduced for clinical trial in heavy metal poisoning. EDTA has a strong affinity for Pb and exchanges its Ca for Pb to form a PbEDTA complex which is then excreted unchanged via the urine. This compound was given iv in a dosage of 0.5 g/30 lb of body weight to 6 patients with chronic Pb poisoning and to 3 normal control patients. All 6 patients with chronic poison prior to treatment showed increased urinary Pb and CP levels. All patients had anemia with stippled erythrocytes (SE) and abnormal fragility tests. EDTA was administered to each patient on consecutive days for periods of 4-18 days. On the 1st day of administration there was a marked increase in urinary Pb excretion and a simultaneous lowering of CP. On succeeding administrations there was a gradual decrease in the amount of Pb excreted while UCP remained at normal levels. During the period of therapy all patients exhibited a rise in H<sub>c</sub>, SE disappeared, and fragility tests returned to normal. In the 3 normal control subjects EDTA was administered on only 1 day with an increase in urinary Pb on that day and no change in the CP. Metabolic balance studies of electrolytes were performed on 2 patients with chronic Pb poisoning. No alterations in metabolic balance occurred during administration of this compound either in a 6- or 18-day study period. These studies indicate that EDTA is an effective way of mobilizing deposited Pb with simultaneous improvement in the patient's condition and no evidence of toxicity.

- 1391** Baldi, G., and Giubileo, M. (Univ. Milan, Italy): La azotemia dei saturnini e degli operai esposti ad assorbimento di piombo. (AZOTEMIA OF WORKERS POISONED BY LEAD AND OF WORKERS EXPOSED TO LEAD HAZARD.) *Medicina del Lavoro* 44:420-8 (Oct.), 1953.

The study involved 50 workers of a storage battery plant who were at work, and 117 who were hospitalized for evaluation of Pb poisoning. Of the latter, 28 had colic, 50 presented signs of chronic poisoning, and 39 showed no signs. The 50 at work were exposed to considerable amounts of Pb at several work sites where concentrations ranged from 0.30-1.23 mg/m<sup>3</sup> of air. Burton's line was seen in 29 and 15 eliminated >20 µg coproporphyrin/100 ml urine. Of these 50 who showed no liver and renal lesions, 7 (14%, av age 40) revealed an azotemia of 50 mg/100ml or more, while the average for the remainder was 0.37. The 28 with colic who had left work in an average of 12 days showed an average azotemia of 41 mg/100 ml and 29% of them exceeded 0.50 g; their blood Pb averaged 154 µg/100 ml (55-250). The 50 suffering from chronic poisoning, who had ceased work in an average of 7 mo, had an azotemia of 35 mg/100 ml and only 12% of them (age, av 50 yr) had >0.50 g; average blood Pb was 90 µg/100 ml (9-250). Azotemia in 39 workers no longer exposed to Pb for an average of 9 mo, who showed no signs of intoxication, was 29 mg/100 ml and blood Pb av 49 µg/100 ml. Since the higher the blood Pb, the higher the incidence of hyperazotemia, the authors felt justified in attributing it to Pb. They consider that the action of Pb lies in favoring the action of enzymes that destroy the protein molecule producing incoagulable catabolites and in partially inhibiting the enzymatic complexes required for the synthesis of amino acids.

- 1392** Bénard, H., Gajdos, A., and Gajdos-Török, M.: (DISTURBANCES OF PORPHYRIN METABOLISM INDUCED BY LEAD POISONING.) *Rev. pathol. gén. et comparée* 53:759-71, 1953.

A review with 55 references. (From Chemical Abstracts 48:865, 1954)

- 1393** Bénard, H., Gajdos, A., Gajdos-Török, M., and Rambert, P. (Hôtel Dieu Hosp., Paris, France): Une intoxication aiguë collective par le plomb. (MASS ACUTE LEAD POISONING.) *Semaine des Hôpitaux de Paris* 29:785-8 (Mar. 2), 1953.

The crew of a ship (41 men) was intoxicated, apparently by a wine containing 4.5 mg/l of Pb. Besides the hematologic counts, their increased coproporphyrinurias (up to 5.65 mg/day) and free erythrocyte protoporphyrin contents (up to 1.62 mg/100 ml) are tabulated. The blood Pb, determined in 10 men, averaged 105 µg/100 ml. Urines contained no uroporphyrin and their red cells were free of coproporphyrin. In the opinion of the authors, the signs most frequently demonstrated in Pb poisoning are high urinary coproporphyrin and free erythrocyte protoporphyrin levels.

- 1394** Beyrer, K.: Beitrag zur Prophylaxe und Therapie der Bleivergiftung. (THE PROPHYLAXIS AND THERAPY OF LEAD POISONING.) *Med. Klin. (Munich)* 48:1506-8, 1953.

This is an account of observations made on 45 workers who were exposed to the risks of Pb inhalation and among whom many cases of severe Pb poisoning occurred. The symptoms are stated and the results of laboratory examinations--blood cytology, hemoglobin determinations, porphyrin excretion--are described. No evidence was found in these cases of the development of chronic Pb poisoning of encephalopathy, cirrhotic kidney, or arteriosclerosis. Only 2 cases of neuritis were encountered. The author considers from this evidence that the main effect of Pb is on the bone marrow. In no instance did the usual tests give any indication of disturbance of liver function. An interesting observation was made in 6 workers who had undergone resection of the stomach, and these were particularly susceptible to Pb as was shown by the rapid onset of symptoms and of anemia and porphyrinuria. It is suggested as a cause that in these cases there is interference with the normal absorption of Fe and riboflavin. Levulose drinks were given over a period as a prophylactic to workers exposed to risk, but as judged by laboratory tests it was ineffective although the men stated that it improved their sense of well-being. BAL and also levulose with Na citrate were tried in the actual treatment of cases of Pb poisoning but were not found to be of value. (From Bulletin of Hygiene 29:67, 1954)

- 1395** Brigatti, L., and Grandis, C.: Sulla presenza di un precursore etero-solubile delle porfirine nelle urine di addetti alla lavorazione con piombo. (Nota 1). (THE PRESENCE OF AN ETHER-SOLUBLE PRECURSOR IN THE URINARY PORPHYRIN OF LEAD WORKERS. I.) *Medicina del Lavoro* 44:113-23 (Mar.), 1953.

As summarized by the authors, the so-called "precursor" of porphyrins is understood to be a chro-



mogen, soluble in ether, colorless, which, after exposure to ultraviolet rays or treatment with reducing substances, yields coproporphyrin (CP) and, in the normal individual, makes up most of the urinary porphyrin. The determination of the total urinary CP, by separating the preformed fraction (UCP) and the precursor, was performed by the method of Sallet et al, as modified by Schwartz et al; the reading was by a Beckman D.U. spectrophotometer.

The 155 workers examined worked in an automotive concern in Turin and all were exposed to Pb. The intent was not to select purposely individuals having Pb poisoning symptoms. Owing to factory exigencies the research was carried out on a single urine sample taken between 2 and 3 PM; therefore, values/l instead of /24 hr were given. In order to corroborate the results obtained, the elimination of the UCP and of the precursor in the urines taken at intervals in a 24-hr period were studied separately on 5 workers. Of the examined workers 29.1% showed a normal urinary CP or one slightly above normal, with an average of 124 µg/l of UCP and of 160 µg/l of precursor. The percentage ratio of precursor to total porphyrinuria was 56.3%. An increased urinary CP with an average of 428 µg/l of UCP and 323 µg/l of precursor was found in 50.3%. The percentage ratio of precursor to total urinary CP was 45.4%. An extremely high total urinary CP with an average of 2130 µg/l of UCP against 1200 µg/l of precursor was found in 20.6%. The percentage ratio of precursor to total urinary CP was 36%. In this last group the precursor values showed extremely large variations since, in some cases, only a few micrograms of precursor were found and, in others, values greater than those of the UCP. In the cases followed day by day, a very random elimination of the UCP and of the precursor was noted which showed remarkable variations in the single fractions. In the cases where a remarkable elimination of UCP occurred, there was never found an equally high daily elimination of precursor because, even if the precursor showed in some fractions actual "surges" of elimination, in other fractions it was reduced to but a few traces. The authors therefore believe that the percentage ratio of precursor to total urinary CP, computed on the basis of the data determined in the 3rd group of laborers should actually be considered lower, inasmuch as the cases with very high values/l of precursor may have been fortuitously detected in the moment of maximum daily elimination.

The conclusion is that in the urines of workers exposed to Pb in addition to preformed urinary CP, some precursor is to be found. Contrary to what happens with normal individuals, the precursor in Pb poisoning does not represent the larger constituent of the excreted porphyrin, but, conversely, it diminishes with the increased CP content of the urine. (14 references)

- 1396 Brigatti, L., and Grandis, C.: Sul comportamento della coproporfirinuria totale e della protoporfirina libera eritrocitaria in addetti a lavorazione con piombo, seguiti periodicamente. (Nota II). (BEHAVIOR OF TOTAL COPROPORPHYRIN AND FREE ERYTHROCYTIC PROTOPORPHYRIN RESULTING FROM

PERIODIC EXPOSURE TO LEAD. II.) *Medicina del Lavoro* 44:211-17 (May), 1953.

As summarized by the authors, they had followed the behavior of total urinary coproporphyrins (CP) (preformed fraction and precursor), of the free erythrocytic protoporphyrin (PP), and of the blood picture of 21 workers exposed to Pb absorption and on 5 workers who had been changed to other work not involving Pb because of manifestations of Pb poisoning. A small number of workers (3 of 21), subjectively in good health, showed normal values of CP, of PP, and normal hematologic values; most of them (14) manifested only a moderate increase in CP and PP, though transient sudden surges of both values occurred. These individuals reported occasionally, and without any close relation to the period of greatest porphyrin excretion, some digestive disorders. In addition, a small group of laborers (4) manifested severe changes of the porphyrin metabolism (CP >1 mg/l, PP of ~400 µg/100 ml red cells), a moderate anemia and presence of stippled erythrocytes. From the clinical viewpoint, digestive disorders, Pb line on gums, painful abdominal palpation and liver enlargement were noted. In the group kept under control and removed from exposure, a remarkable decrease of total CP and PP was seen after only 1 mo. In 2 cases showing rapid improvement, the total CP and PP kept on diminishing, while they remained almost stationary or even showed new increases in the remaining. In the cases showing signs of Pb intoxication, a reduction of the precursor-to-total CP percentage ratio (from 50-30%) and an approximate parallelism between the excretion of preformed fraction and the content of PP was observed. (12 references)

- 1397 Bruusgaard, A. (Nat'l. Workers' Hosp., Oslo, Norway): Påliteligheten av basofilittelling hos blyeksponerte individer. (RELIABILITY OF BASOPHIL COUNT IN SUBJECTS EXPOSED TO LEAD.) *Tidsskrift for den Norske Laegeforening* 73, No. 13/14: 530-1, 1953.

Basophil counts are still the standard method for control of Pb poisoning in many countries. However, this method is subject to statistical limitations as well as technical and human errors. It is mainly a diagnostic aid in evaluation of Pb risk to groups of workers. The method should be recommended only when especially trained and experienced personnel is available and the test is carried out with standardized techniques. Preferably 2 smears should be made from each individual especially in single cases and smaller groups. Results should be interpreted and evaluated with care and reserve.

- 1398 Crepet, M., Chiesura, P., and Gobatto, F. (Univ. Turin, Italy): Comportamento della funzione renale nella intossicazione professionale da piombo. (KIDNEY FUNCTION IN OCCUPATIONAL LEAD POISONING.) *Folia Medica* (Naples) 36:181-96, 1953.

Kidney function was studied in 20 cases of Pb poisoning, established by history and laboratory findings. In most of the cases, a more or less significant reduction of glomerular filtration was found with corresponding reduction of urea

clearance; only in a few cases was any significant albuminuria observed and a higher than normal number of formed cells in the sediment. In addition, there was observed a diminution of the plasma and blood flow. The authors conclude that in Pb poisoning, kidney function may be dangerously severe despite the fact that "external" signs are not evident. (24 references)

- 1399 Dangl, F., Frank, O., and Lachnit, V. (Univ. Clinic, Vienna, Austria): Bleisauuntersuchungen im ultravioletten Licht. (EXAMINATION OF LEAD LINE IN ULTRAVIOLET LIGHT.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 3:6-8 (Jan.), 1953.

In order to distinguish the typical Pb gum line, workers with entirely normal gums, with questionable conditions, and those with definite Pb lines were chosen. An ultraviolet (UV) lamp with Wood-Filter was used. The normal fluorescence of gums and teeth was observed, as well as that following local and parenteral application of fluorescent dyes. Unquestionable Pb line showed a dark zone in the place of the gum, which differentiated itself against the remaining bluish fluorescing gum. In 1 patient with Pb poisoning, the dark line was seen to disappear gradually while he received treatment for Pb poisoning. In doubtful cases, a narrow Pb line could be clearly differentiated from the dental tartar under the UV light. In some cases in which examination under ordinary light suggested a Pb line, examination under UV light clearly demonstrated merely the red fluorescence of dental tartar. The examination of the gum line under UV light will be especially helpful in persons exposed to Pb who do not yet exhibit other signs of Pb poisoning. Gingivitis which also appears as a dark line will present a source of error. The Bi line will also present the same dark coloration, which is interpreted as a deposit of metal sulfide.

- 1400 Davydova, G.N. (Leningrad San.-Hyg. Med. Inst., USSR): Klinicheskie nablyudeniya nad primeneniem askorbinovoi kisloty pri svintsovykh otravleniyakh. (THE USE OF ASCORBIC ACID IN LEAD POISONING.) Trudy Leningradskogo Sanitarno-Gigienicheskogo Meditsinskogo Instituta 14:66-73, 1953.

From 1944-48, the ascorbic acid metabolism was followed in 98 Pb poisoning cases and compared with data reported by Matusevich (1945) for 22 Pb cases observed in 1940-41. D. found that the vitamin C levels in blood were considerably lower in the cases followed by her (0.072 (in 1944)-0.296 (in 1948) mg%) in comparison with the 1940-41 values (0.390 mg%) found by M. The author explains this large difference on the basis of differences in the environment and states that Martinson, et al, had found for Leningrad residents in 1943-44 the vitamin C content to range from 0.1-0.3 mg%. She points to the fact that even in 1948 her findings for the Pb cases were lower than those of the Leningrad residents, emphasizing the effect of environmental factors, in this case, Pb. The urinary content of her cases through the years varied from 0.314-1.294 mg%. She administered vitamin C to 25 of them (20 women, 5 men), who showed signs

of moderately severe Pb poisoning, 300 mg vitamin C daily for 20 days, or 500 mg/day for 20 days. The course of the treatment is described for 3 of the cases, and the values obtained for the vitamin C content of the blood and urine, and urinary Pb are shown in a table. The results indicated some increase in the content of vitamin C in the body, but no saturation of tissue was obtained, and the urinary Pb was not reduced to normal levels after these massive doses. However, she believes that vitamin C produces a favorable effect in Pb poisoning although it is not specific.

- 1401 Desoille, H., and Albahary, C. (Paris, France): Saturnisme hydrique rôle d'un branchement de T.S.F. (LEAD POISONING FROM WATER: CAUSED BY GROUND WIRE OF RADIO SET.) Presse Médicale 61:1247-8 (Oct.), 1953.

The occurrence of Pb poisoning in a family of 3 is reported. The head of the family was affected most severely. About 1 mo after he experienced abdominal cramps, nausea and constipation, a bilateral antebrachial paralysis developed. Medical examination included coproporphyrin (1200 µg/l) and blood Pb analyses (100 µg%). His wife and daughter exhibited subclinical Pb poisoning. Examination of water used by the family revealed the presence of 0.875 mg Pb/l. The cause was found to be a Cu wire, used as the ground connection for a radio, which was wrapped around a Pb water pipe, and thus favored electrolysis of Pb. After the wire was removed, and even after a long period of stagnation of the water in the pipe, the Pb content of the water dropped to 0.2 mg/l. The authors stress individual susceptibility to Pb and the necessity of the following tests for the confirmation of a diagnosis of Pb poisoning: counts of stippled erythrocytes, determination of coproporphyrinuria, and of free protoporphyrin in erythrocytes.

- 1402 Dietze, A. (City Hosp. Lübeck-Travemünde, Germany): Bleivergiftung bei Abwrackarbeiten. (LEAD POISONING IN SHIP-BREAKERS.) Deutsche Medizinische Wochenschrift 78: 136-7 (Jan.), 1953.

A case of subacute Pb poisoning as a result of Pb inhalation is described. A 28-yr-old burner in the breaking-up of old warships worked for 8 hr/day from May 1-21. The work was mostly done in the open, although sometimes he had to work in ill-ventilated spaces. The ship was still covered with a good coat of paint causing a real Pb hazard. Protective measures were neglected by the burner (ie, respirator was used only occasionally). He noticed the first signs after 2 wk: sweetish taste in the mouth; abdominal colic and vomiting; a little later, headaches; nausea and a certain uncertainty in the nerve functions. Roentgenologic examination showed colonic spasm; subicterus, reticulocytosis, anemia and porphyrinuria (145 µg%) were seen on admission. No Pb line was observed. After a 14-day treatment with BAL he was discharged from the hospital. The condition deteriorated soon again, probably as a result of a strong Pb mobilization by the BAL. Now a Pb line was demonstrable, the nose was blocked and he breathed through the mouth. After a 52-day treatment in the hospital

he was discharged and the Pb line had disappeared. In 3-1/2-6 mo, 8 more cases of Pb poisoning occurred on the same ship.

The authors make special note of the fact that a strong Pb mobilization took place after treatment with BAL which makes the treatment with the drug questionable.

- 1403 Du Pont de Nemours, E.I., and Co.: MAINTAINING HYGIENE IN TETRAETHYL LEAD OPERATIONS. Prepared by the Medical Division of the Du Pont Company especially for Industrial Physicians and Nurses in the Petroleum Industry. Wilmington, Delaware, Du Pont de Nemours and Company, Inc., 1953, 39 pp.

In part 1 of the book, medical aspects of tetraethyllead (TEL) and Du Pont TEL compounds are discussed. This section includes a description of some of the characteristic salient clinical manifestations of TEL intoxication. Part 2 deals with regulations governing the handling and blending of Du Pont TEL compounds.

- 1404 Faraone, G., Sorrentino, G., and Lombardo, F. (Inst. Legal Med. and Assurance, Univ. Messina, Italy): Il problema del saturnismo nei lavoratori delle ceramiche in S. Stefano di Camastra (Messina), dal punto di vista clinico, anatomo-patologico e preventivo. (THE PROBLEM OF LEAD POISONING IN CERAMIC WORKERS OF S. STEFANO DI CAMASTRA (MESSINA) FROM THE CLINICAL, ANATOMICOPATHOLOGIC AND PREVENTIVE POINTS OF VIEW.) Rivista degli Infortuni e delle Malattie Professionali 40:616-47 (May-June), 1953.

The authors describe the various operations of the work in the potteries, pointing out that both the working conditions and techniques employed were practically primitive as were the personal habits of the workers which were contrary to all hygienic and sanitary regulations; in short, there was a lack of any form of preventing the worker from Pb poisoning. On the basis of clinical and laboratory findings on 1 group of workers, they state that in these potteries Pb poisoning is more a problem of prevention rather than a medical, therapeutic or insurance problem. The histopathologic and chemical findings in 4 fatal cases are described. In conclusion, the authors stress the diagnostic and prognostic value of clinical and laboratory evaluations and their importance in respect to prevention. The determination of coproporphyrin in urine was used more as an index of Pb absorption than the count of stippled erythrocytes and Pb in urine. They also stress the need of establishing a program of prevention by industrial engineering means and indicate the steps that should be taken in this connection. The necessity of an early postmortem examination in fatal cases, where Pb poisoning is suspected, is emphasized. (From authors' summary)

- 1405 Foreman, H., Hardy, H.L., Shipman, T.L., and Belknap, E.L. (Los Alamos, N. Mex.; Boston, Mass.; Los Alamos, N. Mex.; Milwaukee, Wis.): USE OF CALCIUM ETHYLENEDIAMINETETRAACETATE IN CASES OF

LEAD INTOXICATION. A.M.A. Archives of Industrial Hygiene and Occupational Medicine 7:148-51 (Feb.), 1953.

The reports of a number of physicians and investigators on the use of EDTA and its Ca salt (a number by personal communication) are summarized in response to the interest expressed in this new drug, with the view of developing a protocol for use in Pb poisoning. M. Bowditch, Lead Industries Association, agreed to hold a registry of such protocols of cases treated with CaEDTA. The compilation here recorded includes >100 cases (to July 1952) in which the drug was administered to humans (for research purposes, as anticoagulant, in Be poisoning, etc).

In 8 cases of Pb poisoning treated with CaEDTA (5 children, 3 adults), increased Pb excretion followed, and in 4 of the cases there was marked alleviation of symptoms. There was no evidence of toxicity from the use of the drug, nor were there symptoms associated with the mobilization of Pb. Experiments with carbon 14-labeled material showed that it is excreted unchanged. All of the drug was accounted for in the excreta; 60-90% appeared in urine after 6 hr, 95-99% after 25 hr, and remainder in feces. In other patients EDTA was given experimentally to study Ca metabolism. Serum Ca was markedly decreased. Application of water-soluble ointments indicates that EDTA is readily carried through the skin. The protocol for the use of CaEDTA in Pb intoxication is outlined and results are tabulated. (16 references)

- 1406 Frank, O., Jansch, H., Lachnit, V., and Mayer, F.X. (Univ. Med. Coll. Vienna, Austria): Zur Beurteilung der Bleiwerte im Harn. (INTERPRETATION OF VALUES FOR LEAD CONTENT OF URINE.) Wiener Klinische Wochenschrift 65:588-90, 1953.

The Pb content of the urine was compared with the clinical picture in 210 individuals living in or near Vienna. Clinically healthy persons excreted <60 µg/l of Pb as a rule, while in those without occupational exposure to Pb the amount was <30 µg/l. Where clinical signs of increased Pb absorption were present the values were ~1000 µg/l and in most cases of actual poisoning they were still higher. The necessity for repeated analyses of the urine is stressed. The discrepancies between these findings and those in other countries, especially America, and the possibility of regional variations in Pb excretion are discussed. (13 references)

- 1407 Galea, V., Puscariu, F., and Ghelberg, N.: (CHANGES IN IONIC COMPOSITION OF BLOOD IN SATURNISM.) Acad. Rep. Populare Române, Filiala Cluj, Studii Cercetări Stiint 4: 356-62, 1953.

Determinations of Ca, P, and Cl in plasma were carried out on 200 workers exposed to Pb and 21 not exposed to Pb. Changes in the concentrations and in the ratios of the ions in blood were observed. The ratio P/Ca is especially significant. The  $(P \times 100)/(Ca \times Cl)$  in plasma is >11 at the beginning of the exposure to Pb in more than 70% of the cases with clinical symptoms. In 65% of the cases which do not show clinical symptoms the

plasma is also >11. (From Chemical Abstracts 50: 9612, 1956)

- 1408 Giannattasio, R.C., Pirozzi, M.J., and Bedo, A.V. (Kings County Hosp., Brooklyn, N.Y.): TUBERCULOUS MENINGITIS AND CONCOMITANT LEAD INTOXICATION. New York State Journal of Medicine 53:330-2, 1953.

Two cases of tuberculous meningitis with concomitant Pb intoxication are presented. The literature was reviewed and similar cases were not found. The difficulty in the differential diagnosis between Pb encephalopathy and tuberculous meningitis is stressed. (From authors' summary)

- 1409 Gilman, H., Spatz, S.M., and Kolbezen, M.J. (Chem. Lab. Iowa State Coll., Ames): ORGANOLEAD SALTS. Journal of Organic Chemistry 18:1341-51 (Oct.), 1953.

Preparation of a variety of triethyllead compounds derived from mono- and poly-basic acids is reviewed. Most of these compounds were sternutators. A few diethyllead compounds were also prepared, but none of these exhibited sternutatory activity. Effect of solvent on extent of alkyl-Pb cleavage in  $R_4Pb$  or  $R_3PbOH$  type of structure was demonstrated. Usefulness of organo-Pb salts in identification of carboxylic, sulfonic, sulfinic, sulfonamide, and related compounds is pointed out. (From authors' summary; 15 references)

- 1410 Goldblum, R.W., Derby, S., and Lerner, A.B. (Univ. Michigan, Ann Arbor): THE METAL CONTENT OF SKIN, NAILS AND HAIR. Journal of Investigative Dermatology 20:13-8, 1953.

Quantitative values of 14 metals, including Pb, in samples of normal skin, nails, and hair from 18 white males (age 15-70 yr) were obtained by spectrographic analysis. Because of great variations in concentration of any given metal in different samples, differences were reduced by selecting only values grouped in the center of scattergram charts (an example for Fe is shown): these 9 of the 18 values were considered the approximate representation of normal ranges. Metals were divided into 3 groups: Ca and P, those associated with enzymes, and inert metals. Thus it was possible to demonstrate some correlation of content of these metals in the samples. Pb contents, grouped with inert metals, were for skin, nails and hair respectively in % of dry tissue:  $2.52 \times 10^{-2}$ - $1.34 \times 10^{-1}$ ;  $9.7 \times 10^{-3}$ - $2.4 \times 10^{-2}$ ;  $4.1 \times 10^{-3}$ - $1.0 \times 10^{-2}$ .

- 1411 Groetschel, H. (State Ind. Med. Officer, Hessen Min. Labor, Wiesbaden, Germany): Porphyrinbestimmung im Urin von Bleiarbeitern. (PORPHYRIN DETERMINATION IN THE URINE OF LEAD WORKERS.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 3:146-7 (Sept.), 1953.

Statements made by Weidner and Hunold (Abstract No. 3609) in respect to urinary porphyrin levels in Pb workers are criticized. It is not clear what the authors mean by saying that healthy persons excrete in 24 hr 30-80  $\mu g\%$  porphyrins, etc. Values given by others are reviewed. In summarizing the latter, 0-60, or at most 80  $\mu g$  porphyrin/l urine can be considered normal;  $\sim 500 \mu g/l$  is considered dangerous Pb exposure. Values given by Weidner and Hunold

would be correct if they referred not to percent, but to 24 hr, or at least, to 1 l. urine. Determination in 24-hr urine is of course best, because porphyrin levels fluctuate not only day by day, but also at various times during a day. Although the author believes that porphyrin determination is a valuable tool of diagnosis, he believes that it must be supported by other tests and signs such as body weight, anemia, high stippled cell counts, Pb line, pallor, and constipation. Extensor weakness is no longer considered an early sign of Pb poisoning.

- 1412 Gryglewicz, E., and Gasiorek, M.: Uzyteczność półilościowej metody oznaczania porfiry w moczu w walce z ołowicą. (VALUE OF SEMIQUANTITATIVE PORPHYRIN DETERMINATION IN URINE IN THE PREVENTION OF LEAD POISONING.) Med. Pracy 3, No. 3/4:313-8, 1953.

The authors conclude that porphyrin determinations in urine in mass examinations (312 workers exposed to Pb poisoning) is a better index of early Pb poisoning than basophilic stippling of the red cells. (From Excerpta Medica Sect. II, 7:Abstr. No. 1103, 1954)

- 1413 Guyotjeannin, C. (Paris, France): Au sujet des hématies à granulations basophiles dans le saturnisme. (BASOPHILIC STIPPLING OF ERYTHROCYTES IN LEAD POISONING.) Médecin d'Usine 15:362-4 (July-Aug.), 1953.

The author points out the value of determination of basophilic stippling (BS) as a method for detecting Pb poisoning and recommends a venipuncture instead of a finger prick for sampling. Routine determinations of basophilic granulation, if possible, should be done by the same person with pipettes calibrated the same way and methods of fixation and staining should be the same. The following formula was proposed for determining index of BS:  $BS \times 5 \text{ million} \times 7000/E \times L$ , where BS = number of stippled cells/100 leukocytes; E = number of erythrocytes/ $\text{mm}^3$  blood of patient; L = number of leukocytes/ $\text{mm}^3$  blood of patient, and 5,000,000 and 7000 are normal values for erythrocytes and leukocytes. Data were given for 2 cases and it was shown that index of BS did not always correspond to number of BS cells.

- 1414 Hammond, J.W., Pretsch, F., and Pipkin, R. W.: HYGIENE STUDY OF THE PAINT DEPARTMENT, BAYTOWN REFINERY. Medicine for Industry (The Medical Bulletin), Standard Oil Company (N.J.) 13:195-9 (June), 1953.

In Sept. 1949, personnel of the Paint Department were tested for signs of Pb absorption. Results, reported in Feb. 1950, indicated that 17 employees could have developed Pb poisoning if their exposure had not been reduced. Effectiveness of control measures then instituted was assessed by another series of determinations in Aug. 1950, as reported in Supplement I. A 25% average reduction in Pb excretion was found. In June 1951, Supplement II was issued and gave results of urinary Pb tests run during Feb. and Mar. 1951. This report showed an average reduction in Pb excretion of 57% when compared with 1950, and of 65% when contrasted with 1949. In Feb. and again in Aug. 1952, painters were checked for urinary Pb excretion. Results are giv-

en in this Supplement III. Summary table showed that reduction noted in 1950 and 1951 did not continue for the group as a whole; an increased number of men (43) were excreting Pb in the high range, even though average amount of Pb voided by each was less than former averages. However, this was an improvement, for had there not been a decrease in exposure, urinary Pb values would have been higher rather than lower, because Pb excreted is in direct ratio to daily exposure. Therefore, enlargement of the group with significant Pb values, upon analysis, was not alarming. It indicated success of the rotation scheme which was adopted as a control measure. A majority of these men have exposures so close to the borderline that a decrease of a few micrograms in amount of Pb excreted will remove them from the significant classification. The slight reduction necessary may be achieved within the next year by continued observation of control measures. This could be especially so if particular attention is paid to safeguarding of those laborers and painter helpers assigned to buffing operations; for it is those employees who now unfavorably weigh averages because of their exposure to Pb dust in air. (From authors' summary)

**1415** Hart, H., and Laszlo, D. (Montefiore Hosp., N.Y.): MODIFICATION OF THE DISTRIBUTION AND EXCRETION OF RADIOISOTOPES BY CHELATING AGENTS. *Science* 118:24-5, 1953. Pb-EDTA (ethylenediaminetetraacetic acid), Y-EDTA, and <sup>14</sup>C-labeled EDTA all leave the body rapidly when injected iv (Rubin et al, 1952; Foreman et al, 1952). La-EDTA is <10% excreted through the kidneys; the paper was written therefore, to explain this phenomenon.

**1415a** Holmquist, I.: (DETERMINATION OF LEAD CONTENT OF BLOOD IN ROUTINE PHYSICAL EXAMINATION.) *Nord. hyg. tidskr.* 1953, No. 7-8:128-40.

A spectrographic method was used to determine Pb content of blood at the periodical checkup examination of workers exposed to Pb in a Pb smeltery. With this method 2,280 determinations have so far been carried out. Number of stipple cells varies considerably from day to day, both in persons exposed to and not exposed to Pb. To assess the risk of Pb poisoning only in the light of the number of stipple cells is probably a rather uncertain method. Determination of Pb content in the blood contra urine and the value of coproporphyrin determination as a routine method are discussed. With a Pb content in blood of >100 µg/100 cc, the writer found normal porphyrin values in the urine in 35% of the cases examined. (From Archives of Industrial Hygiene and Occupational Medicine 8:490 (Abstracts), 1953)

**1416** Horiuchi, K., Fukumura, S., and Ida, N.: THERAPY FOR INDUSTRIAL LEAD POISONING. *Japanese Medical Journal*, No. 1535:3754-6 (Sept.) 1953. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School. Vol. 1, April 1949-March 1959, p. 32.

**1417** Horiuchi, K., Ida, N., and Fukumura, S.: DIAGNOSIS FOR LEAD POISONING. *Japanese Medical Journal*, No. 1526:2850-3 (July), 1953. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School. Vol. 1, April 1949-March 1959, p. 32.

**1418** Horiuchi, K., Takada, I., and Tamori, E. (Osaka City Univ., Japan): INDUSTRIAL LEAD POISONING. IV. DISTRIBUTION OF LEAD IN THE BODY OF THE HEALTHY JAPANESE OF URBAN POPULATION. 3. LEAD CONTENTS IN THE TISSUES. *Igaku to Seibutsugaku (Med. and Biol.)* 29:188-9, 1953.

Pb contents in various organs of normal humans were determined by the dithizone method (Horiuchi, et al, 1952). Results obtained, in µg/100 g fresh tissue, with number of samples given in parentheses, were: cerebrum (27) 0-20, heart (31) 0-50, lung (38) 0-80, spleen (39) 0-40, pancreas (31) 0-50, liver (41) 25-130, stomach (16) 0-30, intestine (18) 0-40, kidney (40) 20-90, adrenal gland (10) 0, thyroid gland (5) 0, testes (3) 0, ovary (3) 0, muscle (25) 0-20, skin (2) 50-130, bone (34) 23-1450, bone marrow (6) 0-50, and cartilage (6) 0-200. (From Chemical Abstracts 48:2921, 1954)

**1419** Hunter, D. (London Hosp., England): OCCUPATIONAL DISEASES WITH NEUROLOGICAL SYMPTOMS AND SIGNS. *Practitioner* 171, No. 1021:48-58, 1953.

This is a review of a number of occupational diseases. Historical illustrations of neurological signs and symptoms are presented, and important aspects of effects of various industrial agents including symptomatology, mode of action, experimental demonstrations in animals, types of treatment, methods of prevention, and legislation are discussed. The following diseases are described: cysticercosis, decompression sickness, and intoxication due to Pb, Hg, Mn, methyl chloride, tri-orthocresyl phosphate, and organic P insecticides.

**1420** India, Government of: Ministry of Labour: ENVIRONMENTAL AND MEDICAL STUDIES IN THE STORAGE-BATTERY INDUSTRY. Office of the Chief Advisor Factories, Report No. 2, 1953.

This report describes an investigation made in 1950-1951 in all the 16 Pb storage-battery plants (492 employees) then operating in India. Operations are described, and each of the factories is rated as to building construction, sanitary and related facilities, and control measures which are provided. Air tests for Pb fumes and dust were made at typical operations in each plant. Pb exposures were found to be within and only slightly over the MAC of 1.5 mg/10 m<sup>3</sup> air in only 2 of the plants. These 2 were those which had the highest ratings for physical environments and the controls provided to keep air contamination low. Occupational histories of all employees were procured, and, in addition, they were examined for subjective symptoms and such objective symptoms as Pb gum line, pallor, and tremor. No hematological examinations were made, but 216 urine specimens and 176

blood counts were analyzed for Pb, and 449 urine specimens were examined for porphyrins. In spite of Pb exposures as high as 6.0 mg/m<sup>3</sup>, there were no cases of disabling plumbism seen. Early plumbism was detected in 10.6% of the workers. Urine, blood, and porphyrin determinations were not used in making the diagnosis but were used in attempts to correlate these findings with medical examinations. Correlations between urinary Pb and exposure and between excretion and diagnosis of early plumbism were not considered to be good, but correlation between urinary Pb content and time-intensity (product of exposure in months by atmospheric exposure in mg/10 m<sup>3</sup>) and correlation between urine porphyrin and early plumbism and with time-intensity were considered to be good. It was concluded, in view of ease of performing the test, that periodic porphyrin tests were desirable as a means for screening groups of workers exposed to Pb. The report closes with a recommended code for manufacture and repair of Pb storage batteries. (From Archives of Industrial Hygiene and Occupational Medicine 10:350, 1954)

- 1421 Katsunuma, H. (Tokyo Univ., Japan): MEGAKARYOCYTES AND LEAD POISONING. Journal of the Science of Labor (Japan) 29: 113-8, 1953.

From a clinical study of Pb poisoning syndrome cases megacaryophthisis in the bone marrow was found to be one of the most reliable symptoms of Pb poisoning. (English summary) (From Chemical Abstracts 48:6029, 1954)

- 1422 Komatsu, F., Honda, S., and Shimizu, Z. (Shinshu Univ., Japan): TETRAETHYLLEAD INTOXICATION CASES IN TRAFFIC COMPANY EMPLOYEES. Journal of the Science of Labor (Japan) 29:446-54, 1953.

Some employees of a certain transit company handling gasoline containing 1-3 ml TEL/gal complained of anorexia, vertigo, lassitude, insomnia, loss of weight, and numbness of extremities, and showed clinically low blood pressure, impaired vision and hearing, low erythrocyte and hemoglobin counts, the presence of stippled and polychromatic cells, anisocytosis, and poikilocytosis. The Pb in blood and urine was in the normal upper limit in most cases and in the range of intoxication in a few cases. (From Chemical Abstracts 48:7287, 1954)

- 1423 Lapaton, S.: De la spécificité des hématies à granulations basophiles dans le saturnisme. (THE SPECIFICITY OF BASOPHILIC STIPPLING IN LEAD POISONING.) Medical Thesis, Paris, 1953, 55 pp.

Following preliminary tests with May-Giemsa-Grunewald and particularly Loeffler's Blue Stain and counts of basophil erythrocytes the author demonstrated that the results obtained with the microscope on a black field cannot be utilized and that only basophilic erythrocytes seen microscopically on a light field have any diagnostic value. The results obtained from experiments with the guinea pig and rabbit and from clinical observation prove that the presence of basophil erythrocytes is an excellent test which always reflects Pb intoxication. If the level of basophil erythrocytes has no great significance it can

still be admitted that when >10% basophil erythrocytes are present, the worker must be watched and that when they are present in numbers above 20% Pb poisoning must be suspected. (From Archives des Maladies Professionnelles 15:74 (Thesis Reviews), 1954)

- 1424 De Larrard: Sur un cas de saturnisme hydrique longtemps méconnu. (A CASE OF LEAD POISONING DUE TO WATER, THE CORRECT DIAGNOSIS OF WHICH WAS NOT MADE FOR A LONG TIME.) Proceedings, Société de Médecine du Travail de Bordeaux et de sa Région, Jan. 20, 1953. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 14:292, 1953.

A forester, consumer of large amounts of water and bouillon, had had a water supply system installed, using Pb pipes. He was soon attacked by Pb poisoning which became worse in summer when he drank a great deal of water, and improved during the winter months. The 1st and 2nd summers he was treated symptomatically; during the 3rd summer, the colics were diagnosed as gallbladder disease, and a cholecystectomy was performed. During the 4th summer a gastrectomy was proposed. Hospitalization during the observation period brought improvement in signs, and the operation was canceled. The patient was seen by the author during the 5th summer. Analysis of the water showed Pb content of 33 mg/l. Condemnation of the water supply system brought about apparent recovery. Three years later, arterial pressure rose to 18; urea level, which had been 1.25 g during the most severe periods, dropped to 0.40 g, then rose to 0.60 g. Neither stippled cells nor Pb line had ever been observed. Ca and vitamin D used in therapy gave good results.

- 1425 L'Épée, P., and Lazarini, H.J.: Stomatite saturine. (LEAD STOMATITIS.) Proceedings, Société de Médecine du Travail de Bordeaux et de sa Région, Feb. 24, 1953. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 14, No. 3:293, 1953.

The patient (23 yr old) had been employed in the cutting of metal plate of a ship, painted with red Pb, by means of a cutting torch. After doing this work for <3 wk he developed a severe stomatitis, bad breath, voluminous visible and painful submaxillary adenopathy, fever, fatigue, insomnia, and severe ulceration of gums. Proof that this condition was caused by Pb is considered by the author in the fact that the patient also had slight attacks of Pb colic and Pb anemia. The rapidity and intensity of the symptoms are due to the fact that this unfinished ship had been repainted several times with red Pb only, with no covering paint, so that the cutting torch caused vaporization over a large expanse and not only at the point of the flame.

- 1426 Marconi, E. (St. Anna Hosp. Castelnuovo Monti, Italy): Un saturnismo subacuto da autoimpallinamento accidentale trattato con mercaprol (B.A.L.); aspetti etiopatogenetici e medico-legali. (SUBACUTE SATURNISM CAUSED BY ACCIDENTAL SELF-INFLICTED WOUND TREATED WITH DIMERCAPROL

(BAL): ETIOPATHOGENIC AND MEDICOLEGAL ASPECTS.) Archivio di Medicina Interna (Parma) 5:159-74 (Sept.-Oct.), 1953.

See Abstract No. 1498.

- 1427 Massachusetts Division of Occupational Hygiene (Boston, Mass.): JEWELRY ENGRAVER ILL FROM LEAD POISONING. Occupational Health 13:72 (May), 1953.

A new source of occupational Pb poisoning came to the attention of the Massachusetts Division of Occupational Hygiene when a doctor on the staff of a veterans' hospital sent to the Division laboratory a sample of urine for Pb analysis. The patient on admission to the hospital had complaints indicative of Pb poisoning: anorexia, nausea, vomiting, constipation and abdominal pain. At this time, a well-defined Pb-line was noted, and he had basophilic stippling of red blood cells. The possibility of Pb poisoning was therefore very likely. Chemical analysis confirmed the diagnosis, the values for both urinary Pb and coproporphyrin being extremely high. Treatment was then begun with EDTA. The rate of Pb elimination during this therapy was watched by repeat urinalyses, and the high Pb content results were proof that the patient was excreting Pb. The patient, a jewelry engraver, was admitted to the hospital. Inquiry as to the materials he employed brought out the fact that he used Intense White during the previous 6 mo and Chinese White during 8 yr before that, both water-color paints. He had the habit of repeatedly wetting his finger on his tongue, dipping it into the pigment, and rubbing it on the jewelry he was working on, to make an opaque surface for roughing out the design prior to the actual engraving. Meanwhile, samples of the Chinese White and Intense White were subjected to chemical analysis, which revealed that the Chinese White paint contained a Zn pigment and the Intense White, a Pb carbonate. To determine the extent of the Pb hazard from this trade, a spot check was made among jewelry shops. It was found that other methods of coating metal prior to engraving are generally used, where the finger was not moistened with the tongue. To prevent further cases of Pb poisoning from this source, a number of dealers of artists' supplies was advised to inform their sales force of the Pb content of the Intense White and to warn customers to use it in a manner which takes into account its inherent poisonous possibilities.

- 1428 Montesana, G. (Univ. Palermo, Italy): Considerazioni su un caso di Encefalopatia Saturnina. (A CASE OF SATURNINE ENCEPHALOPATHY.) Sicilia Sanitaria 6:829-35 (Nov. 15), 1953.

A 42-yr-old man from S. Stefano di Camastra had worked from age 15 in the ceramics industry, using Pb-containing paints and glazes. The present illness began ~3 yr ago when he experienced mild precordial pains. For ~3 mo before seen he had suffered colic-type pains and more recently, severe headaches, vomiting, and pronounced asthenia. He had discontinued work ~1 mo ago. His family stated that he had been exhibiting progressive deterioration of general health and of mental capacity, especially memory. Among the clinical

findings, increased liver and spleen were noted. Blood picture showed no stippled cells, and there was no gingival Pb line. Pb in urine was 420.80 µg/24 hr (3-day average, by Preti and Maugeri's method); porphyrins, 128 µg/24 hr. EKG showed moderate signs of myocardial involvement; X rays of the gastrointestinal tract gave evidence of gastritis and spastic colitis. The course of his illness and treatment, principally with nicotinic acid, throughout the 3-mo hospitalization are described. Within that time complications of bronchopneumonia and furunculosis arose. Diagnosis was Pb poisoning with signs of encephalopathy and nephromyocardiosclerosis, hypochromic anemia and chronic bronchitis with basilar emphysema. Diagnosis of Pb poisoning was based on work history, intestinal colic, and elevated elimination of Pb and porphyrins.

- 1429 Messmer, E. (Heidelberg Med. Univ. Clinic, Germany): Zur Frage der Bleibenzinschädigung. (LEADED GASOLINE INTOXICATION.) Sammlung von Vergiftungsfällen 14:276-83, 1953.

This is a lengthy discussion of the compensability of disability for nervous disorders claimed on the basis of Pb poisoning. The claimant had been exposed to contact with leaded gasoline in 1943 and had suffered a mild case of Pb poisoning from which he had recovered completely. It was found that no compensability existed on the basis of Pb poisoning. The complaints were not the result of this illness, but were of constitutional origin.

- 1430 Morelli, A. (Univ. Florence, Italy): Su tre casi di intossicazione acuta da piombo tetraetile. (THREE CASES OF ACUTE POISONING BY LEAD TETRAETHYL.) Folia Medica (Naples) 36, No. 6:440-3, 1953.

In this instance, TEL poisoning developed in a man, his wife, a 32-yr-old pregnant woman, and in their daughter, 9 yr old. The woman had obtained a bottle of fluid which she thought was gasoline and used it to clean the floor of their bedroom. Since the floor was of brick, it absorbed a great deal of the fluid. During the night that followed the father arose at 3 o'clock to go to work. He did not feel well, had nausea and several attacks of vomiting, but thought this to be due to stomach upset. After a bout of diarrhea he felt perfectly normal. The woman and the daughter arose about 8 AM, both with vomiting, nausea, diarrhea and headaches. The woman, believing that the liquid she had used on the floor was responsible, washed the floor with water and she and her daughter slept again in the same room. The following day both felt very much worse and called a physician who found them in a psychotic state, especially the mother, with motor agitation, becoming more aggravated up to loss of consciousness. The girl remained conscious, but talked senselessly. Both were anuric from the 2nd day and died the day after the physician's visit. The findings on the part of the nervous system, respiratory, cardiovascular, and digestive are described for both cases. The type of poisoning described is likened by the author to that incurred in the cleaning of tanks that had contained TEL-gasoline.

- 1431 Müller, K. (Ind. Superv. Board, Darmstadt,

Germany): Zur Kasuistik der Bleitetra-  
äthylvergiftung. (TETRAETHYL LEAD POI-  
SONING; CASE REPORTS.) Zentralblatt für  
Arbeitsmedizin und Arbeitsschutz 3:8-9  
(Jan.), 1953.

Four cases of TEL poisoning are described. Fol-  
lowing the publication of P. Fischer's report in  
1950, special efforts were made to eliminate all  
hazards at this particular plant. Workers engaged  
in cleaning tanks were provided with protective  
clothing, masks. However, after 3 wk, the suits  
became unusable because of daily cleaning, and  
certain parts were replaced with rubber. The  
neck region no longer was protected, and it is  
believed that this gave rise to skin absorption of  
TEL. In TEL poisoning, diagnosis is based almost  
entirely upon central nervous symptoms: blood  
and urine Pb levels do not give reliable indication  
of the course of the poisoning. These 4 cases of  
poisoning occurred after about 6 wk exposure and  
3 wk after the incidence described by Fischer;  
therefore probably as a result of insufficient  
protection against TEL. All 4 cases showed  
disturbances of the nervous system. Pb levels in  
urine were 0.348, 0.176, 0.359, and 0.329 mg/l;  
blood levels were 0.03, 0.056, 0.062, and 0.063  
mg%.

- 1432 Njemirovskij, Z.: (DIAGNOSTIC SIGNIFI-  
CANCE OF THE LEAD LINE.) Arhiv. Hig.  
Rada 4:500-10, 1953.

The author reviews various opinions regarding the  
diagnostic significance of the Pb line. In order  
to clear some controversial points the author ex-  
amined 50 workers of a storage battery plant and  
50 workers in a Pb mine and smelting plant. A  
control group consisted of 50 metal workers who  
had not been exposed to Pb. The results are sum-  
marized as follows: (1) the Pb line is not an  
essential symptom of Pb poisoning; (2) there are  
other factors besides Pb and H<sub>2</sub>S which contribute  
to the formation of the Pb line; they are probably  
related to the physiological state of the epithe-  
lial tissue of the gingiva; (3) oral hygiene plays  
a secondary role in the formation of Pb line.  
(From Industrial Hygiene Digest 18:518, 1954)

- 1433 Peñalver Ballina, R. (Havana Med. Coll.,  
Cuba): Tratamiento del saturnismo con el  
derivado calcico del acido etileno diamino  
tetra acetico. (TREATMENT OF LEAD POISON-  
ING WITH THE CALCIUM DERIVATIVE OF ETHYL-  
ENEDIAMINETETRAACETIC ACID.) Boletín del  
Colegio Medico de la Habana 4:289-91  
(July), 1953.

The literature on the clinical use of CaNa<sub>2</sub>EDTA in  
the treatment of heavy metal poisoning is reviewed,  
with special reference to Pb poisoning. The first  
case of Pb poisoning (storage battery worker)  
treated with this drug in Cuba is mentioned. The  
1st day he received 1 ml in 250 ml 5% glucose by  
iv infusion over 1 hr to determine tolerance; then  
2 hr later 4 ml in the same manner. In the follow-  
ing 4 days 2 g/day were administered and after a  
5-day interval, a 2nd course was given; total ad-  
ministration was 19 g EDTA.

- 1434 Queries and Minor Notes: LEAD ENCEPH-  
ALOPATHY. Journal of the American Med-

ical Association 151:165, 1953.

The inquirer states that: a 46-yr-old man whose  
personality hitherto had been well-integrated and  
"normal" now has anxiety, decreased libido, sudden  
tearfulness unprovoked and unaccompanied by feel-  
ings of sadness, irritability, and failure to com-  
prehend as he formerly did. Results of hematolog-  
ical examination were normal. In 1949, he had Pb  
poisoning, which was diagnosed in a hospital.  
There has been no exposure to Pb since. Was the  
Pb responsible for the present psychiatric syn-  
drome? He had Pb line, stomatitis, gastrointesti-  
nal symptoms, hematological changes and Pb enceph-  
alopathy in 1949 and had two previous attacks in  
1947 and 1948. There are no extrinsic psychogenic  
factors now.

Answer: The symptoms described are not unusual  
in the encephalopathy produced by plumbism and  
are compatible with this diagnosis. Persons with  
Pb poisoning usually have absorbed Pb for long  
periods, and, while a deleading program may remove  
most of the Pb from the trabeculae, a considerable  
quantity still remains in the cortical bone. This  
Pb is potentially dangerous and may be released  
at some future date if the patient is subjected  
to unfavorable influences, such as chronic or  
acute infections, under fatigue, improper diet  
with malnutrition, or alcoholism. The presence  
of Pb in the blood in concentrations >0.06 mg/100  
ml and in the urine in concentrations >0.1 mg/l,  
the presence of a Pb line, or stippling of the  
red blood cells is indicative of absorption. If  
these studies are negative, psychiatric consulta-  
tion is indicated.

If a diagnosis of plumbism is established, rapid  
deposition of the circulating Pb should be effect-  
ed. The patient should be placed on a high Ca (2  
g/day), adequate P (1.5 g/day) diet. This may be  
in the form of milk, cheese, legumes, and greens  
and may be supplemented by dicalcium phosphate  
and Ca gluconate taken orally. Vitamin D in doses  
of 1,200-1,500 units/day should be prescribed.  
The procedure of choice after cessation of symp-  
toms is controversial. Some workers recommend a  
slow deleading or detoxification program while  
others suggest no further therapy other than avoid-  
ance of precipitating factors as listed above,  
with Ca and vitamin D supplements taken during  
periods of stress or infection.

- 1435 Queries and Minor Notes: ABORTIONS AND  
EXPOSURE TO LEAD. Journal of the Ameri-  
can Medical Association 152:1494, 1953.

The questioner stated that a patient has just had  
her 2nd spontaneous abortion, both at 3-1/2 mo  
gestation; the 1st occurred in June, 1952, the 2nd  
in March, 1953. During her 2nd pregnancy, she  
was taking prophylactic Proloid (a thyroid prepa-  
ration) and diethylstilbesterol. She had no symp-  
toms of abortion until the event took place with  
typical bleeding and cramps. She has been working  
with Pb styphnate and butyl acetate since Novem-  
ber, 1950. Could there be any connection between  
the abortions and the patient's exposure to these  
chemicals?

Answer: Pb could have induced the abortions  
provided sufficient exposure occurred, but it is  
recognized that other causes could have operated  
in bringing them about. If this patient has re-



sumed work, it may prove possible to appraise the extent of exposure. Since Pb styphnate commonly is handled in small quantities and sometimes wet, determination of Pb in the general workroom atmosphere may be without value. The exposure, if any, is likely to be sharply local and may represent "hand-to-mouth" transfer, even though gloves may have been worn. Particularly if this patient has resumed work, but even if she has not, the urinary level of Pb should be determined. In addition, although it is not a conclusive test, examination for cellular stippling on a quantitative basis should be done, and the basophilic aggregation test should be conducted. If other persons are engaged in identical work, some or all should be tested for Pb in the urine and blood; however, negative results in other employees may not be significant, since exposure may have been strictly individual. Exposure to Pb on the part of the husband would be significant and should be determined.

**1436** Queries and Minor Notes: LEAD POISONING. Journal of the American Medical Association 153:608, 1953.

Whether in screening of factory workers for possible exposure to Pb, the presence of basophilic stippling of red cells in an otherwise normal blood picture is considered pathognomonic of chronic Pb poisoning, was answered by saying that mere demonstration of qualitative stippling of red cells is insufficient evidence on which to base the diagnosis of Pb poisoning. Quantitative enumeration has some merit, and the basophilic aggregation test is still superior. Yet the indication or enumeration of any formed elements of the blood is not pathognomonic of Pb poisoning, such procedures may be of value in the screening of numbers of exposed workmen. Greater reliance may be placed on the quantitative determination of Pb in the urine or blood.

**1437** Rageth, S. (Med. Serv. Canton Hosp., Chur, Switzerland): Bleivergiftung nach Sprengunfall. (LEAD POISONING AFTER BLAST INJURY.) Zeitschrift für Unfallmedizin und Berufskrankheiten 46:207-18 (Sept. 15), 1953.

After reviewing the literature (61 references, symptoms given) on the toxic effect of Pb-containing retained missiles, the author reports the case of a 60-yr-old forester who developed a chronic Pb poisoning 6 yr after injury from Pb chips. Previous illnesses were catarrh of the upper air passage in 1938 and chronic gastroduodenitis in 1944. In 1945, he was injured in an explosion by cartridge chips containing Al, Pb azide (1.4 g in 7 cartridges) and hexogen. Hexogen can be injurious to the nervous system, but not in the amount present in the charges. Direct consequences were tinnitus, impairment of hearing, and a traumatic cataract with secondary glaucoma in the left eye. In 1951, he developed heart trouble and was hospitalized. Other symptoms were pallor, poor vision in the left eye, shortness of breath, severe headache, nausea, dizziness, impairment of hearing, tinnitus, insomnia, irritability, loss of memory, fatigue, decreased ability to work, loss of appetite and weight, nocturia, but no colic or constipation.

He showed a psychoorganic syndrome with reduced learning ability, retardation, deterioration of optic perception, reduced acoustic perception, failing concentration and increased subjective fatigability. There were some disturbances of the nervous system, mainly on the left side. Blood showed 4,450,000 red cells, 6000 leukocytes, no basophilic stippling, polychromatic cells or reticulocytes and urine showed glucose values up to 1.4%. Pb was determined in blood and stool in July, Nov, Dec, 1951 and July, 1952. Values in blood were 147, 280, 15, 92 µg/100 g and in stool, 65, 3, 16, 320 µg/100 g, respectively. The patient was treated with Na iodate, Na bicarbonate and Ca as well as with spasmolytic drugs. The Pb chips were surgically removed from the subcutis, but he still suffered from chronic symptoms. He changed his occupation and became a semi-invalid subsequently.

The author discusses the pathology of Pb-containing foreign bodies, pointing out that there can be a latency of 12 days to 48 yr. Therapy is discussed and early surgery is recommended when the projectiles are embedded in the bone marrow or joint cavities.

**1438** Rigner, K.G., Sjöholm, S.G., Sjöholm, O., and Vesterberg, R.: (LEAD EXCRETION OF LEAD HARDENERS IN A MODERN SWEDISH TOOL FACTORY.) Nord. Hyg. Tidskr. No. 3/4: 41-7, 1953.

An orientation is given on the amount of Pb and coproporphyrin (CP) in urine and on the occurrence of basophilic stippling (BS) in the blood of a group of workers who had been slightly exposed to Pb during their work as Pb hardeners in a modern tool factory. The amount of Pb in the urine of these workers was higher than the amount in the control group. The CP and BS values were on the same level as those of the control group. The exposure had not caused any evident symptoms of Pb poisoning. Attention is drawn to the difference in Pb in urine, and to none in CP and BS. Emphasized also is the importance of cooperation between people with medical, technical, and analytical-chemical competence in order to solve the problem of Pb exposure. It is necessary to perform investigations like the present one on groups of subjects in many factories in which cases of Pb poisoning have been reported as well as in those in which this has not been the case. (A.M.A. Archives of Industrial Hygiene and Occupational Medicine 7:444, (Abstracts) 1953)

**1439** Rodier, J., and Rodi, L. (Inst. Hyg., Morocco): Imprégnation saturnine et exploration hépatique. (LEAD ABSORPTION AND LIVER FUNCTION TESTS.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 14, No. 4: 364-6, 1953.

The reason for this investigation was the controversial view of some authors concerning liver damage as a result of Pb poisoning, some minimizing it, others tending to attribute it to Pb if the patient involved had been so exposed. The authors selected 43 workers of various occupations who had been in contact with Pb for an average of 3 yr and showed definite evidence of Pb absorption. Certain liver tests were performed on them and on a control

group. The battery of tests used consisted of a determination of the ratio of esterified cholesterol to total cholesterol, a thymol turbidity test, and a study of the cephalin cholesterol. The results of these tests did not show definitive differences between the 2 groups. The authors were struck by the fact that so many of the subjects considered to be healthy exhibited positive results, and wondered whether this was attributable to the parasitic diseases to which the Moroccans were liable. The authors conclude that Pb absorption is not accompanied by distinct liver disorders at least not insofar as fat and protein metabolism are concerned; however, the probability of a connection between Pb absorption and liver insufficiency is not easily dismissed.

- 1440** Rodman, M.J. (Rutgers Univ., Newark, N.J.): A NEW THERAPEUTIC AGENT IN LEAD POISONING. *American Professional Pharmacist* 19:987-91, 1027 (Dec.), 1953.

The incidence, sources, and diagnosis (in adults and children) and treatment of Pb poisoning are briefly reviewed and discussed. Prior to the introduction of CaEDTA, there was no safe way to control the excretion of Pb from the body. BAL, potentially toxic in itself, may actually cause the condition of the Pb victim to become worse. The advantages and effectiveness of EDTA are discussed. The suggested daily dose of CaEDTA is 1 g in 24 hr by intravenous drip at a rate of 0.5 g/hr/30 lb body weight. This is continued for 3-5 days with a total maximum/wk of 5 g. Courses should be separated by '5 days' rest periods.

- 1441** Salvini, M. (Univ. Padua, Italy): Contributo allo studio delle cardiopatie nel saturnismo. (HEART DISEASE IN LEAD POISONING.) *Folia Medica (Naples)* 36, No. 5:337-71, 1953.

The author undertook a study on 56 patients suspected of having Pb poisoning, for 11 of whom he proposed 3 classifications on the basis of abnormal EKG findings: (1) "Pb poisoning in cardiac disease" comprising "carriers" of the disease who become exposed to Pb risk; (2) "heart disease in Pb poisoning" comprising patients with clinically pathologic heart picture and partial manifestations of the Pb poisoning syndrome; (3) "Pb-poisoning induced heart disease" comprising negative extraoccupational cardiac history, with onset at a definable time and at an age <50 yr, after severe exposure to Pb poisoning risk. Among the latter, the incidence was 8.3% (4 cases of 48). The workers' age and exposure period, clinical findings (anemia, colic, nephropathy, neuropathy), types of signs, EKG findings, are shown individually in a table.

- 1442** Savičević, M. (Ind. Hyg. Inst., Yugoslavia): Povodom prvih zapazanih trovanja tetraetilolovom u našoj zemli. (OUR FIRST CASES OF POISONING WITH TETRAETHYLLEAD.) *Glasnik Higijenskog Instituta* 2:46-63, 1953.

The first recognized cases of TEL poisoning in Yugoslavia are described. The 1st of the 6 cases was a woman, 25 yr old, who developed an acute psychosis characterized by delirium, hallucina-

tions and disorientation, with cyanosis, insomnia and hyperhidrosis. Bronchopneumonia developed, but responded to chemotherapy, and the patient made a complete recovery 26 days after the onset of illness. Signs of mental disturbance were observed in her husband; it was then found that their 2 children were hospitalized for treatment of an acute mental sickness, and poisoning was therefore suspected. Investigation of their home showed that they had sprayed the walls and the door of their house with TEL for the purpose of exterminating bed bugs. Two of the cases were severe and the 4 others showed slight or moderate degree of mental disturbance.

Because of the increasing use of Pb gasoline, the author discusses briefly the chemical characteristics of TEL, mode of action, clinical picture, treatment of poisoning and preventive measures. (13 references)

- 1443** Shiels, D.O., Palmer, G.R., Cornish, P.E., and Kearley, E.J. (Ind. Hyg. Div. Dept. Health, Victoria, Australia): PORPHYRINURIA IN PERSONS EXPOSED TO LEAD HAZARDS. *Medical Journal of Australia* 2:171-6, 1953.

Shiels and associates say that during the last 2-1/2 yr it has been the practice in their division to determine the coproporphyrin (CP) content of all specimens of urine examined for Pb in an attempt to assess the value of this very rapid test as an aid in the prevention and diagnosis of Pb poisoning. This paper describes the results obtained from the examination of 279 specimens of urine from persons who had had various degrees of exposure. Some had just commenced work in a Pb hazard; some had been exposed to Pb hazards of various degrees of severity for long periods; some actually had Pb poisoning. Summarizing the results of 279 determinations of Pb and CP in urine and of 240 stipple-cell counts (SC), the authors say that the mean values of Pb in urine and the corresponding mean CP values show a close correlation between the 2 up to mean values of 0.376 mg/l and 1.74 mg/l, respectively. Similar though not so close correlation exists in regard to the total SC counts and the CP in urine up to mean values of 13,000 SC/million red cells and 1.1 mg of CP/l of urine. There is a fairly close correlation between blood Pb values and CP in urine values up to 0.17 mg/100 ml of blood and 2.25 mg/l of urine. The authors feel that from the point of view of routine control of employees exposed to Pb hazards the determination of the urinary CP content has certain advantages over other tests, especially when a large number of persons are involved. The test can be performed in ~10 min, whereas urinary Pb determinations may take several hours. Although a SC count can be carried out in ~10 min for the actual count, the performance of a large number of these is tedious, and the preparation of slides, making of films, fixing and staining, washing and drying consume considerable time. One advantage of the SC count is that the film provides a more or less permanent record, which may be examined or produced many months after being made. Whereas urine may be accidentally or purposely contaminated with Pb, the occurrence of accidental contamination with porphyrin

may be ruled out, and the purposeful contamination with the appropriate quantity is possible only to a very skilled person. The determination of CP in urine is also of value in helping to decide on the question of possible contamination with Pb. In a case in point a high urinary Pb value was obtained (0.6 mg/l) in a sample of urine sent in for analysis. The CP result was also high (0.7 mg/l), indicating that the patient had certainly had considerable absorption of Pb and that the sample was probably not contaminated with Pb. Disadvantages are that the porphyrin in the urine is not stable under the influence of light, and hence the determination must be carried out shortly after the urine has been collected and on samples which have been kept in amber-colored bottles and/or in the dark. The concentrations of CP in the urine are not quite so closely related to the clinical conditions as are the SC counts. It has also been pointed out that abnormal amounts of CP in the urine indicate damage to the organism, whereas abnormal amounts of Pb do not. This distinction, though valid, is not quite of so much importance as it may appear to be at first sight, since experience with >2000 analyses for Pb in urine has indicated definitely that abnormally high values are in the great majority of cases associated with signs and symptoms which indicate damage to the organism. In the diagnosis of doubtful cases of Pb poisoning, it is not considered advisable to abandon SC counts the determination of Pb in urine or blood; rather these studies and the CP determination in urine should continue to be made. Furthermore, it is advisable in addition to determine the ratio of monocytes plus large lymphocytes to small lymphocytes. (20 references)

- 1444 Sidbury, J.B., Jr., Bynum, J.C., and Fetz, L.L. (Communicable Dis. Center, US Publ. Health Serv.; Emory Univ.; Georgia Dept. Publ. Health, Atlanta): EFFECT OF CHELATING AGENT ON URINARY LEAD EXCRETION. COMPARISON OF ORAL AND INTRAVENOUS ADMINISTRATION. Proceedings of the Society of Experimental Biology and Medicine 82: 226-8, 1953.

Seven patients (5 adults and 2 children) with either symptoms of Pb poisoning or excessive amounts of Pb in their blood and/or urine, were treated with  $\text{CaNa}_2\text{EDTA}$ . To the adults, 1 g was administered iv on the 1st day and 2.0 g/day thereafter for a total of 5 days. Children were given a test dose of 1/10 the calculated daily dose, and subsequently 30 mg/kg in 5% glucose in water twice daily. Orally, the dose for both adults and children was 30 mg/kg twice/day. In all cases, marked increases in urinary Pb were obtained. The iv administration was the more effective. Preliminary results indicated that EDTA is the most effective agent proposed for the treatment of Pb poisoning. Side reactions were minimal with the dosage schedule employed.

- 1445 Suntuč, F. (Occup. Dis. Ind. Hyg. Clinic, Prague, Czechoslovakia): Naše zkušenosti s léčbou otravy olovem citranem sodným. (EXPERIENCE WITH THE TREATMENT OF LEAD POISONING WITH SODIUM CITRATE.) Pracovní Lékarství 5:320-5 (Dec.), 1953.

Treatment of Pb poisoning with Na citrate (5-20 g daily orally, for 10-28 days) in 17 patients was compared with treatment of a similar group with Fe and liver extracts. The workers had been removed from exposure shortly before treatment. The patients' complaints cleared up after a few days of treatment. A statistically significant decrease in blood Pb was observed, although the course of the blood-Pb curve was not affected. No effect was seen on the hemoglobin content. A decrease in stippled cells was observed only after large doses of the citrate. Urinary porphyrins were not significantly altered nor was the Pb concentration in the urine. No unfavorable reactions of any sort were observed, only sporadically did swelling of the legs develop. An exacerbation of Pb poisoning was not observed. Comparison with Fe and liver extracts led the author to the conclusion that both methods are approximately the same in so far as the above criteria are concerned.

- 1446 Symanski, H.: (RELATIONS BETWEEN WORK AND FOCAL INFECTIONS.) Ann. Univ. Saraviensis 1:306-16, 1953.

A review and discussion of the role of Pb and other toxic substances in focal infections in industrial workers. (32 references) (From Chemical Abstracts 52:18960, 1958)

- 1447 Takada, I. (Osaka City Univ. Med. School): INDUSTRIAL LEAD POISONING. IV. THE DISTRIBUTION OF LEAD IN THE BODY OF HEALTHY URBAN POPULATION OF THE JAPANESE. 1. LEAD CONTENT IN THE WHOLE BLOOD. Igaku to Seibutsugaku (Med. and Biol.) 26:245-7, 1953.

The normal Pb content in the blood of the healthy urban population, as determined by the dithizone method, was  $\sim 31 \mu\text{g}/100 \text{ g}$  in 95% of  $\sim 300$  samples tested. (From Chemical Abstracts:11308, 1953)

- 1448 Takada, I. (Osaka City Univ., Japan): INDUSTRIAL LEAD POISONING. IV. DISTRIBUTION OF LEAD IN THE BODY OF THE HEALTHY JAPANESE OF URBAN POPULATION. 2. LEAD IN THE URINE AND FECES. Igaku to Seibutsugaku (Med. and Biol.) 28:74-6, 1953.

The excretion of Pb in the urine and feces of healthy Japanese averaged  $\sim 44 \mu\text{g}/\text{day}$  (or  $\sim 46 \mu\text{g}/\text{l}$ ) and  $\sim 240 \mu\text{g}/\text{day}$ , respectively. (From Chemical Abstracts 48:2921, 1954)

- 1449 Tara, M.S. (Social Security Reg. Center Occup. Dis., Paris, France): Les diagnostics de laboratoire du saturnisme. (LABORATORY DIAGNOSIS OF LEAD POISONING.) Proceedings of the Meeting on Social Medicine and Industrial Hygiene. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 14:396-8, 1953.

In seeking to establish the diagnostic value of different laboratory methods in 185 cases of Pb poisoning and 75 controls, it was decided that the determination of ketone bodies, of urinary urobilin, and urinary pH, never led to useful conclusions; nor is the establishment of Ambard's constant practical. For the determination of renal involvement in Pb poisoning the levels of urinary albumin

and of blood urea are sought by the author. Levels >0.50 were found in 34.5% of the Pb poisoned and in 12% of normal individuals. It is believed that high blood urea levels are found rarely in acute intoxication, but that they are rather an indication of a persistent but mild poisoning that is repeated over a period of time. In regard to basophilic stippling (BS) of erythrocytes, increased numbers can be considered only as an indication of exposure but not as a certain sign. In the total of 260 persons 28% were found to have >50 BS/100 leukocytes. Anemia is not a consistent sign, having been found in 45% of Pb poisoned and in 17% of healthy persons. The author does not place any reliance on blood Pb values, since this gives the quantity of Pb in the blood at a given moment, and not that which is in combined form in the organism. He recognizes that its determination at close intervals permits the institution of effective treatment; levels of >80 µg were found in 16 of the 75 controls, and in 122 of 185 Pb poisoned. Determination of coproporphyrin III is a difficult process and its presence is not specific for Pb poisoning. Because of all these inconsistent results, the author has sought a more reliable method of detecting early Pb poisoning, and believes to have found it in the determination of the indoxyl levels in the urine.

- 1450 Tara, S., Cavigneaux, A., and Delplace, Y. (Reg. Center Occup. Dis., Public Health, Paris, France): Le saturnisme du saladier. (LEAD POISONING TRACED TO SALAD BOWL.) Ann. Méd. lég. criminol. police sci., Méd. Sociale, et toxicol. 33:63-6, 1953.

The case reported is that of a woman who for 10 yr had supervised workers engaged in soldering of connecting wire to small transformers and condensers and who had suddenly become ill following the midday meal with colic and diarrhea which persisted for 2 days. After transient weakness and general malaise she recovered without return of gastroenteric signs. Four weeks after the onset of the illness, a dentist saw a Bi line on her gums and another physician made the diagnosis of stomatitis and anemia caused by Pb, as an occupational illness. The authors found a paradentosis with a diagonal deep-blue shiny line on the gum, a mild secondary anemia, coproporphyrin III in the urine and a blood Pb content of 140 µg which dropped to 20 µg. On the basis of her work history, an occupational Pb poisoning was denied. Upon the suggestion of Dérobert, Hadengue and Lebreton (Ann. méd. légale No. 1-2, Jan.-Feb., 1951, pp. 60-4) the authors tested the Pb content of 1/2 l. of dilute vinegar after standing for 2 days in a poorly glazed salad bowl, and found 12.5 mg. This offered an explanation of the alimentary origin of the poisoning. Rivemale also had been able to demonstrate the release of considerable quantities of Pb in pottery ware. (From Deutsche Zeitschrift für die gesamte gerichtliche Medizin 42:648 (Abstracts), 1954)

- 1451 Tara, S., Cavigneaux, A., and Delplace, Y. (Reg. Center for Occup. Dis., Soc. Security, Paris, France): Dolichocolon et saturnisme. (DOLICHOCOLON AND LEAD

POISONING.) Proceedings of the Society of Industrial Medicine and Hygiene. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 14:154-6, 1953.

The authors pointed to the temptation on the part of many physicians to attribute to Pb poisoning diseases which may have characteristics in common with the occupational disease, but which may be of entirely different etiology. They also protested against the assumption that hyperazotemia and the presence of stippled cells mean Pb poisoning and warned against false laboratory results in regard to the former and difference in interpretation of the latter. Two cases of dolichocolon were presented where, although Pb exposure and absorption did exist, the disease could not be attributed to Pb poisoning, but was idiopathic dolichomegacolon. Case 1. A 19-yr-old man, who had worked for 5 mo in a plant making vitrifiable enamel, was exposed to Pb-containing dusts. Examination on Nov. 5 showed 3,000,000 red cells, 8000 white cells, 31 stippled erythrocytes/100 leukocytes and the worker was hospitalized on Nov. 7. A blood test on Dec. 6 showed 180 stippled erythrocytes/100 leukocytes and the diagnosis of Pb poisoning was made. Examination on Dec. 22 showed 4,300,000 red cells, 86% hemoglobin, 5400 white cells with 52% granular, 2 stippled erythrocytes/100 leukocytes, blood urea 0.42%, Pb in blood 60 µg, urinary indoxyl 45 mg, coproporphyrin III, 200 µg. However, there were no evident signs of Pb poisoning, even though blood Pb was elevated. Checking the file at the hospital led to the diagnosis of megadolichocolon.

The findings in Case 2, a 48-yr-old North African, employed in a Pb recovery works in April, and hospitalized in July for abdominal pains, constipation and vomiting with 0.90% azotemia and a diagnosis of appendicitis, were similar. There were no signs of Pb poisoning, 6 stippled erythrocytes/100 leukocytes and 300 µg porphyrins/l were present. The patient returned to work in late August, but abdominal pains and constipation reappeared and he was hospitalized again in September with 1.15% azotemia. Examination in October showed no Burton line, 3,940,000 red cells, 9400 white cells, 67% granulocytes, 18 stippled erythrocytes/100 leukocytes, 0.27% azotemia, Pb in blood 110 µg/100 ml, no albuminuria, porphyrin 100 µg/l urine, indoxyl 35 mg/l urine. Radiologic examination in November showed a significant dolichomegacolon.

- 1452 Tomita, N., Sato, B., and Hirashima, N.: (POST-MORTEM EXAMINATION OF A BODY POISONED BY LEAD ARSENATE.) Science and Crime Detection (Japan) 6:214-25, 1953.

A report. (From Chemical Abstracts 48:4374, 1954)

- 1453 Vigliani, E.C.: Expériences de nouveaux traitements de la colique saturnine. (EXPERIENCE WITH NEW TREATMENTS OF LEAD COLIC.) Bruxelles-Méd. 33:651-64 (Mar. 29), 1953.

Seven patients suffering from Pb colic admitted to the author's clinic in Milan since November 1951 have been treated with intramuscular cortisone. In 6 patients no other treatment was given, but

in the most recent case intravenous Ca therapy had been employed. Total dosage of cortisone was up to 500 mg which led to rapid relief of abdominal pain, and relief of constipation in 24-50 hr. When comparison was made with patients treated in the clinic with 2:3 dimercaptopropanol (BAL) and with intravenous Ca, cortisone was shown to be effective in reducing the duration of colic, and there were fewer abdominal pains during convalescence. Patients treated with cortisone recovered well-being, appetite and strength more quickly than those on other regimens, in spite of the persistence of anemia in the majority of cases. Blood and urinary Pb concentrations, and coproporphyrinuria, were not significantly affected by cortisone, nor was marked increase of urinary K observed. An initial oliguria was followed by polyuria with abundant excretion of NaCl. Urinary 17-ketosteroids were diminished at first, but later returned to original values. Blood pressure was not raised by the cortisone treatment, but as a rule was lowered by termination of colic. The mechanism of the beneficent effect of cortisone on Pb colic is not known. A number of possible explanations are discussed. (From Bulletin of Hygiene 29:173, 1954)

- 1454** Voinar, A.O. (Stalin Med. Inst., Stalino-Donbass, USSR): Kolichestvennoe sodержanie mikroelementov v yadrakh nervnykh kletok po dannym emissionnogo spektral'nogo analiza. (CONTENT OF MICROELEMENTS IN THE NUCLEI OF NERVE CELLS AS MEASURED BY EMISSION SPECTRA.) Biokhimiya 18, No. 1:29-33, 1953.

In addition to the organic and mineral substances in cellular nuclei, a metal component is present in many enzymes, such as alkaline phosphatase, arginase, cytochrome oxidase, and carbonic anhydrase, so that a knowledge of the microelements in tissues becomes important. By a method described, the author isolated the cellular nuclei of the brain. Twenty-three microelements were determined qualitatively and quantitatively in the nuclei of the cerebral and cerebellar cortex of man, cow, and dog. Among these, Al, Ga, Pb, Li, Fe, Si, Ni, Mu, Zn, Mo, Ba, Ti, Cu, Ag, and Co were always present, with the heavy metals in relatively large concentrations. (Pb content in ash was 0.1% in man and 0.08% in animals.) Ge, Sn, Cd, and Sr were found less frequently, and K was always absent.

- 1455** Weber, O.A., and Valic, F.: (RELATIONSHIP OF BLOOD LEAD CONTENT AND URINARY COPROPORPHYRIN.) Arhiv Hig. Rada 4:511-20, 1953.

Urinary coproporphyrin and blood Pb were determined in 154 subjects. The regression of the logarithms of the urinary coproporphyrin concentration upon the logarithms of the Pb concentrations in blood and vice versa were found to be linear in the concentration range above the normal values. The regression equation was computed and the 95% confidence limits for the predicted values of coproporphyrin concentration from the measured concentration of the blood Pb and vice versa are given. On the basis of these results the following conclusions may be drawn: (1) the Pb content up

to 60 µg/ml blood, which is the upper limit for normal values, does not produce coproporphyrinuria; (2) the increased amount of Pb in blood will not increase the excretion of coproporphyrin if the exposure to Pb is short; and (3) the 95% confidence for the prediction of the respective concentrations from each other are too wide to give even approximately good estimation. In the diagnosis of Pb poisoning, it is therefore necessary to perform both analyses. Each has its own meaning. (From Industrial Hygiene Digest 18:517, 1954)

- 1456** Yamaga, S., and Saruta, K. (Yokohama Med. Coll., Japan): A SURVEY ON INDUSTRIAL LEAD POISONING. Journal of Science of Labour (Japan) (Rodo Kagaku) 29:606-9, 1953. In clinical examinations of 71 Pb poisoning cases no significant difference was found between those who inhaled Pb vapor or dust and those who handled Pb. (From authors' English summary)

1954

- 1457** Atchabarov, B.A., and Peisakh, S.A. (Acad. Science, Kazakh SSR): Ob izmeneniyakh chuvstvitel'nosti pri svintsovoi intoksikatsii. (CHANGES IN SENSIBILITY IN LEAD INTOXICATION.) Izvestiya Akademii Nauk Kazakhskoi SSR No. 136, Seriya Fiziologii i Meditsiny No. 4:24-33, 1954.

The authors investigated the effect of long exposure to Pb on sensibility indices in 400 workers. All were subjected to neurologic examination and were also seen by an otolaryngologist and a therapist. The workers were divided into the following groups: essentially healthy people or "Pb carriers," i.e., in them no hematologic signs or Pb poisoning were found, and those in whom various degrees of poisoning were seen. Among those with poisoning, in 32 (8%) slight sensibility disorders were seen, and in 29 of them, hypoesthesia. In all, disturbances in pain perception were established, accompanied by slight lowering of tactile, and rather often, of temperature perception. However, no deep muscular-articular sensibility disorders were observed. The findings on all are shown in tables as to length of exposure, e.g., in 104 who had worked <1 yr, 3.8% showed disturbances, and in 10 who had been exposed for 17-21 yr, 40%. As to those affected or not affected by Pb, 5.5% of the "Pb carriers" showed disturbances, 15% of those with mild poisoning did so and 13.5% of those with moderate or severe poisoning.

The authors conclude that sensibility disorders can develop very early, even in the absence of hematologic changes. The frequency of these disorders has a tendency to increase with seniority and with the appearance of the cardinal symptoms of Pb poisoning. They consider that these disturbances are related to lesions of the cerebral cortex which give rise to foci of blockage. (16 references)

- 1458** Atchabarov, B.A., and Sabdenova, Sh.S. (Acad. Sci., Kazakh SSR): O nekotorykh gemodinamicheskikh sdvigakh pri svintsovoi intoksikatsii. (SOME HEMODYNAMIC SHIFTS IN LEAD INTOXICATION.) Vestnik Akademii Nauk Kazakhskoi SSR 11, No. 12 (Whole No.

117):77-82, 1954.

On the basis of their observations, the authors conclude that in a majority of the Pb intoxication cases there is a disturbance of venous and arterial blood pressure, expressed as arterial hypotension and venous hypertension. The former increases with the gravity of intoxication. Pb colic is not always accompanied by arterial hypertension. The rate of blood circulation generally remains normal.

- 1459** Aubertin, E., Dulong de Rosnay, Ch., Labadie, P., and Tavernier, J. (Clinic Inf. Dis. Lab. of Reg. Social Sec. Fd., Bordeaux, France): Intoxication par le plomb consécutive à l'ingestion d'extrait de saturne. (LEAD POISONING FOLLOWING INGESTION OF GOULARD'S EXTRACT.) *Journal de Médecine de Bordeaux et Sud-Ouest* 131, No. 8:766-8, 1954.

A woman, 36-yr-old, sought medical advice because of sore throat progressing to complete dysphagia, followed by epigastric pains with nausea and vomiting. A marked anemia was found on examination. The patient admitted taking Goulard's extract to effect abortion. Hospitalization and treatment brought improvement but bilateral radial paralysis appeared a month after the poisoning. Clinical and laboratory findings are described.

- 1460** Bandino, R.: Osservazioni sull'apparato cardiovascolare di minatori che lavorano in galleria nelle Miniere metallifere (piombo, zinco e argento) del bacino minerario del Sulcis (Sardegna). (OBSERVATIONS ON THE CARDIOVASCULAR APPARATUS OF MINERS WORKING IN METALLIFEROUS MINE-GALLERIES (LEAD, ZINC, AND SILVER) OF THE SULCIS MINE-FIELD (SARDINIA).) *Proceedings of XI International Congress of Industrial Medicine by Members of the Institute of Industrial Medicine of the National Accident Department. Rassegna di Medicina Industriale* 23:305 (Sept.-Oct.), 1954.

The arterial pressure of miners working in galleries was measured before and after the 8 working hours, and it was found that the systolic pressure was under the physiologic level, while the difference between the systolic and diastolic remained normal. The author remarks that the alteration affects especially those workers who are not affected by silicosis, and judges that the alteration is due to the action of Pb on the adrenals and on the circulation. After transfer to other work in the open air, the affected workers returned to normal in a few months.

- 1461** Baron, J.: Etude hématologique du saturnisme. (HEMATOLOGIC STUDY OF LEAD POISONING.) Thesis, Lyon, 1954, 116 pp. The reviewer states that this thesis is an excellent presentation of hematologic manifestations in Pb poisoning. The personal observations confirm the classical opinions on the constancy of stippled erythrocytes in the course of Pb absorption and on their diagnostic value. Certain logical arguments recommend the counting of stippled erythrocytes on the basis of number of red cells rather than on leukocytes. The myelo-

gram of Pb poisoning patients was also studied, and contributed to the confirmation of the medullary origin of the basophilic granulations. The erythroblasts with basophilic stippling, the vacuolar erythrocytes and the associated macrophage reaction constitute a characteristic triad. Serum Fe, determined in a number of patients, was generally higher than normal. The pathogenesis of Pb anemia is in fact complex. It is connected essentially with a disorder in hemoglobin formation, since Fe is no longer capable of binding with the porphyrin molecule.

A very complete bibliography of French and foreign literature is included. (From *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 16:89 (Thesis reviews), 1955)

- 1462** Bashour, F.A. (Minneapolis, Minn.): URINARY UROPORPHYRIN, PORPHOBILINOGEN AND COPROPORPHYRIN EXCRETION IN LEAD-EXPOSED WORKERS. *Proceedings of the Central Society for Clinical Research. Journal of Laboratory and Clinical Medicine* 44:764-5, 1954.

Urinary coproporphyrin (CP) and uroporphyrin (UP) excretion, erythrocyte protoporphyrin (PP), blood Pb concentration, basophilic stippling, basophilic aggregate, hematocrit, and hemoglobin (Hb) were studied in a group of 44 industrial workers exposed to Pb. With the exception of 5 individuals with clinical complaints suggestive of Pb poisoning, all were in good clinical condition at the time of study. Most striking changes were observed in the levels of urinary and erythrocyte porphyrin. Per day CP excretion averaged  $1704 \pm 783$   $\mu\text{g/day}$  as compared to a normal average of  $189 \pm 79$   $\mu\text{g}$ . The erythrocyte PP values averaged  $467 \pm 254$  (range 146-942) as compared to control  $29 \pm 4.5$   $\mu\text{g}/100$  ml. Erythrocyte CP values were only slightly elevated, all values falling in the range of 0.6-6.4  $\mu\text{g}/100$  ml. The daily UP excretion averaged 96.2  $\mu\text{g}$  vs normal  $13 \pm 10$   $\mu\text{g}$ .

The UP methyl ester (ME) was crystallized from the combined extract of 24 urine collections of 6 individuals in the Pb-exposed group. The crystalline UP ME melted at  $259-262^\circ\text{C}$  indicating the presence of at least some Type III isomer, but whether as 8 or less COOH groups was not determined. It behaved as a Type B Waldenstrom porphyrin and is receiving further study. Blood Pb concentration was  $>0.06$  mg/100 ml in 39 individuals, while 10 had hematocrits of  $<40\%$ . Basophilic stippling (BS) was elevated in only a few instances. Significant correlation coefficients were observed for the following tests: BS and Pb aggregates (0.79); urine CP and UP (0.68); blood Pb and urine CP (0.37); blood Hb and urine CP (0.33). Recent investigation has revealed the presence of porphobilinogen (PBG) in a 2nd group of 13 workers exposed to Pb. These results are in accord with the finding of Schwartz et al of the increased excretion of UP together with CP and PBG in experimental Pb poisoning. This is the 1st report of excessive UP excretion in human beings having Pb exposure.

- 1463** Belknap, E.L., and Perry, M.C. (Columbia Hosp., Milwaukee, Wis.): TREATMENT OF

INORGANIC LEAD POISONING WITH EDATHAMIL  
CALCIUM-DISODIUM. A.M.A. Archives of  
Industrial Hygiene and Occupational  
Medicine 10:530-47 (Dec.), 1954.

Seven men with heavy Pb absorption were hospitalized and treated with  $\text{CaNa}_2\text{EDTA}$  intravenously (iv) in doses of 5 cc or 1 g diluted in 250 cc of 5% dextrose in distilled water twice a day for 5 days followed by a rest period of 2 days, with resumption of the 5-day course, then another period of rest for 2 days, and finally a course of 4 days as before. The total dose of the drug administered varied from 25-30 g. Pb excretion in the urine increased from 5 to 10 to 20 times, with a definite peak of such excretion occurring almost immediately within the first 24-48 hr after the beginning of treatment. There was a sharp reduction of urinary Pb excretion after 2 or 3 days, despite continued treatment. A secondary peak of Pb excretion occurred after 2 or 3 days' rest period. It is therefore suggested that the most effective way to use EDTA is to give it iv for only 2 or 3 days, alternating with a 4- or 5-day rest period, thus reversing the regimen of 5 days' treatment and 2 days' rest used in the authors' patients. Usually the coproporphyrin (CP) excretion in the urine dropped promptly soon after the EDTA treatment was started and remained down. If CP excretion does not drop promptly after the institution of the treatment, it may be that further deleading courses of the drug should be given. Thus, porphyrin in the urine may be used as an index of the effectiveness of EDTA in deleading Pb.

One of the patients resumed his former occupation as an operator of a wastepaper press, the paper worked on having been heavily contaminated with Pb. Reexposure necessitated readmission to the hospital for recurrence of abdominal Pb colic. The patient was given EDTA orally in tablet form, 2 g daily, or a total dose of 16 g. Close observation of the Pb excretion in the urine suggested that possibly oral administration of EDTA is somewhat effective, though to a much less degree than iv administration.

Oral prophylactic treatment is still too experimental to be widely recommended. Treatment with the drug given iv proved to be not only effective but safe, with no real evidence of any untoward results immediate or remote. Iv treatment with the drug does not give the prompt relief of Pb colic that one expects within 1/2 hr with iv administered Ca gluconate. Therefore, a combination of Ca gluconate iv in alternate doses with iv administered EDTA is calculated to give immediate pain relief, combined with a sharp reduction of circulating, and therefore potentially dangerous, Pb.

- 1464 Bell, A.: LEAD POISONING FOLLOWING THE USE OF AN OXY-ACETYLENE TORCH: REPORT OF FOUR CASES. New Zealand M. J. 53:57-60, 1954.

A large gold dredge was being dismantled by cutting off the heads of rivets with oxyacetylene torches. Men who had been working on the upper horizontal decking of the pontoon of the dredge for ~3 weeks all complained of excessive thirst and slight headaches. Bell was told that the pontoon had been painted with red Pb paint when it was assembled ~12 yr ago, and analyses of paint scrapings taken from its hull determined the Pb

concentration at 40%. When he watched one of the men at work, it was obvious that, in spite of possible wind, the worker would breathe large quantities of fumes created by the burning paint, as the rising hot fumes were not substantially dispersed until they were well past his breathing zone. Tests revealed that the men were inhaling ~120 times more than the suggested MAC of atmospheric Pb. The 4 men who had used the oxyacetylene torch to remove rivets from the Pb-painted pontoon were studied for stippled cell count, Hb content, presence of pallor, and blue line around the gums, and they were asked about symptoms, appetite, metallic taste, dyspnea, abdominal pain, and constipation. Because of the extremely heavy concentration of atmospheric Pb at the men's breathing zone, the author did not believe that the conventional type of filter pad respirator covering nose and mouth, would afford adequate protection. The question of men's using a respirator with its own independent airline was ruled out, as it would have been awkward. In view of these difficulties and of the fact that practically all industrial Pb poisoning is due to the inhalation of dust and fumes, it was suggested that the rivets should be removed either with a pneumatic rivet gun or with hammer and chisel. It is commonly assumed that if a potentially toxic process is carried out in the open air it is almost invariably safe because of general ventilation. In many cases this is correct but this report illustrates that this is not necessarily the case. (From Journal of the American Medical Association 155:934 (Abstracts), 1954)

- 1465 Cali', V. (Univ. Palermo, Italy): *Sindrome neurologica da saturnismo ed effetti terapeutici della B<sub>12</sub>*. (NEUROLOGIC SYNDROME OF LEAD POISONING AND THERAPEUTIC EFFECTS OF B<sub>12</sub>.) *Silicia Sanitaria* 7:173-80 (Mar. 15), 1954.

The case described is that of a 53-yr-old typographer whose symptoms (asthenia, headaches, dizziness, memory loss, etc), as related, began 3 yr earlier. At the time of admission, he presented polyneuritis and mild encephalopathy. The diagnosis of Pb poisoning was made on the basis of the known work exposure to dusts arising from Pb type, finding in laboratory tests "positive" stippled cells (stippling was virtually absent in the spinal fluid), positive Burton's line; Pb in urine 75.5 µg/24 hr (after 3 iv injections of Mg sulfate, 96.80); urinary porphyrins, 114.28 µg/24 hr. X rays of the digestive system showed gastroduodenitis, signs of spastic colon. Treatment with high doses of vitamin B<sub>12</sub> brought rapid regression of the polyneuritic signs and a marked improvement of the clinical syndrome of encephalopathy.

- 1466 Compère, A., Dejace, J., Herry, J., and Mignolet, F. (Med.-Social Ind. Center, Liège, Belgium): *Le saturnisme est-il devenu un mythe? (HAS SATURNISM BECOME A MYTH?)* *Médecin D'usine* 16:72-9 (Feb.), 1954.

The authors studied the clinical files of 546 workers exposed to the risk of Pb poisoning. The following results were found. Of 18 Pb rollers, all showed basophilic stippling (BS) at one time,

>50% showed dental changes and 12 had digestive troubles and constipation. A storage battery repairman showed BS, albuminuria, azotemia and dental changes. Of 7 Pb foundries, 57% showed blood anomalies. Of 90 Pb welders, 32.30% showed blood anomalies and 30% showed dental changes. Some galvanizers suffered from headaches, nausea, loss of appetite, digestive troubles, and blood anomalies. Of 144 typographers, 23% showed blood anomalies and >45% had dental lesions. Of 38 linotypists, 39% showed blood anomalies and many had dental lesions. Of 193 painters, 18.5% showed blood anomalies and many had dental changes. Of 30 painters who regularly used red Pb, 60% showed blood anomalies and many showed dental lesions. Also studied were 346 cases and the results of the urinary coproporphyrin test and BS were compared. The authors concluded that BS was more sensitive and more certain in the detection of Pb poisoning. Treatment of those workers with blood anomalies with nicotinamide and Na citrate gave variable results. Some methods for improving conditions of Pb workers are described and it is concluded that the 2 best methods were adequate plant installations and personal hygiene.

- 1467 Cotter, L.H. (Columbia Univ. Coll. Phys. Surg., New York, N.Y.): TREATMENT OF LEAD POISONING BY CHELATION. *Journal of the American Medical Association* 155:906-8 (July 3), 1954.

CaNa<sub>2</sub>EDTA, the safety of which had been established earlier, was used in the treatment of a series of Pb poisoning cases. After testing tolerance to the drug, the patients received 2 g/day for 1 wk (250 mg every 2 hr). Careful biochemical records were made before and 1 mo after treatment, particularly of the levels of serum electrolytes, because of known affinity of EDTA for these in plasma. Four case reports selected from a series of 26 patients (with occupational exposure) as typical of exposure symptoms, and recovery, are presented. Results of biochemical tests for these 4 cases are tabulated. It was significant that the Ca, Cu, Na, and Mg content was at no time seriously disturbed. Two patients in the series showed a rise in total serum organic phosphate, and 2 showed a rise in serum Cu. Serum cholesterol was low in the average case and was the slowest factor to return to normal. (In the determination of all the chemical values, muffle furnace methods are required to destroy the chelating agent.)

- 1468 Crepet, M., and Gobbato, F. (Univ. Turin, Italy): Alterazioni emodinamiche in corso di colica saturnina. (HEMODYNAMIC CHANGES IN THE COURSE OF LEAD COLIC.) *Medicina del Lavoro* 45:523-32 (Oct.), 1954.

Three Pb poisoning cases, 25, 26, and 35 yr old (founder, auto body repairman, painter), 2 of whom presented colic, are described. Tests included cardiac volume, vascular resistance, systolic and diastolic pressure, renal hemodynamics, EKG, and orthodiagraphic examination, which are described in detail with results tabulated for each patient. As summarized by the author, these tests showed that hypertension in Pb colic is due to an increase in peripheral resistance. A decrease of the cardiac output takes place, as well as func-

tional rigidity of the arteries and an increase in pulse rate. The afferent glomerular arteriole takes part in the arteriolar systemic spasm. This causes a fall in glomerular filtration rate. In a case with toxic symptoms, not of the colic type, with persistent arterial hypertension the increase of peripheral resistance was localized in the kidney and brain similar to essential hypertension. In each case examined, removal from exposure brought a return to normal circulatory equilibrium.

- 1469 Cupcea, S., Raucher, C., Derevenco, P., Deleanu, M., Pop, M., and Gross, E.: Contributions au problème de l'examen de la réactivité dans le saturnisme. (EXAMINATION OF REACTIVITY IN PLUMBISM.) *Rev. Sci. Méd. Bucharest*. 2:106-15, 1954.

Since in excessive absorption of toxic substances, including Pb, response to nervous stimuli is delayed before any clinical signs appear, the following groups of workers were subjected to tests of reactions to hearing the spoken word, and to various electrical stimuli: I, not exposed to Pb; II, exposed to Pb for a short time; III, exposed for a longer time; IV, with definite signs of poisoning. The longer the latent period between a signal and response, the greater and more pronounced was the absorption of Pb. Soviet investigators had established the norm for the length of delay in response; it is therefore suggested that this technique be used in evaluating the degree of absorption of Pb. (From *Bulletin of Hygiene* 31:46, 1956)

- 1470 DeLuca, S. (Ind. Physician, Soc. Mining and Metallurgy, Pertusola, Italy): Indagine di massa per la ricerca della porfirine urinarie nei lavoratori di P.b. (MASS INVESTIGATIONS OF URINARY PORPHYRINS IN LEAD WORKERS.) *Rassegna di Medicina Industriale* 23:289, 350-2 (Sept.-Oct.), 1954.

The author considers the determination of coproporphyrin (CP) in urine to be an important method of diagnosis of Pb poisoning. Normal elimination is 20-60 µg/24 hr; 150 µg/24 hr constitutes a sign of alarm. Of 50 foundry workers, 15 cases excreted excessive amounts of CP. Of these, 8 cases eliminating 250-500 µg CP/24 hr are listed in a table together with clinical signs, hematology, and whether compensated or not by the Insurance Board. Aside from the usual findings, liver enlargement, high hypertension, cardiac hypertrophy, diffuse polyarthritis, hypertrophic gastritis, bronchial asthma, and myocardial sclerosis were observed. Compensation was granted in 3 cases, the remaining were to be observed.

- 1471 Drogichina, E.A., Okhnyanskaya, L.G., Ginzburg, D.A., Mumzhu, E.A., Sadchikova, M.N., and Ryzhkova, M.N. (Acad. Med. Sci., USSR): Rol' vysshikh otdelov tsentral'noi nervnoi sistemy v razvitií i techenii patologicheskogo protsessa pri nekotorykh intoksikatsiyakh. (ROLE OF THE HIGHER SEGMENTS OF THE CENTRAL NERVOUS SYSTEM IN DEVELOPMENT AND COURSE OF PATHOLOGIC PROCESSES IN CERTAIN INTOXICATIONS.) *Trudy Akademii Meditsinskikh Nauk SSSR* 31: 9-27, 1954.



The authors studied 130 patients with chronic Pb or Hg poisoning, selected from a working population of >500 in Pb and Hg works; in addition, 40 healthy persons were examined. The study group was divided into subgroups of those who were exposed but did not show overt signs of poisoning; those with mild forms of intoxication, showing asthenia, vegetative disorders, and, in the case of Pb poisoning, blood disorders; those with severe degrees of poisoning, including Pb colic and encephalopathy. In addition to clinical examination, numerous tests were applied for the detection of disorders of the function of the nervous system. These were based on tests developed by Pavlov, and were carried out by the neurologic and clinical physiology divisions. Specifically, these included the olfactory reflex and optical chronaxy; oculocardiac reflex; the biological properties of the blood of the patients and relation to the condition of the higher segments of the nervous system. For this, the isolated frog heart and the dorsal leech muscle test was used. Several cases are described as examples of the findings which are presented.

1472 Editorial (R.T. Johnstone): HORRIBLE DICTU! Industrial Medicine and Surgery 23:381-2 (Aug.), 1954.

CaEDTA or Versene is the best known deleading agent yet evolved. The author points out that CaEDTA should be used only as a therapeutic agent. As yet there is no proof as to its value as a preventive measure. Skin cream containing CaEDTA particularly should not be adopted because of the danger that good industrial hygiene would be ignored. The author emphasizes that there is no substitute for rigid hygiene in industry.

1473 Field, J.B. (Univ. S. California School Med., Los Angeles): SIMPLE MANAGEMENT OF LEAD POISONING. California Medicine 80: 101-3, 1954.

Colic, nausea, vomiting and alternating constipation, diarrhea, and insomnia, that had set in 4 mo before admission to the hospital, had increased in severity in a 30-yr-old woman in the week of admission (March 22, 1953). Several physicians had diagnosed her condition as enteritis, but treatment with antibiotics was ineffective. Since 1952, the patient had been working in a ceramics plant as a sprayer of underglaze ("frit" mixed with silica containing ~5-20% Pb). She had not been given a protective face mask, and the ventilator clearing the air of the fumes had been disconnected because of its noise. On March 20, urinary Pb content was >0.5 mg/l (normal;  $\leq 0.08$  mg/l). Blood Pb level was 0.365 mg/100 cc (normal;  $\leq 0.05$  mg). Hb was 8.8 g/100 ml, erythrocytes were 3.8 million/mm<sup>3</sup>, and there were 1.4% basophilic stippled erythrocytes. Urine, blood and X-rays were normal.

Therapy consisted of a high Ca diet supplemented with Ca gluconate orally, Mg sulfate and atropine sulfate, morphine and codeine sulfate, and barbiturate sedation. On March 25, treatment with CaEDTA was started, 2 g in 1 l. of 5% glucose in saline solution given intravenously (iv) over a 6-8 hr period, and for 9 days thereafter. Patient improved within 4 days after start of EDTA therapy.

Blood Pb content fell to <0.1 mg% (May 16). Urinary Pb levels, remaining high during the phase of increased excretion (>0.5 mg/l) fell rapidly to <0.1 mg/l. The patient was discharged from the hospital on April 3 on a high dosage of Ca gluconate and ferrous sulfate. Hb increased to 12 g/100 cc of blood (Apr 18) and to 13.5 g (June 6).

The author has used CaEDTA by iv drip in 10 other cases to reduce the amount of Ca in the serum. Reduction of as much as 50%, to near tetanic levels, was observed. The amount of Ca to be bound and excreted was easily calculated and verified by examination. No toxic phenomenon other than minor venospastic pain in the cannulated vessel was observed when as much as 2 g was administered at one time.

He concludes that administration of CaEDTA results in pronounced enhancement of Pb excretion and rapid subsidence of the symptoms of Pb intoxication. Use of CaEDTA (calcium versenate) in doses of 1-2 g/day in an iv drip for rapid excretion of body-stored Pb and relief of associated symptoms is recommended by him. The drug can also be given orally but then the excretion of Pb is slower.

1474 Fourcade, J., and Caron, M. (France): Sur une série dramatique d'intoxications saturnines d'origine hydrique. (A DRAMATIC SERIES OF CASES OF POISONING BY LEAD FROM THE WATER SUPPLY.) Annales de Médecine Légale et de Criminologie, Police Scientifique et Toxicologie 34:191-6, 1954.

The high Pb content of a drinking water supply (2.3 mg Pb/l at the kitchen tap) which was conducted through Pb pipes, caused Pb intoxication of 5 members of a farm family with lethal outcome for 2 or possibly 3 of them. The most prevalent symptoms were painful colics with occasional vomiting and constipation, paresis and later paralysis of the muscles and death from uremia. In 1 subject erythrocytes with basophilic stippling were noted. Analysis of the organs of 2, upon exhumation, showed the following in mg Pb/kg: muscle 1.6, 3.5; liver 30.0, 19.0; kidney 8.3, 8.3; brain 10.2, 7.7; tibia (diaphysis) 43.0, 21.7; hair 124.0, 94.7; teeth 85.3, 99.0. For comparison, the tibia of the grandfather contained 9.9 mg Pb/kg.

1475 Griffith, G.C., Butt, E.M., and Walker, J. (Univ. S. California, Los Angeles): THE INORGANIC ELEMENT CONTENT OF CERTAIN HUMAN TISSUES. Annals of Internal Medicine 41: 501-9, 1954.

Tables are given which show the average content of Cu, Fe, Pb, Mn, Hg, and Zn from 910 autopsied patients. Pb was found in constant amounts at all times at all ages, but in the aorta after age 40 it increased 50-100% concomitantly with the degree of arteriosclerosis present, compelling the speculation that Pb, Ca, and perhaps other inorganic elements compete for the role of catalyst in the enzyme metabolism of the aorta. (From authors' summary)

1476 Gobbato, F., and Monarca, G. (Univ. Turin, Italy): Rilievi clinico-statistici su 89 casi di anemia saturnina. (CLINICAL AND STATISTICAL FINDINGS IN 89 CASES OF LEAD

ANEMIA.) Proceedings of XI International Congress of Industrial Medicine by Members of the Institute of Industrial Medicine of the National Accident Prevention Department. *Rassegna di Medicina Industriale* 23:234-42 (July-Aug.), 1954.

Statistical studies on 89 workers suffering from Pb anemia, 45 grinders (av age 37.4 yr, 2.7 yr service), 29 founders (av age 42.9 yr, 7.2 yr service), 15 in other occupations (av age 49 yr, 12.1 yr service), showed the following: The anemia in these cases of active Pb poisoning was of moderate severity and of normochromic type. The degree of anemia was independent of the type of occupation; the average period of exposure producing anemia was greater in founders as compared with grinders, and in other trades as compared with founders. The severity of the anemia was independent of the age of patients despite the fact that the older workers had been exposed for longer periods of time. In 89% the red cell count was <4 million. Improvements in the blood picture as seen in 58 cases about 2 mo after removal from exposure showed no significant statistical differences in the various groups, ie, type of occupation and age. (20 references)

- 1477 Graziani, G., Fusco, M., and Rossi, L. (Univ. Naples, Italy): Ferro serico e saturnismo. Nota III; La ferremia da carico nel saturnismo professionale. (SERUM IRON AND LEAD POISONING. III. IRON TEST IN OCCUPATIONAL LEAD POISONING.) *Folia Medica* (Naples) 37:643-53, 1954.

From the curve of serum Fe after oral or iv administration in 20 persons with mild Pb poisoning it is concluded that there exists a disturbance of absorption and utilization of Fe, as was observed already in experimental Pb poisoning.

- 1478 Guichard, A., Roche, L., Collard, N., and Dalmais, J. (Lyons, France): Polyartérite et polyartériolite systématisée des membres avec périostite distale d'origine saturnine probable. (GENERALIZED POLYARTERITIS AND POLYARTERIOLOSIS OF THE EXTREMITIES WITH DISTAL PERIOSTITIS PROBABLY CAUSED BY LEAD POISONING.) *Lyon Médical* 86:73-88 (July 25), 1954.

The case described is that of a 57-yr-old shepherd whose history revealed epidemic dysentery while a prisoner of war in 1940, a moderate alcoholism (2 l./day) with enlarged liver, chronic glaucoma, a periostitis of the tibiae which led to a radiologic study of the extremities, and chronic Pb poisoning. The findings revealed a generalized opacification of all extremities, distal periostitis of the 2 tibiae and elbows, absence of osteopathy, diabetes, arterial hypertension, aortic, mesenteric or iliac calcification. Pb poisoning as cause was based on the fact that from 1928-38 the man had worked in a storage battery factory in the plating operation which was done in a closed room. While he washed his hands before eating, changed his clothing at the end of the day, never ate in the workroom, consumed 1-1/2 l milk/day and had a weekly mineral-springs bath, he did smoke at work and drank lithia water directly from the bottle. While seen by the authors in 1953, a BAL treatment re-

vealed prophyris in urine and he suffered a small attack of colic, interpreted as being due to mobilization of Pb. The authors conclude that the man was still suffering from Pb poisoning 15 yr after exposure and that the conditions observed, which they consider to be the first such case reported, were due to metabolic interaction between Pb and Ca.

- 1479 Gupta, M.N., and Harihara Iyer, C.R. (Jamshedpur, India): URINARY PORPHYRIN TEST FOR LEAD ABSORPTION. *Proc. Soc. Study Ind. Med.* 6:176-92, 1954.

An investigation was carried out to ascertain whether estimations of urinary porphyrin were as valuable as indications of Pb absorption as estimates of Pb in the urine or the blood. Sixteen Pb storage factories were visited and 461 workers observed. The results of examining urine and blood for Pb and urine for porphyrin in 172 cases are stated and portrayed in a series of graphs. Normal Pb concentration in blood ranges from 0.01-0.06 mg/100 ml whole blood; concentrations >0.07 mg/100 ml indicate Pb exposure; and those >0.10 mg/100 ml indicate considerable exposure. The amount of porphyrin in the urine was found to be closely correlated with the amounts of Pb found in the blood and urine. Thus positive porphyrin reactions occurred in some 85% of urines containing  $\geq 0.10$  mg Pb/l but in only some 21% of urines containing <0.10 mg Pb/l; positive porphyrin reactions occurred in 90% of persons with  $\geq 0.08$  mg Pb/100 ml blood. After careful examination of all the many estimations made, the conclusion is drawn that porphyrin examination might replace costly blood Pb and urine Pb examinations. Estimation of porphyrin is comparatively simple. Increase of urinary porphyrin can be used as an early indication of Pb absorption. The findings were also correlated with clinical observations. (From *Bulletin of Hygiene* 30:420, 1955)

- 1480 Hardy, H.L., Elkins, H.B., Ruotolo, B.P.W., Quinby, J., and Baker, W.H. (Massachusetts Gen. Hosp., Boston): USE OF MONOCALCIUM DISODIUM ETHYLENE DIAMINE TETRA-ACETATE IN LEAD POISONING. *Journal of the American Medical Association* 154:1171-5 (Apr. 3), 1954.

Three cases of chronic occupational Pb poisoning and 3 normal control patients were studied. Urinary Pb was determined before treatment with Ca-EDTA (Ross and Lucas method (1935), and direct ashing method followed by dithizone during and after Ca-EDTA). Coproporphyrins (CP) in urine were determined by Maloof's method. The 3 cases of poisoning, 46-50 yr old, are described in some detail. Treatment was by daily iv administration of 3 g EDTA in 600 ml of 5% dextrose in distilled water, over a 2-hr period in the 1st case. Treatment was discontinued for 48 hr after the 1st day because of nausea, watery bowel movements and rise in temperature. The dosage was then resumed. In the 2nd case treatment was by 3.5 g EDTA iv daily for 7 days, as above, and in the 3rd, 4 g in 450 ml dextrose over 2 hr for 5 consecutive days. Favorable results in elimination of Pb were obtained. The authors believed

that the clinical course was favorably influenced by the treatment as seen in the remarkable Pb excretion with coincident decrease in CP excretion and reversal of hematologic abnormalities. It was noted that the increased excretion of Pb showed decreasing amounts over a period of sustained administration. No harmful effects were observed. The theory of the action is discussed, and several problems to be solved by additional research are outlined. These include the cause of the rapid return to pretreatment levels of urinary Pb and CP when EDTA is discontinued.

- 1481 Harkanyi, I., and Bencze, G. (Budapest Med. Coll., Hungary): *Ölommérgezéssel kapcsolatos téves diagnózisok esetei.* (DIAGNOSTIC ERRORS IN LEAD POISONING.) *Orvosi Hetilap* 95:766-8 (July 11), 1954; *Current List of Medical Literature* 27:26545, 1955.

- 1482 Harris, W.H., Beauchemin, J.A., Hershen-son, H.M., Roberts, S.H., and Matsuyama, G. (Middletown, Conn.): *STUDY OF METAL IONS IN THE CENTRAL NERVOUS SYSTEM. I. PRELIMINARY CONSIDERATIONS.* *Journal of Neuropathology and Experimental Neurology* 13:427-34, 1954.

Frontal, parietal, occipital, and temporal lobes, and insula, basal ganglia, brain stem and cerebellum from 4 human brains were wet ashed with  $\text{HNO}_3$ , concentrated to 10 or 25 ml, and spectrographically analyzed. Al, Cu, Co, Cr, Ca, Hg, Mg, Mn, V, Ni, Pb, Ti, and Zn were found at least once in all of the 8 portions of the brain; the majority of these metals were present in all areas of all 4 brains. Ag, Bi, and Mo were not detected. (32 references)

- 1483 Hickling, S. (Wellington, New Zealand): *LEAD POISONING IN CARPENTER'S SHOP.* *New Zealand M. J.* 53:423-5, 1954.

The cases reported here were discovered when a carpenter employed on house construction reported to his physician with a history of abdominal colic, constipation, and general malaise. Clinical examination revealed a marked blue line on his gums. Questioning of the patient indicated a probable exposure to the dust of Pb at his work. The patient's condition was serious enough to necessitate admission to hospital. When the patient's workplace was visited, it was found that precut wooden houses had been given a priming coat of red Pb paint to preserve them in transit. Before erection they required smoothing and finishing in the carpenter's shop. This process produced large quantities of dust on the floor and in the air, mainly in the vicinity of 2 sanding machines, but it also spread practically throughout the shop. Samples of the dust from various places were analyzed. Fresh dust under the sanding machines contained 38% Pb by weight, old dust near sanding machine 52% Pb by weight; floor dust 10 yd from machine 48% Pb by weight. It was obvious that all 15 men employed in the carpenter's shop had been freely exposed to inhalation of the dust in the

air, and to its ingestion when eating or smoking. The symptoms, signs, and the results of blood examination in these 15 men indicated that the foreman alone escaped the ill-effects of chronic Pb absorption. Exhaust ventilation and exhaust fans were fitted to the sanding machines. An industrial vacuum cleaner was obtained to keep the floors, benches, and other parts of the premises as free from dust as possible, and suitable filter-pad respirators were provided for the workmen. The hazards involved in their work and the precautions necessary to avoid them were explained to the workmen, and, in view of their Hb levels and stippled cell counts, it was considered essential to transfer 6 of the men temporarily to outside building work. (From *Journal of the American Medical Association* 157:280 Abstracts, 1955.)

- 1484 Honing, C. (Gemeente-Apotheek, 's-Gravenhage, Netherlands): (USE OF ETHYLENEDIAMINETETRAACETATE IN PHARMACY.) *Pharm. Weekblad.* 89:840-4, 1954.

In Pb poisoning the following solution is used intravenously: 1 g  $\text{Na}_2\text{EDTA}\cdot 2\text{H}_2\text{O}$  in 25 ml  $\text{H}_2\text{O}$  heated to boiling with 0.268 g  $\text{CaCO}_3$ , filtered, and pH adjusted to 7. The volume was made up to 30 ml and the solution autoclaved for 0.5 hr at  $115^\circ$  before use. A similar preparation containing 950 mg  $\text{Na}_2\text{EDTA}\cdot 2\text{H}_2\text{O}$  and 250 mg  $\text{CaCO}_3$ /10 ml can be used for Ca injections. A solution of 19.1 g  $\text{Na}_2\text{EDTA}\cdot 2\text{H}_2\text{O}$  in 900 ml  $\text{H}_2\text{O}$ , adjusted to pH 7.5 with NaOH and sterilized, can be used to dissolve kidney stones. Oxidation of a procaine-adrenaline solution can be prevented for 2 mo by the addition of 5 mg  $\text{Na}_2\text{EDTA}\cdot 2\text{H}_2\text{O}$ /100 ml solution. (From *Chemical Abstracts* 49:4236, 1955)

- 1485 Horiuchi, K., and Takada, I.: *STUDIES ON THE INDUSTRIAL LEAD POISONING. I. ABSORPTION, TRANSPORTATION, DEPOSITION, AND EXCRETION OF LEAD. 1. NORMAL LIMITS OF LEAD IN THE BLOOD, URINE, AND FECES AMONG HEALTHY JAPANESE URBAN HABITANTS.* *Osaka City Medical Journal* 1:117-25 (Jan.), 1954. In *Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School*, Vol. 1, April 1949-March 1959, pp. 71-9.

The content of Pb both in blood and urine followed a logarithmic normal distribution curve. The upper limit of the content of Pb in the whole blood was 31  $\mu\text{g}/100\text{ g}$  and that in urine, 159  $\mu\text{g}/\text{day}$ , both excluding 5% of the population. The arithmetic mean of the content of Pb in the feces was 240  $\mu\text{g}/\text{day}$ . There was no significant difference between monthly and yearly average contents of Pb in blood. There was no correlation between the content of Pb in the whole blood and age. Pb is always abundant in the blood corpuscles and scarce in the blood plasma.

A modification of the USPHS method was used for the analyses. Blood samples were from 206 male and 38 female subjects; 78 24-hr urine samples were available and 31 fecal specimens.

- 1486 Ida, N. (Osaka City Med. School, Japan): *STUDIES ON THE MAXIMUM TOLERABLE CONCENTRATION OF LEAD IN AIR.* *J. Osaka City Med. Center* 3:194-206, 1954.

The maximum tolerable concentration of Pb in the air is  $\sim 0.05 \text{ mg/m}^3$  for Japanese male adults working 8 hr/day for over a year in the Pb industry. (From Chemical Abstracts 49:1241, 1955)

- 1487** Imamura, Y.: STUDIES ON THE INDUSTRIAL LEAD POISONING. I. ABSORPTION, TRANSPORTATION, DEPOSITION, AND EXCRETION OF LEAD. 3. AN EXPERIMENTAL STUDY OF LEAD INTAKE IN HUMAN BEING. Osaka City Medical Journal 3:167-94 (Jan.), 1954. In: Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 1, April 1949-March 1959, pp. 125-52.

Pb acetate was given by mouth to 2 normal Japanese male adults in 4 stages: (1) at 3 mg (1.64 mg Pb) daily for the 1st 61 days; (2) 6 mg (3.28 mg Pb) daily for 60 days; (3) no Pb intake for 67 days; (4) no Pb but medication for 98 days. The Pb contents of the Pb subjects' diets were 70-299  $\mu\text{g/day}$ . One subject served as control. Aside from determination of Pb in blood, urine, and feces, the subjects received medical examinations including red and white cell counts, stippled cells, reticulocytes, coproporphyrin in urine, and liver function tests by 6 different methods. Blood Pb of the Pb subjects ranged from 14-108  $\mu\text{g}/100 \text{ g}$ , in control, 9-59. Urinary Pb extremes were 20-613  $\mu\text{g/day}$ , and 10-202 for the control. Fecal Pb was  $>2 \text{ mg}$  on the 2nd day of intake and 1 mg/day thereafter.

In summary, ingested Pb was recovered most rapidly in the feces, followed by urine and blood in that order. At the end of the experiment 70-80% of the ingested Pb had been recovered in the excreta while the rest remained in the body. The only changes observed were a decreased erythrocyte count and hemoglobin content and an increase in urinary coproporphyrin during the Pb intake stages. No clinical symptoms were noted and liver function was normal.

- 1488** Kench, J.E., and Clarkson, T.W. (Univ. Manchester, England): BIOCHEMICAL METHODS FOR DETECTION OF LEAD AND CADMIUM ABSORPTION. Transactions of the Association of Industrial Medical Officers 4:110, 1954. The author reports that research is in progress to find specific biochemical changes which could be used in detection of Pb and Cd poisoning. The intermediary metabolism of porphyrins in Pb workers is being studied to ascertain if a characteristic porphyrin pattern is present. Work is also being done to determine if quantitative relationships between individual amino acids may afford means of distinguishing between normal and Pb workers' urines.

- 1489** Kitzmiller, K.V., Cholak, J., and Kehoe, R.A. (Univ. Cincinnati, O.): TREATMENT OF ORGANIC LEAD (TETRAETHYL) INTOXICATION WITH EDATHAMIL CALCIUM-DISODIUM. A.M.A. Archives of Industrial Hygiene and Occupational Medicine 10:312-8 (Oct.), 1954.

Cases of TEL poisoning are described in detail. Three of 6 patients were given EDTA treatment, 1 was treated with BAL, 1 was given supportive and sedative treatment only, and 1 with no significant

exposure was not treated. Blood and urine tests are reported in detail. No valid conclusions could be drawn as to the useful therapeutic effects of EDTA from the review of these cases, but the authors found that the drug was well tolerated. No harmful effects were observed. However, no significance could be attached to transient periods of clinical improvement with increase in the elimination of Pb, since such episodes are frequent when no specific treatment is given.

- 1490** Lachnit, V., and Frank, O. (Univ. Vienna, Austria): Zur Diagnose und Therapie der beruflichen Bleiintoxikation. (DIAGNOSIS AND THERAPY OF OCCUPATIONAL LEAD POISONING.) Wiener Zeitschrift für innere Medizin und ihre Grenzgebiete 35:189-98 (May), 1954.

This is a survey of publications on the subject of Pb exposure and its resulting toxic manifestations, ranging from increased exposure to forms of severe poisoning. The various signs, symptoms, and effects on body organs and fluids, measurement of Pb levels in blood and urine, porphyrin excretion, assessment of white blood cells, and urea and nitrogen values are discussed. Intoxication by TEL and its effect on the central nervous system are discussed separately. According to the authors, the only treatment of Pb encephalopathy is by repeated lumbar puncture. Other forms of Pb intoxication such as colics are treated with spasmolytic agents (papaverin, atropin, buscopan), saline enemas for regular elimination, and Ca to reduce circulating Pb. Mobilization of Pb from the bones and its elimination by chelating agents are described. The dangers of too rapid or massive Pb mobilization are pointed out. The article includes therapeutic experiences with BAL in humans and animals, and treatment with Na citrate, EDTA and CaEDTA. Two of authors' own cases of Pb intoxication treated with CaEDTA are reported.

In a 48-yr-old worker with acute Pb colic and other signs of Pb intoxication due to inhalation of Pb vapors, the urinary coproporphyrin (CP) excretion was 1056  $\mu\text{g}/24 \text{ hr}$ , urinary Pb was 500  $\mu\text{g}/\text{l}$ . Few basophilic stippled erythrocytes were seen in the blood, many in the bone marrow. After CaEDTA treatment (daily iv dose, 0.5 g, increased quickly to 4 g, making a total dose injected of 40 g after 3 days), the patient became symptom-free. Urinary CP excretion returned to normal levels, and the stippled cells and other signs of intoxication disappeared.  $\text{CaNa}_2\text{EDTA}$  was given successfully in the 2nd case which is not described in detail.

Treatment of the Pb-induced porphyrinuria with liver extracts, total liver extract and lactoflavin, prophylactic and therapeutic liver preparations and folic acid, nicotinic acid and ascorbic acid in Pb intoxication are mentioned. In several cases, the authors have observed a marked reduction in CP excretion with administration of vitamin  $\text{B}_{12}$ , accompanied in one case by disappearance symptoms. Large parenteral doses of vitamin  $\text{B}_1$ , according to many authors, have an excellent effect in toxic neuritis. (123 references)

- 1491** Lane, R.E. (Univ. Manchester, England): LABORATORY INVESTIGATIONS IN SUSPECTED INDUSTRIAL POISONING. British Medical

Journal 1:978-80 (Apr. 24), 1954.

Addressing himself to the general practitioner, the author stresses the need of consulting experienced laboratories in cases suspected to be suffering from industrial poisoning, or when the doctor is supervising (as an industrial medical officer) the health of a group of workmen. While in the latter case the fact of exposure is known, laboratory tests are required to estimate its degree. The more important use of laboratory investigations lies in the prevention of poisoning. Unfortunately, this does not fall within the functions of laboratories connected with the National Health Service; therefore the practitioner has to make special arrangements. Whether the laboratory test is to be used for diagnostic or prophylactic purposes, it must be carried out with care not only in performance, but in the collection of specimens. Exposure to a number of industrial poisons requiring laboratory tests are discussed briefly. That to Pb is given first and in greater detail on the basis that it still continues to occur and the diagnosis is often missed. The author cautions that reagents and glassware free of Pb, specially cleansed, be used for collection and analysis of specimens. Contamination of the specimens from Pb must be carefully avoided, and no preservatives should be added. The normal Pb content of urine is  $\leq 100 \mu\text{g/l}$ . Low-grade absorption will be indicated by up to  $150 \mu\text{g Pb/l}$ ; repeated values of  $200 \mu\text{g}$  indicate substantial absorption, and  $>300 \mu\text{g}$  indicates excessive absorption and potential poisoning. Reliance should not be placed on single determinations. Diagnosis must rest on the clinical picture in conjunction with all laboratory findings which include Pb in blood ( $0-80 \mu\text{g}/100 \text{ ml}$  normal range), coproporphyrin in urine, and stippled cell counts (although not entirely specific, and not for TEL exposure). The latter test, performed by experienced technicians, together with hemoglobin estimation and a limited number of urinary Pb determination, provides a cheap and objective method of supervising Pb workers.

**1492** Langner, K.K. (USSR): Novokainovaya blokada pri otravlenii svintsom. (NOVOCaine BLOCK IN LEAD POISONING.) Klinicheskaya meditsina 32:82 (May), 1954.

Sixteen patients with Pb colic, who had been followed by the author for a number of years, were subjected to exploratory novocaine block according to Vishnevski's method. Ten patients responded to a single block by disappearance of intestinal colic; the stool became normal, appetite returned. In 3, blockade was repeated; in 3 others, it was ineffective. The author concludes that novocaine block exerts its action by modifying the regulatory function of the nervous system.

**1493** Lejeune, R.: A propos d'un cas de polyartérite et polyartériolite systématisée des membres supérieurs et inférieurs, d'origine saturnine probable. Contribution à l'étude des artérites et périostites saturnines. (A CASE OF GENERALIZED POLYARTERITIS AND POLYARTERIOITIS OF THE UPPER AND LOWER EXTREMITIES PROBABLY CAUSED BY LEAD POISONING. CONTRIBUTION

TO THE STUDY OF ARTERITIS AND PERIOSTITIS IN LEAD POISONING.) Thesis, Lyons, 1954.

This thesis forms the substance and contains the bibliography of the publication by Guichard et al, as mentioned in a footnote at the end of their article. (See Abstract No. 1478)

**1494** Lesage, R.: Les intoxications professionnelles. Saturnisme. (OCCUPATIONAL POISONING. LEAD POISONING.) Concours Médical 76:855 (Feb. 27), 1954.

The author presents briefly the symptoms and signs of Pb poisoning. Methods of determining the intoxication, and the interpretation of the findings are mentioned and the paper concludes with briefly stating the directions which should be followed.

**1495** Levrat, M., Roche, L., Bret, P., and Anjou, A.: La radiologie intestinale de la colique de plomb; le mega-côlon saturnin. (INTESTINAL RADIOLOGY OF LEAD COLIC; LEAD MEGACOLON.) Archives des Maladies de l'Appareil Digestif et des Maladies de la Nutrition 43:206-9 (Feb.), 1954.

See following abstract.

**1496** Levrat, M., Roche, L., Bret, P., and Anjou, A. (Lyons, France): Radiologie intestinale de la colique de plomb. (RADIOLOGY OF THE INTESTINAL TRACT IN LEAD COLIC.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 15, No. 2:113-8, 1954.

The authors point to the extreme difficulty in obtaining X-ray pictures of the abdomen in the acute stages of Pb colic. Patients do not reach the hospital until the acute stage is over, by which time any characteristic X-ray appearances have disappeared. A study was made in which Ba was given and observed by X ray while passing along the intestines in 8 cases of Pb colic. The movements of the Ba are shown in a series of illustrations from which Pb colic seems to present a picture of atony without distension. The atony occurs throughout the intestine, in the jejunum and on to the ileocecal valve. Generally, intestinal atony is associated with distension. This is not the case in Pb colic, and this may help in differential diagnosis of doubtful abdominal disorders. The authors state that the pathogenesis of this disorder is mysterious. Pb colic can be induced by BAL. Atony of the intestine with dilation is attributed to a hypertony of the orthosympathetic; and rapid relief of Pb colic may be produced by splanchnic infiltration.

**1497** Ludovico, P. (Univ. Rome, Italy): Le epatopatie nella medicina del lavoro. (LIVER DISEASE IN OCCUPATIONAL MEDICINE.) Folia Medica (Naples) 37:1058-82, 1954.

The pathology of liver diseases is reviewed with reference to infections and poisoning with a number of substances including Pb. (86 references)

**1498** Marconi, E. (St. Anna Hosp. Castelnuovo Monti, Italy): Un saturnismo subacuto da autoimpallinamento accidentale trattato con mercapurolo (B.A.L.). (aspetti etiopatogenetici e medico-legali). (SUBACUTE

SATURNISM CAUSED BY ACCIDENTAL SELF-INFLICTED WOUND TREATED WITH DIMERCAPROL (BAL); ETIOPATHOGENIC AND MEDICOLEGAL ASPECTS.) Rivista di Patologia Clinica 9: 263-78 (July), 1954.

The case described is that of a 56-yr-old man who, from the age of 17-18 was an excessive drinker of wine, as well as an excessive eater and smoker. He was hospitalized with complaints of abdominal pains, headaches, dyspepsia with vomiting, and gastric acidity. The findings included anemia and hypotension for which he was treated symptomatically. Forty-five days later a gingival Pb line pointed to the possibility of Pb poisoning. Questioning revealed that 1 1/2 mo before hospitalization he had accidentally shot himself, whereupon treatment with BAL was instituted, and the bullet was removed surgically. Analysis revealed in urine 0.07 mg% Pb, traces of As and Sb. The composition of the bullet showed 93.72% Pb, 0.36% As and 5.91% Sb. The diagnosis of subacute Pb poisoning is justified by the author on the basis that the Pb projectile was dissolved in the acid medium of the patient's organs.

1499 Mariné Pérez, J. (Spain): Intoxicación Saturnina. (LEAD POISONING.) Medicina Colonial (Madrid) 23:142-8, (Feb. 1) 1954.

The route of absorption of Pb (ingestion, inhalation), metabolism, signs in acute and chronic poisoning, diagnosis of the disease, and treatment are reviewed.

1500 Mazzoleni, A. (Univ. Milan, Italy): Studio sulla frequenza dell'ipertensione tra i saturnini con coliche pregresse. (STUDY OF THE INCIDENCE OF HYPERTENSION AMONG WORKERS AFFECTED WITH LEAD POISONING WHO HAD PREVIOUSLY SUFFERED FROM LEAD COLICS.) Medicina del Lavoro 45:482-7 (Aug.-Sept.), 1954.

The incidence of hypertension was studied in 27 workers (age at last examination, 39-58 yr) who had previously suffered from Pb colics. These were grouped as follows: (1) Those with an interval of <3 yr between 1st colic and last pressure reading (7); with interval of 3-10 yr (9); interval of >10 yr (11). The data collected showed a rather remarkable percentage of hypertensives (5/11) among workers reexamined 10 yr after the 1st colic. For a statistical assessment of the results a control was carried out on a group of 11 workers who had never been in contact with Pb. Also a comparison was made between the percentage of hypertensives among workers affected with Pb poisoning who had previously suffered from Pb colics and the percentage of hypertensives among the whole population (according to Weisz). Both comparisons pointed to the probable existence of a correlation between Pb colics which had occurred >10 yr earlier and arterial hypertension.

1501 Merli, A.: Comportamento dell'emometria, dei punteggiati basofili e delle porfirine urinarie negli operai di una fabbrica di accumulatori al piombo. (THE RELATIONSHIP OF BLOOD COUNTS, BASOPHILIC STIPPLED ERYTHROCYTES, AND PORPHYRINURIA IN WORKERS OF A STORAGE BATTERY PLANT.) Abstracts of

Reports from the Institute of Industrial Medicine of Milan. Rassegna di Medicina Industriale 23:282 (Abstracts); 396-9, 1954.

After first describing the various operations in the manufacture of batteries, ie, melting, mixing, pasting, pouring and trimming of plates, etc, the author reports the findings on all workers of a battery plant in respect to Hb determination (Sahli's method), basophilic stippling (fixing smear in methyl alcohol, microscopic counts after immersion in aqueous Azur II solution, adding a small amount of soda), and urinary coproporphyrins (gross comparison under Wood's light). The findings are tabulated individually for each worker as to sex, age, length of Pb work, history, objective signs, and the criteria examined. The author concludes that there was correlation of all the findings, so that any one single abnormal finding would justify the suspicion of Pb intoxication. This in turn would permit the timely institution of therapeutic measures (antianemic and detoxicating) or of removal, either temporary or permanent, of the worker from Pb risk.

1502 Messmer, E. (Heidelberg Med. Univ. Clinic, Germany): Zur klinischen Begutachtung gewerblicher Bleivergiftungen. (CLINICAL EXPERT OPINION ON OCCUPATIONAL LEAD POISONING.) Medizinische Klinik 49, No. 6: 218-23, 1954.

The author emphasizes the essential distinction between Pb encephalopathy due to poisoning by inorganic Pb, and the cerebral symptoms due to the TEL contained in leaded (Pb) gasoline. The symptoms of TEL poisoning are always acute and cerebral: a prodromal stage, lasting several days, of lassitude, headache, loss of appetite, irritability, and bradycardia, followed by mental confusion and schizophrenic manifestations. Pb encephalopathy following exposure to inorganic Pb is of a more chronic nature, with headache, lack of concentration, sleeplessness, giddiness, and finally convulsions. The pathologic lesions in the brain show injury, in the case of TEL, chiefly in the ganglion cells; in Pb encephalopathy, in the vessels with secondary atrophic degeneration. True chronic Pb poisoning from the handling of Pb gasoline is practically unknown, partly because the amount of Pb in the volatilized gasoline is so small (1 l. of Pb gasoline contains 0.6-1 ml of ethyl fluid, the TEL content of which is about 60%) and partly because the inorganic Pb compounds to which TEL is converted in the body are so rapidly excreted. Some risk of Pb poisoning, however, may occur in aeroplane tank attendants, especially during the cleaning of motor parts, when the burning of Pb gasoline may give rise to fine inorganic Pb dusts. In the diagnosis of inorganic Pb poisoning the most reliable criterion is the spectrographic analysis of blood, since true Pb poisoning is never found with a normal content of Pb in blood. The "blue line" on the gums is never found in TEL poisoning, and in poisoning by inorganic Pb it must be carefully distinguished from a deposit of Pb sulfide on the margin of the gums. In exposing malingers who claim a recrudescence of symptoms towards the end of their period of compensation, quantitative analysis of urine and feces is in-

dispensable. The occurrence of abnormally high ratio of Pb in feces to Pb in urine indicates recent ingestion of Pb, which can also be demonstrated by abdominal radiography. An increase of stippled erythrocytes to a maximum after several days, followed by a decrease, is a further indication of such ingestion. In discussing the possible causal relationship between Pb poisoning and injury to the kidneys and liver, hypertonia and peptic ulcer, the author concludes that while liver injury from direct toxic action on the liver cells must be regarded as probable, Pb nephritis and arteriosclerosis can only be associated with exposure to Pb in the sense of tending to increase any disorder of the kidneys or arterial system already present, and that a causal association with peptic ulcer has not been firmly established.

- 1503 Michelis, F. de: (STOMATOLOGY OF WORKMEN EXPOSED TO OR AFFECTED BY OCCUPATIONAL POISONING. 2. LEAD.) Med. Secur. Trab. 2:46-52 (June), 1954.

The effect of Pb poisoning on the teeth has been studied in 76 workmen. They showed loss of sensibility in their dental pulp, very edematous mucosa, deep gingival bags, and, in some cases, rarefaction of the alveolar bone. Painless caries were frequent, as well as painful and recurrent abscesses. The author deduces that paradental processes are due to the direct action of Pb, since the gums act as emunctories; the accumulation of Pb at a time of excessive ingestion or mobilization, or when the arterial walls are specifically injured, produces the concentration that is necessary to make it act. Pulpal-necrosis (afterward infected) occurs when the Pb passes through the blood stream of the dentinal canals. Twelve patients with chronic Pb poisoning were studied, 9 with no teeth and the other 3 with a few loose teeth. They all had very retracted alveolar processes, anemic and edematous mucosa, and alveolar osteitis. The remaining teeth had lost sensibility and had painless caries. Paradentitis (inflammation) and paradentosis (noninflammatory pathologic conditions) can be produced simultaneously. (From Industrial Hygiene Digest 18:1254, 1954)

- 1504 Morel, P., Roche, L., and Baron, J. (France): Le myélogramme dans le saturnisme; valeur diagnostique. (THE MYELOGRAM IN LEAD POISONING; DIAGNOSTIC VALUE.) Proceedings of the Society of Industrial Medicine of Lyons. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 15, No. 4:308-11, 1954.

Although the changes in blood produced in Pb poisoning have been studied extensively, relatively little is known about those taking place in the bone marrow. Therefore the authors studied the myelogram of ~100 persons with definite or suspected Pb poisoning. Biopsy material was obtained by sternal puncture. As in blood, increased numbers of stippled red cells appear in the marrow. To illustrate, the counts of 5 smears that were sufficiently homogeneous, are given: the stippled cells in bone marrow and peripheral blood/million erythrocytes, respectively, were: 8400, 800;

6200, 5500; 19,000, 15,000; 6000, 1600; 6200, 1800. The marrow does not show changes occurring soon in blood after Pb absorption (stippled cells, decrease in hemoglobin, and mild anemia) until much later, by which time macrophages, which are normally rare in the marrow, are abundant, particularly in chronic cases. This hyperplasia of macrophages is of considerable diagnostic value. When once these changes have been established in the marrow they persist for perhaps 3-4 mo; if however, BAL has been used to eliminate the Pb, the marrow quickly becomes normal, perhaps in 1 mo, which indicates the value of this treatment for clearing Pb out of the system. In delayed Pb poisoning, symptoms of blood change appear long after exposure to Pb has ceased (>5 yr in one case) and the myelogram changes persist longer still in such cases. The execution of myelograms is difficult and can be done only by a fully qualified hematologist, and the inconvenience of sternal puncture limit the application of this test. However, in certain cases it is indispensable for the diagnosis of Pb poisoning.

- 1505 Morgan, J.L. (Emporia, Kans.): THE DIAGNOSIS OF LEAD POISONING. Journal of the Kansas Medical Society 55:11-6, 1954.

Pb poisoning occurs when absorbed Pb produces sufficient damage to cause disabling symptoms. The diagnosis is based on the history, symptoms and signs, coupled with the laboratory findings, and is not based on any one specific laboratory test. Certain simple tests are of practical value in confirming a clinical diagnosis of Pb poisoning. These tests are: Hb determination, the stipple cell count and the urinary porphyrin test.

The urinary porphyrin test is much easier to perform than the stipple count. The porphyrin test has a much clearer "end point," and is usually positive before the stipple count becomes abnormally elevated. The quantitative advantages of the stipple count, however, would seem to preclude its complete replacement by the porphyrin test. (From author's summary; 17 references)

- 1506 Nunziante, Cesàro, A., Rao, M., and Cannavò, C. (Univ. Messina, Italy): Comportamento dei lipidi citomematici nel rischio saturnino. (LIPIDS IN THE BLOOD CELLS IN EXPOSURE TO LEAD POISONING.) Folia Medica (Naples) 37:483-6, 1954.

The blood of 45 workers, exposed to Pb from 1-43 yr was examined; 2 of them were afflicted with Pb poisoning. Hematologic findings (red and white cells, etc) revealed no particular changes. Sudanophil reaction (according to Sheedan and Storey) was minimum in 6 cases exposed from 1-7 yr; average, in 19 cases exposed for 1-18 yr; and maximum in 20 cases exposed for 3-30 yr, among the latter, the 2 with clear signs of poisoning. The authors conclude that sudanophilia and time of exposure to Pb showed a certain, although not strict, parallelism.

- 1507 Ohlsson, W.T.L. (Örebro, Sweden): Kalciumdinatrium EDTA vid kronisk blyförgiftning. (CALCIUM DISODIUM SALT OF ETHYLENEDIAMINE TETRAACETIC ACID IN THERAPY OF LEAD POISON-

ING.) Svenska Läkartidningen 51:2324-9 (Sept. 3), 1954.

The effectiveness of EDTA therapy, based on published reports, is substantiated in the treatment of a case of occupational Pb poisoning which is described.

- 1508 Okhnyanskaya, L.G. (Acad. Med. Sci., USSR): Ol'faktometriya pri intoksikatsii rtut'yu i svintsom. (OLFACTOMETRY IN MERCURY AND LEAD POISONING.) Trudy Akademii Meditsinskikh Nauk SSSR 31:28-32, 1954.

Elsberg's test (1935) was used to determine disorders of the sense of smell in patients with Pb or Hg poisoning and in workers exposed to these substances. In Hg poisoning, a lower threshold and longer period of adaptation was found, and for Pb poisoning, a heightening of threshold and shortened adaptation. The greatest changes were observed in respect to stimuli of predominantly sympathicotropic action. The changes in activity of the olfactory analyzer were found to correspond to the degree and phase of intoxication and they were reversible.

- 1509 Olson, K.B., Heggen, G., Edwards, C.F., and Gorham, L.W. (Albany Med. Coll.; Saratoga Springs Comm. Res. Lab., N.Y.): TRACE ELEMENT CONTENT OF CANCEROUS AND NONCANCEROUS HUMAN LIVER TISSUE. Science 119:772-3, 1954.

Twelve trace elements were studied by a spectrographic method in the livers of 6 persons dying of noncancerous disease, 2 persons dying of carcinoma of the esophagus and portal cirrhosis of the liver, 4 persons dying of gastrointestinal cancer with metastasis to the liver, and 1 case of acute lymphatic leukemia. Pb was present in a few samples but in most was below the level of detection for the method of analysis used. In the case of acute lymphatic leukemia with hepatic infiltration, Pb was present in measurable amounts, but it is not possible to say whether it is significantly increased, since it is found erratically in other livers.

- 1510 Ostapenya, P.V., Seleznev, A.F., and Gel'fer, E.A. (USSR): Sluchai otravleniya tetraetilsvintsom cherez vodu shakhtnogo kolodtsa. (OCCURRENCE OF POISONING WITH TETRAETHYLLEAD IN WELL WATER.) Gigiena i Sanitariya 1954, No. 2:48-9.

In 1941 a peasant used a fluid contained in a metal barrel, which he had gotten from some army barracks, to paint the walls in his home. The whole family died as a result of this. A farmer in a neighboring village also had in his possession a barrel containing the same fluid, so he immediately got rid of it by pouring it into a hole dug on his grounds about 25-30 m from a well (concrete shaft) and covered it with earth. The barrel was then rinsed with water and this rinse water was dumped very close to the well. About 1-1/2-2 yr thereafter, the water had an odor of rotting apples, and its use was discontinued for a while after another well was dug. Then the water was used continuously until 1953. Until 1950 the members of the family (5) were well with the exception of the father who periodically complained of

general weakness and headaches. In 1950 the eldest daughter died. Two other members died in 1953. The other 2 also became ill in 1953, but recovered after a lengthy stay in the hospital. The major signs were fearfulness, sensation of hair in mouth and on lips. At the same time, a cow on this farm became ill and died; some sheep had died somewhat earlier. Only a dog survived.

Since no such manifestations were seen in neighboring farms, an investigation of the premises was undertaken. A fruity odor was detected in the vicinity of the well. Analysis of the water gave 10-15 mg TEL. Analysis of the soil showed only traces of it. In the other well, 131 m away and lower in slope, TEL was also found, but in smaller quantities. In neighboring wells, situated higher, no TEL was detected. The reason for the occurrence of the poisoning after this period of time is attributed to the slope of the ground and to the lowering of the underground flow of water.

- 1511 Pavlova, I.V., and Mumzhu, E.A.: (THE ACTION OF DIGESTIVE ENZYMES IN LEAD POISONING.) Trudy Akad. Med. Nauk. S.S.S.R. 98-102, 1954.

Patients with chronic Pb poisoning of varying duration and gravity were studied. Pepsin-activity variations were greater in the controls; amylase and lipase activity was lower than in health. No parallelism was detected between the deviations from normal and the severity of the Pb poisoning. Some parallelism appeared between the deviations in the enzyme activity and the state of the central nervous system. (From Chemical Abstracts 50: 5165, 1956)

- 1512 Perales, N., and Gonzalez, T. (Nat'l. Inst. Ind. Med. Hyg., Spain): Las cifras de Pb en sangre y orina y diversos sintomas de saturnismo. (Estudio estadistico.) (NUMERICAL VALUES OF Pb IN BLOOD AND URINE AND VARIOUS SYMPTOMS OF LEAD POISONING. (STATISTICAL STUDY.)) Medicina y Seguridad del Trabajo (Madrid) 3, No. 9:46-8, 1954.

The frequency of blood Pb values from 1-200 µg/100 ml (at 25 µg intervals) was determined on 96 exposed workers; the arithmetic mean obtained was 66.66 and standard deviation, 42.50. The frequency of urinary Pb determined on 96 workers (similarly) from 1-250 µg/100 ml gave an arithmetic mean of 77.29 and standard deviation of 52.58. The correlation between blood and urine values was +0.20. The correlation in 125 workers showing > or <60 µg/100 ml in blood and urine and the various signs of Pb poisoning (Pb gum line, colic, tremor, polychromasia, stippled cells) led the authors to conclude that all signs considered pathologic or classical are only possible and not always constant in a severe poisoning, for although they indicate the existence of Pb poisoning there is no correlation with the amounts of Pb in blood and urine.

- 1513 Raymond, V. (Paris, France): Évolution des maladies professionnelles: le saturnisme. (DEVELOPMENT OF OCCUPATIONAL DISEASES: LEAD POISONING.) Proceedings of the Society of Industrial Medicine and Hygiene.



The author had followed 52 cases of Pb poisoning over various periods of time, up to >3 yr after onset of clinical signs. In all cases, except one, the persons had been removed from exposure. From the results of his observations, the author feels that a period of 3 yr is insufficient to consider such patients to have become stabilized. In this last group of 30 patients, 10 had improved, 15 were essentially in the same condition, 5 were in aggravated condition.

- 1514 Reinl, W. (Staatl. Gewerbeärztes Nordrhein, Düsseldorf, Germany): (OCCURRENCE, TREATMENT, AND PREVENTION OF LEAD POISONING.) Z. Erzbau u. Metallhüttenw. 8:325-9, 1954.

A discussion with 24 references. (From Chemical Abstracts 49:13556, 1955)

- 1515 Reinl, W. (Supervisory Distr. State Ind. Med. Office, North Rhine area, Düsseldorf, Germany): Über den jetzigen Verlauf der Bleivergiftungen unter besonderer Berücksichtigung der Verhältnisse in Nordrhein. (THE PRESENT TREND IN THE INCIDENCE OF LEAD POISONING WITH PARTICULAR REFERENCE TO CONDITIONS IN THE NORTH RHINE AREA.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 4:102-7 (July), 1954.

The incidence of industrial Pb poisoning in the North Rhine district in the years 1926-1952 is recorded with some comparison with the experience in England. In 1931 a peak of incidence amounting to 460 cases occurred in the North Rhine area, after which there was a gradual but irregular fall to about 45 cases in 1938, followed by an increase to 85 cases in 1940. During the war years the incidence fell to a very low level and in 1945 there was a record of only 1 case. After that year the number of cases increased each year to a maximum of 142 in 1950 and then diminished again to 62 in 1952. The reasons for this post-war increase are described and are to be found in the industrial recovery of the country and also in the special exposure to risk of workers engaged in the manipulation of scrap metal covered with thick Pb paint. At the time Pb comes second in importance to CO in the list of substances causing industrial poisonings. A description of the various industrial processes in which Pb poisoning constitutes a risk is given. A list gives the percentage frequency of symptoms recorded in 392 cases of Pb poisoning during 1945-52. These symptoms are described. Stippled erythrocytes were found in 83.7% of the cases. The value of this sign is described and discussed, as also is the occurrence of anemia and the chemical determination of Pb in blood. It is noted that saturnine encephalopathy was diagnosed in only 2 cases in this series, and these are described.

- 1516 Roche, L., and Lafon, F. (Lyons, France): Syndrome neurologique atypique et intoxication mixte par le plomb et l'arsenic. (ATYPICAL NEUROLOGIC SYNDROME AND MIXED INTOXICATION BY LEAD AND ARSENIC.)

Struck by the coexistence of Pb and As intoxication in 3 workers hospitalized in the authors' clinic, one of them (L.) chose this for her thesis in 1953. Each of the 3 cases is described in detail. They were: (1) a 38-yr-old and (2) a 56-yr-old man, both industrial plumbers for >20 yr, and (3) a 41-yr-old man who had been an orchardist until 1930, then a mechanic, and from 1947 had worked in a metallurgic plant. Cases 1 and 2 exhibited signs of subacute poisoning (colic, anemia, signs of neuronal involvement), and Case 3, those of a more gradual progress. Although a similar case of mixed intoxication was reported by Sartorelli (1954), the clinical picture was different in the 3 cases above; the common element was the association of a change in the peripheral and central neurons, the location, however, was different: quadriplegia in Case 1, associated with amyotrophy of all muscles; paralysis involving the lower limbs, becoming generalized and similar to Landry's syndrome in Case 2; attack of the upper limbs and later, the lower.

Pb poisoning was evident in all, and Pb colic, the classical blood changes (anemia, stippled cells), and urinary porphyrins preceded the neurological manifestations. As intoxication was indicated by the amount present in the hair (~25 mg/kg; 3 workers in the same plant as Case 3 showed 10-14).

The authors conclude that in any case of atypical neurologic syndrome the possibility of a toxic etiology should be considered. Since the combination of Pb and As seems to produce a particular neurotropism, it is of major importance to investigate the clinical and chemical indications of this double intoxication in any Pb paralyzes, because As is often found as an impurity of Pb.

- 1517 Orlova, A.A. (USSR): Izmenenie serdechnoi deyatel'nosti u bol'nykh s intoksikatsiei svintsom i rtut'yu. (Po dannym elektrokardiografii.) (CHANGES OF HEART FUNCTION IN LEAD AND MERCURY POISONINGS. (ELECTROCARDIOGRAPHIC DATA.)) Trudy Akademii Meditsinskikh Nauk SSSR 31:102-12, 1954.

The authors studied 234 patients, 104 with Hg poisoning and 130 with Pb poisoning. In addition to general medical examinations, EKG's were performed. As summarized, in Hg and Pb poisoning cardiovascular function is altered. In a number of cases, disorders of myocardial function occurred, characterized by a decreased voltage of P, R and T waves. By applying a physical load, it was possible to effect myocardial changes which may be compensatory. By means of the ocular cardiac reflex, increased stimulation of the vagus nerve could be demonstrated. The type of disturbances shown by EKG, in view of the known correlation of EKG and functional state of the central nervous system permitted the conclusion that changes in rhythm and waves, the singular reaction of the ocular cardiac reflex and of physical load are attributable primarily to disorders of the higher segments of the central nervous system by Hg and Pb. The changes in cardiac function in these intoxications reflect the complex of reactions of the organisms to the toxic processes.

- 1518 Ruotolo, B.P.W., and Elkins, H.B. (Boston, Mass.): LEAD AND COPROPORPHYRIN EXCRETION OF PATIENTS TREATED WITH EDTA. A.M.A. Archives of Industrial Hygiene and Occupational Medicine 9:205-9 (Mar.), 1954.

Pb poisoning continues to be a problem in Massachusetts. The Division of Occupational Hygiene has been evaluating Pb exposure by urinalysis and during 1947-1952 ~700 workers were found to excrete enough Pb to indicate a hazardous exposure.

In a study for the evaluation of the effectiveness of EDTA treatment, 24-hr urine samples (adjusted to sp gr 1.024) of 10 Pb-intoxicated patients were analyzed (dry ashing method by Hardy et al, and modified Ross-Lucas method, 1935), along with samples of a control group, all of whom were treated with EDTA. As a rule, 0.1 g CaEDTA/30 lb body weight was administered intravenously for 1-7 days. For this study the number of days of treatment in most cases was 4-8; 3 received 10, and 13, 25-day treatments, respectively, which required 1 or more rest periods. Samples of urine immediately before treatment were obtained in all but 2 patients. During treatment, begun at suitable periods, collection was daily and at varying intervals after the last dose.

Concentrations of Pb in the urine at time of diagnosis ranged from 0.17-1.2 mg/l, and coproporphyrin (CP) 0.1-14 mg/l (estimates). Average values obtained at hospitalization and thereafter, for Pb and CP, respectively, in mg/l: in the 1st samples, 0.56 and 6.4; pre-EDTA, 0.28 and 3.7; 1st day EDTA, 6.8 and 4.3; 2nd day, 9.0 and 3.8; 3rd day, 7.7 and 2.3; last day, 3.3 and 0.7; 2nd day post-EDTA, 0.78 and 1.0, etc, to 4th week post-EDTA, 0.22 and 1.1. Three controls (medical personnel) were given a single injection of EDTA; their average Pb excretion on that day was 0.4 mg/l vs 1.2 mg in the patient group on that day.

The authors conclude from these results that EDTA is an excellent agent, provided there are no harmful side-effects.

- 1519 Saita, G., and Moreo, L. (Univ. Milan, Italy): Le porfirine nella bile dei saturnini. (PORPHYRINS IN THE BILE OF LEAD POISONED SUBJECTS.) Medicina del Lavoro 45:84-92 (Feb.), 1954.

Contents of porphyrins in the bile were determined (by Vigliani and Sonzini's method, 1938) in 21 subjects, 12 of whom gave evident signs of severe acute Pb poisoning and 9 were affected by chronic poisoning. Particular attention was given to the behavior of the coproporphyrin (CP) isomers in the bile. The results showed that Pb poisoning causes a higher biliary elimination of porphyrins (3 times normal). This increase is more evident in the acute than in the chronic stage. CP and protoporphyrin (PP) IX only are to be found in the bile of subjects suffering from Pb poisoning in a reciprocal ratio not differing from the normal. Elimination of PP in the bile behaves almost the same as that of PP in blood. Determination of the isomers showed that the bile in Pb patients contains both CP I and CP III in a varying percentage, greatly in favor of CP III, as compared with the ratio in normal subjects. The authors assume that the higher contents of CP in the bile in Pb poisoning are mainly due to an increased elimina-

tion of CP III. In the urine as well as in the bile the elimination of CP I was slightly higher than normal, whereas the elimination of CP III strongly increased.

The authors conclude from this that Pb poisoning produces a metabolic alteration affecting especially PP IX and CP III and therefore the porphyrins of Series III. According to the findings, it does not seem strictly necessary to ascribe to the liver a special synthesizing function in respect to porphyrins of Series III but only an eliminating function competing with that of the kidneys, of the porphyrins of this series, which are manifestly increased in the blood because of a metabolic disorder in hemoglobin synthesis. (24 references)

- 1520 Saita, G., Moreo, L., and Fabiani, A. (Univ. Milan, Italy): Studio sulle porfirine nel sangue midollare e nel sangue periferico nel saturnismo. (STUDY ON THE PORPHYRINS OF THE BONE MARROW AND PERIPHERAL BLOOD IN LEAD POISONING.) Medicina del Lavoro 45:293-9 (May), 1954.

The content of porphyrins in the marrow and peripheral blood was studied in 21 workers affected by Pb poisoning, 14 in the acute stage and 7 in the chronic. The following were the mean values obtained: in the acute stage the marrow porphyrins (copro-(CP) + protoporphyrins (PP)) reach an average of 471 µg/100 ml of red cells, and the blood porphyrins 440 µg/100 ml of red cells. In chronic Pb poisoning the total marrow porphyrins were 490 and blood porphyrins 460 µg/100 ml of red cells. In cases of advanced Pb "shrunk kidney," the marrow and blood porphyrins remain normal. Any other type of porphyrins are absent. In both forms of Pb poisoning the marrow and blood porphyrins are greatly increased compared with the normal, without significant differences between the marrow and peripheral blood. The same behavior is shown only by the PP, which constituted by far the greater and sometimes the exclusive part of the total porphyrins; on the other hand the earlier and more severe the intoxication the higher is the value of the CP, with higher values in the marrow blood than in the peripheral blood where it is almost always absent in cases of chronic Pb poisoning. A certain relation was observed between urine CP and rate of CP elimination. The marked increase of the marrow CP, which in acute Pb poisoning represents the forerunner of PP, shows that the disorder of hemoglobin metabolism is more marked in the acute stages of poisoning than in the chronic. In the latter where the hemopoietic regeneration is less intense, CP levels are low and the metabolic disorder still in existence is evidenced by the PP alone. CP decreases during its passage through the peripheral blood, most probably on account of the decrease in inhibition exerted by Pb on its utilization for PP synthesis. The persistent marked increase of the blood and marrow PP in cases of chronic Pb poisoning, even when urinary CP has returned to normal values, may represent a diagnostic tool which should not be neglected. (From authors' summary) (25 references)

- 1521 Saita, G., Zurlo, N., and Gattoni, L. (Univ. Milan, Italy): Colica saturnina seguita dopo pochi giorni da morte dosaggio

del piombo negli organi. (LEAD COLIC FOLLOWED IN A FEW DAYS BY DEATH: DETERMINATION OF LEAD IN THE ORGANS.) *Medicina del Lavoro* 45:379-85 (June-July), 1954.

A 61-yr-old man, who had worked for 6 yr as a Pb founder, died from acute heart insufficiency a few days after having suffered from a typical Pb colic. Autopsy findings revealed a diffuse myocardosis, with cicatricial sequelae of old infarct, visceral stasis, arteriosclerosis and nephrosclerosis. The analyses for Pb content in the various organs showed that the highest proportions were to be found in the bones (sternocostal articulations, 15.5 mg; femur, 5.4 mg; sternum, 2 mg/100 g) and in the different sections of the reticuloendothelial system (liver, 1.5 mg; spleen, 0.8 mg). Apart from the absolute amounts, this distribution was not unlike the one observed in normal subjects. The Pb content in the kidneys was low (0.31 mg/100g) and also the proportion between blood and urine Pb was abnormal (Pb was very high in the blood (160-185 µg%) and relatively low in the urine (150-210 µg/l)).

From these data, the authors conclude that in their case there was a certain want of equilibrium between the amount of Pb circulating and deposited in the different organs and the amount eliminated with the urine, which was perhaps one of the causes of the occurrence of the acute intoxication. The adrenal Pb was very high (3.9 mg/100 g). This may support the modern theories which attribute to the adrenal an important role in provoking the occurrence of Pb colic and its collateral manifestations. In addition to the organs mentioned above, Pb was also determined in large intestine (1.05 mg/100 g), aorta (1.02), trachea (0.77), pancreas (0.67), thyroid (0.60), bone marrow (0.42), brain (0.40), lung (0.35), muscle (0.275), stomach (0.22), testicle (0.20), esophagus (0.18), heart (0.15), tongue (0.14), prostate (0.11), small intestine (0.09), bladder (0.09). All determinations were made on fresh tissue. (12 references)

- 1522 Saitta, G. (Univ. Messina, Italy): I lipidi etereestraibili nel saturnismo professionale. (ETHER-EXTRACTABLE LIPIDS IN OCCUPATIONAL LEAD POISONING.) *Folia Medica (Naples)* 37:487-95, 1954.

The serum lipids extractable with alcohol-ether showed in Pb poisoning, as determined on 12 patients, an increase even at low alcohol concentration and there was an increase of total extractable lipids. The critical point denominating the minimum alcohol concentration permitting extraction showed a shift towards lower concentration. The findings suggested to the author a lowering of the immunity against infection on the part of the Pb workers. (23 references)

- 1523 Saitta, G. (Univ. Messina, Italy): Comportamento dei 17-chetosteroidi urinari nel saturnismo professionale. (17-KETOSTEROIDS IN OCCUPATIONAL LEAD POISONING.) *Folia Medica (Naples)* 37:590-6, 1954.

Having found in control normal subjects that the av 24-hr excretion of 17-ketosteroids was 17.49 mg, the author examined 15 workers who had been exposed to Pb for 12-48 yr and who suffered from Pb poisoning. The average for those exposed from

10-20 yr was 9.31; from 20-30 yr, 8.30; from 30-40 yr, 7.56; and for those exposed for 40-50 yr, 6.70 mg. Thus, the effect of prolonged action of Pb on the adrenal was evident. The author concludes that a direct action of Pb on the adrenal can be admitted; not to be excluded is the possible functional interference with other components of the prehypophyseal-adrenal-gonadal complex.

- 1524 Salvini, M., and Massignan, G. (Univ. Padua, Italy): Gli aspetti psichici dell'avvelenamento cronico da piombo tetraetile. (THE PSYCHIC ASPECTS OF CHRONIC POISONING BY TETRAETHYL LEAD.) *Medicina del Lavoro* 45:155-8 (Mar.), 1954.

A case of poisoning by TEL is described. The patient (1 of several observed) had worked in a plant manufacturing TEL from 1940 on. After 1 mo work he experienced acute TEL poisoning (because of insufficient protection) with loss in weight, anorexia, vomiting. He recovered after 6-7 mo. Then he worked for 3 yr in the same factory, but on another job with no exposure to TEL and no further disturbances. After the war, he returned to work with TEL. After 1 yr exposure, various symptoms involving the nervous system began to appear which became aggravated with time, with brief remissions, and culminated in definite mental deterioration of paranoid type.

The authors call attention to the existence of chronic TEL poisoning. They raise the question whether it would not be prudent to institute periodic psychiatric examinations of workers exposed to TEL.

- 1525 Sarkady, L.: Tűmeges ólomérgezés cserépedényekkel. (MASS POISONING CAUSED BY USE OF A LEAD-GLAZED POTTERY.) *Orvosi Hetilap* 95:758-62 (July 11), 1954.

- 1526 Sartorelli, E. (Univ. Milan, Italy): Su di un caso di tetraplegia chiropodale da intossicazione subacuta da arsenico e piombo trattato con B.A.L. (CHEIROPODAL TETRAPLEGIA FROM SUBACUTE ARSENIC AND LEAD POISONING TREATED WITH BAL.) *Medicina del Lavoro* 45:146-54 (Mar.), 1954.

A workman was engaged in the demolition of a Pb foundry, using an O flame for cutting Fe girders, and inhaled dust which was later shown to contain from 10-20% Pb and from 0.11-0.43% As, as well as fumes arising from the cutting process. He developed severe colic with vomiting and profuse diarrhea lasting 10 days, paresthesias with loss of sensation in all extremities, together with pareses and paralyses of varying degree. The urine contained 0.100 mg Pb/l and 0.400 mg As/l in addition to coproporphyrin; 0.135 mg/g of As was found in the nails. As there was no improvement in 4 mo, 300 mg of BAL was given daily for 7 days; this was followed by increased Pb but decreased As concentration in the urine. Detailed blood and urine analyses are given. No clinical improvement followed, and the authors suggest that BAL may have a selective action on Pb and produce biochemical conditions favorable to the fixation of As in the tissues. (40 references)

- 1527 Schiötz, E.H. (Municipal Workers' Hosp.,

Oslo, Norway): Telling av basofilt punkterte røde blodlegemer (B.P.) som ledd i blyfor-giftningsprofylaksen. (BASOPHILIC STIPPLING COUNTS IN THE CONTROL OF LEAD POISONING.)

Nordisk Hyg. Tidskr. 1954, No. 1/2:37-43.

As summarized by the author, in consequence of an article appearing in a previous issue of this journal, in which the value of stippled cell (SC) counts, in the opinion of the author of this paper is underrated, attention is drawn to the following features: The apparently wide variation in the number of SC from one day to another as occasionally observed, may be explained by unavoidable random sampling errors involved. These may interfere markedly with the result, particularly when there are few SC and when few fields are counted. A diagram shows the deviation when 5000 and 20,000 red cells, respectively, are counted. If, 900 SC/million erythrocytes are found after counting of 5000 cells, the margin or error will be 144% to either side; the actual number of SC will consequently be some figure between 0 and 2200. If the figure is 19,000 SC/million after counting of 20,000 cells, the margin of error is merely 15% and thus insignificant. Routinely, a total of 10,000 red cells should be examined to obtain a reasonable degree of accuracy. If the number of SC/million red cells is >2500, a double number of fields should be examined (20,000 cells). Scrupulous care should be taken in the technical performance of the counting. The dark-field method should preferably be used. A detailed description of the technique is given. A single count of up to 5000 SC/million is of no practical consequence unless in the presence of other evidence of Pb absorption. Additional procedures should always be performed if the number of SC is abnormally increased without definite occupational factors being involved. An increased number of SC per se is no specific sign. The author has thus observed up to 17,000 SC/million in individuals not having been exposed to Pb (17,000 in a patient with jaundice and cholangitis). The term poisoning should not be used unless in the presence of subjective symptoms of disease or unhealthiness. (From Bulletin of Hygiene 29:497, 1954)

- 1528 Shiels, D.O. (Dept. Health, Victoria, Australia): THE ELIMINATION OF LEAD IN SWEAT. Australasian Annals of Medicine 3: 225-9 (Aug.), 1954.

After a survey of previous work concerning the elimination of Pb by the skin, results obtained with 7 subjects are reported (6 with Pb poisoning, one (the author) without any significant exposure to Pb but taking 5 mg Pb acetate daily by mouth later in the experiment. Cotton pads (8x6 cm) were attached to the skin of the persons with adhesive tape on thoroughly cleansed parts of the skin and left on for several days. The amount of Pb taken up by the pads in each case was obtained by subtracting the amount contained in the unused control pads and reagents from the total amount of Pb. Final comparisons were made by the "1-color" method in a photoelectric colorimeter and in the last case, also by the "mixed color" method. The values obtained by the 2 methods agreed very well. Results showed that the Pb on the pads represented a considerable amount relative to the total amount

excreted in the urine. External contamination by Pb of the pads was not considered likely. Pb excretion through the sweat glands was significant many days (11-19) after cessation of exposure and during administration of Na thiosulfate for Pb elimination by urine and feces. In the treated patients, comparative data for blood, urine, and sweat Pb were: 0.19-0.24 mg/100 ml; 0.28-1.78 mg (total Pb for period of pad); 0.008-0.165 mg (total on pad) and 0.0016-0.03 mg/day. Author-subject observed increased excretion of Pb in sweat after increased ingestion of Pb and during warmer weather as follows: When no Pb was taken, no Pb was excreted in cool weather (Apr), 0.012 mg (0.13 in urine) in warmer weather (Oct), 0.024 mg (0.17 in urine) during administration of 5 mg Pb/day for 3 days in October, and 0.050 mg during administration of 10 mg/day for 3 days in December (warm weather).

It was concluded that the amount of Pb excreted by the skin of the entire body surface was probably many times that excreted by the skin area covered by the pads and that the total amount thus eliminated may have greatly exceeded that eliminated in the urine, a factor which should be considered in any assessment of the excretion of Pb in man and sweat-producing animals.

- 1529 Shiels, D.O. (Dept. Health, Victoria, Australia): EARLY EFFECTS OF LEAD ON LYMPHOID CELLS. Medical Journal of Australia 1:30-3 (Jan. 9), 1954.

The author returns to a previous claim that a valuable early indication of Pb absorption is to be found in the ratio of monocytes plus large lymphocytes to small lymphocytes  $\frac{L + M}{S}$ . This ratio

is increased when significant amounts of Pb are absorbed and remains increased so long as the absorption of Pb is not too great or too prolonged. This ratio was determined in >2300 blood films including those of persons not exposed to Pb, of those exposed to an industrial Pb hazard, both with and without symptoms, and of those recovering and recovered from symptoms. Results are reported for 5 persons at the beginning and end of their 1st wk of industrial exposure to Pb. At the end of the week the concentration of Pb in the urine was 0.09, 0.15, 0.11, 0.08, and 0.15 mg/l respectively. The technique pursued in examining the blood films is stated in detail, since the blood counts will vary greatly if it is not strictly followed. The way in which the ratio increased for each person is exhibited in a figure. This increase was not due merely to an increase in the relative number of monocytes; there was also a definite increase in the ratio of the number of large to the number of small lymphocytes.

The results indicate a very early effect of Pb on the lymphoid cells, and a useful test in the prevention and diagnosis of Pb poisoning.

- 1530 Shiels, D.O., Thomas, W.C., Palmer, G.R., Cornish, P., and Kearley, E. (Dept. Health, Melbourne, Australia): THE EFFECT OF THE INTRAVENOUS ADMINISTRATION OF SODIUM THIOSULPHATE ON BLOOD LEAD CONTENT AND ON THE EXCRETION OF LEAD IN URINE AND FAECES IN CASES OF LEAD POISONING. Medical Journal

of Australia 2:773-82 (Nov. 13), 1954. The value of the intravenous (iv) administration of Na thiosulfate (TS) in Pb poisoning is considered to have been demonstrated. At Mt. Isa Pb mines and works, this method had become routine, with very rare remissions seen after adequate treatment. It seemed important to know the effect of the treatment on freely circulating Pb in the body, whether it caused storage in a less soluble form in the bones or whether it increased elimination in urine and/or feces. A dose of 30 grains (2 g) in water was given iv every 2nd day. This caused a rapid decrease in the urinary Pb as determined by Taylor's method of precipitation with, or adsorption on, Ca oxalate, dry ashing of the precipitate, and subsequent comparison of turbidity produced in the final Pb solution by Na bisulfite with standard solutions of Pb. The authors slightly modified the method, using silica dishes instead of Pt, and  $\text{HNO}_3$  instead of HCl for the solution of the precipitate prior to ashing. This method is referred to as the modified Taylor's method. Fourteen patients with Pb poisoning who were treated with TS were in Group A, and 4 patients who did not receive this treatment served as Group B. There was no significant difference in the mean concentration of Pb in urine of the 2 groups prior to the commencement of the TS treatment. There was a rapid fall in urinary Pb in all those undergoing TS treatment except in 1 case, and there was no comparable fall in those not receiving this treatment. The fall in urinary Pb concentration was statistically significant and not due merely to daily variations that are known to occur in Pb excretion. More recently a considerable number of determinations of urinary Pb were made, both by the modified Taylor method and by a wet oxidation method, in which oxidation by  $\text{HNO}_3$  or nitrosyl sulfuric acid was followed by determination of Pb concentration by the mixed color dithizone method. While there was no significant difference in the results of analysis of urinary Pb content by the 2 methods in persons not receiving TS treatment, there was a significant difference in the results of the 2 methods in persons who received TS. The values obtained by the wet oxidation methods were ~60% higher. Further, in persons who received TS treatment, the difference between the values as determined by the 2 methods were greater for urine collected during the 24 hr subsequent to the injections than they were for the urine collected prior to the injections. Studies made on some patients are described in greater detail, not only with regard to urinary Pb concentration but also with regard to urinary Pb excretion and fecal Pb excretion. With TS treatment the increased urinary Pb concentration was not maintained for as long as was the case with Na citrate treatment. The difference in the dosages may have been the reason for this. The daily average dose of TS was 1 g (2 g every 2nd day), whereas the dose of the citrate was 12-15 g daily. Thus it was hardly to be expected that the TS would have as great or as prolonged an effect as the citrate. However, clinical experience indicated that the TS treatment was as effective as the citrate treatment, and it may be that the TS is effective because it supplies S. S in various other forms has been use-

ful in the treatment of Pb poisoning.  $\text{H}_2\text{S}$ , Na tetrathionate, S baths, even BAI, have all been used successfully for this purpose. There is no evidence that the treatment with TS causes any storage of the blood Pb content in organs or tissues.

- 1531 Takaoka, K.: (INORGANIC ELEMENTS IN ENDOCRINE ORGANS AND THEIR SIGNIFICANCE.) *Folia Endocrinologica Japonica* 30:499-520, 1954.

From 86 autopsies, including 7 embryos, the water, ash, and trace element contents, analyzed by semi-quantitative spectrographic methods are given. Among the 24 elements examined, Pb was present in approximately 50% of the samples. It was characteristically found in ovaries and adrenal glands (markedly in aged). (45 references)

- 1532 Tara, S. (France): Les saturnismes ignorés. (IGNORED LEAD POISONING.) *Proceedings of the Society of Industrial Medicine and Hygiene. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 15, No. 1:50-1, 1954.

Four cases are presented to demonstrate the need for being acquainted with the exact occupation of workers when diagnosing any illness. A worker who had been trimming Sn statuettes experienced 3 attacks of typical Pb poisoning which were not diagnosed. Pb colic, constipation and stippled red cells were present. The case of a 2nd patient was similar, and he did similar work. A 3rd worker for 18 yr had engraved crystal from which fine dust arose, which was inhaled, as the worker was close to the crystal. He had definite saturnism, which remained unrecognized. The 4th man worked on dressing false diamonds composed of silicate of Pb which contained some 50% Pb by weight. Fine dust was generated in the process. Typical symptoms of Pb poisoning were present. In this last case, the authors consider that the Pb must have become dissociated from the silicate in the body. They wonder whether Pb in other silicates or combinations with talc may not become similarly dissociated in the body.

- 1533 Tolgskaya, M.S., and Reznikov, A.B. (Inst. Ind. Hyg. Occup. Dis., Acad. Med. Sci., Moscow, USSR): Morfologicheskie izmeneniya v tsentral'noi nervnoi sisteme pri otravlenii tetraetilsvintom. (Kliniko-anatomicheskie paralleli i eksperimental'nye issledovaniya.) (MORPHOLOGIC CHANGES IN THE CENTRAL NERVOUS SYSTEM IN TETRAETHYLLEAD POISONING. CLINICAL AND ANATOMICAL PARALLELS AND EXPERIMENTAL STUDIES.) *Trudy Akademii Meditsinskikh Nauk SSSR* 31:168-89, 1954.

Extensive observations are described on TEL poisoning by ingestion and by inhalation in adults and children, as well as of animal experiments with rats and rabbits in acute, subacute and chronic poisoning. Intake of a comparatively small quantity of ethyl fluid (50-70 ml) by adults was followed by a short latent period. A rapid development of changes in the central nervous system took place with the principal ones in the form of

motor excitation. A stuporous condition then gave way to a delirious syndrome. The triad of bradycardia, hypotonia, and hypothermia, present in subacute or chronic poisoning, were not always prominent in the sudden intoxication by ingested TEL. The histologic findings are described in detail. In cases with death on the 3rd-4th day of illness, significant neurovascular changes were demonstrable. In deaths on the 9th-10th day, the changes were more pronounced. In poisoning by inhalation of high concentrations of TEL, accidentally released in dwellings, the patients were in a highly asthenic condition in the 1st days, followed by signs of agitation and fear. There were severe disturbances, such as dysmetria, ataxia combined with psychopathologic signs of delirious-amential nature. Within a day, bradycardia, alternating with tachycardia, and fluctuations in arterial pressure and temperature occurred. While the symptoms were basically the same as those observed in industrial poisoning, in accidental cases a brief latent period was noted with rapid development of the syndrome and death on 8th-10th day. Coma which is not characteristic of TEL poisoning, may develop in cases of massive disturbance of the hemodynamics of the brain. Such a case in a 15-yr-old is described.

In children, the latent period lasts several hours; the younger the children, the shorter is this period. Histologic findings in children differ from those found in the adult. The unique course of the illness, violent progress of the pathologic process, and signs of serous meningitis are attributed by the authors to reactions that are specific for the brain of children. The occurrence of pneumonia in the terminal stage, seen in children, should not be explained by the action of TEL on the respiratory system, for it is observed in all cases of intoxication by ingestion or inhalation.

The authors summarize their observations as follows: TEL produces in acute intoxication in man and in rabbits diffuse damage of the nerve cells of Layers II and III of the cortex and of the lower portions, as manifested by pronounced swelling and vacuolation of the protoplasm and displacement of the nuclei. In less acute, and in chronic intoxication, severe damage of the cells of the thalamohypothalamic region is demonstrable, which substantiates the clinical manifestations. Vascular disturbances include pronounced hyperemia, stases, hyaline thrombi, twistings and invaginations of vascular walls, perivascular edema and hemorrhages. These produce disorders in the nutrition of brain tissue, accompanied by a degenerative process in the astrocytic glia and secondary changes in the nerve cells in the form of pyknosis, tigrolysis of the protoplasm and lysis of the cells.

The latter changes and the highly pronounced degenerative process in the astrocytes appear to be indications of a hypoxia of nerve cells. Changes in the higher nerve activity in rats in chronic and subacute intoxication point to the significant role played by the cortex of the cerebral hemispheres in the pathogenesis of TEL intoxication. The conditioned reflex test permits the demonstration of the functional dynamic disturbances of the

central nervous system. In the initial stages of poisoning, this test shows the cortical involvement. In subacute intoxication, parallel with the pathologic process, the subcortical mechanisms are also included (thalamohypothalamic region). In chronic intoxication of animals with small doses of TEL, degenerative changes in the cortical cells and vascular disturbances develop. In chronic and subacute intoxications, there are diffuse vascular and degenerative changes in the brain. As the pathologic process progresses, not only the cortex, but also the lower portions of the brain become involved in the damage, especially the hypothalamic region where the nerve cells undergo the greatest changes. (13 references)

1534 Vacher, J. (Paris, France): Le Saturnisme. (LEAD POISONING.) *Vie Médicale* 35:677-80 (July), 1954.

Types of Pb intoxication such as industrial and non-industrial are listed. Of all the clinical symptoms, "Pb colic" (abdominal pain of varying intensity accompanied by constipation --never diarrhea--) is the most typical. Arterial hypertension is not a constant sign. Burton Pb lines and Gubler's spots may be present. In chronic forms, nephritis is typically azotemic. Periodical laboratory analyses for proteinuria, uremia and hypertension are indispensable in the examination of Pb-exposed individuals. Typical but rarely found is paralysis of the small muscles of the hands. Also unusual is encephalopathy. Acute forms of massive Pb intoxication are accompanied by classical digestive disturbances and hepatorenal conditions. The laboratory analyses in Pb intoxication include tests for basophilic stippled erythrocytes (in France, more often counted per 100 white cells). Absence of stippled cells does not augur against Pb intoxication but their presence is a definite sign of it. The number of red blood cells is counted to ascertain the presence of anemia. Decrease of the red blood cells from 5-4.5 million by 100-200,000 every 4 mo must be interpreted as a sign of Pb exposure. Blood Pb levels are toxic if 800 µg/l or more; coproporphyrinuria is abnormal at levels >500 µg/l of urine; urine Pb levels are abnormal above 200 µg/l. Many authors have shown that in Pb intoxication the results of the various laboratory analyses do not correlate.

The metabolism and pathogenesis of Pb intoxication are not completely understood. Introduction of Pb into the body is by the oral and pulmonary routes. Prevention is by legislation, excluding all persons affected by liver, renal and other diseases from Pb work. Other preventive measures such as industrial hygiene are discussed. Milk is not an antidote against Pb, while alcohol favors increase of Pb levels. Treatment includes use of drugs such as Ca, iv or oral, together with Na-hyposulfite for acute manifestations, iv Mg sulfate and BAL for chronic forms. For colic, atropine is used. Cortisone, vitamins PP, B<sub>12</sub> and folic acid have been recommended. CaEDTA has been proposed.

Aspects of Social Security indemnity in industrial Pb intoxication are briefly discussed.

- 1535 Vercellesi, P.Z. (Turin, Italy): La spettrografia di massa nella prevenzione del saturnismo professionale. (MASS SPECTROGRAPHY IN THE PREVENTION OF OCCUPATIONAL LEAD POISONING.) Proceedings of XI International Congress of Industrial Medicine by Members of the Institute of Industrial Medicine of the National Accident Department. Rassegna di Medicina Industriale 23:271 (Sept.-Oct.), 1954.

For 3 yr some industries of Turin in which the workers are exposed to danger of Pb poisoning (Pb foundries, Pb paint industry, storage-battery industry) in the course of periodic examinations have been doing spectrographic analyses of Pb in the blood, in addition to evaluation of red and white blood cells and of urinary porphyrins. Pb determination in the blood has proved to be of great importance in the evaluation of the absorption level as well as for taking steps toward the prevention of Pb poisoning.

- 1536 Videla Vial, E., Balmaceda, J.M., Schüller, P., and Yerkovic, L. (Univ. Chile; Inst. Ind. Med., Public Health Serv.): Las Porfirinas. 1. Las porfirinas eritrocíticas en el diagnóstico del saturnismo y su importancia médico legal. (PORPHYRINS. 1. PORPHYRINS IN ERYTHROCYTES IN THE DIAGNOSIS OF LEAD POISONING AND THEIR MEDICO-LEGAL IMPORTANCE.) Revista Medica de Chile 82, No. 1:39-48, 1954.

The authors state that the usual classical signs of the presence of Pb in the human body, such as the "Pb line," anemia, basophilic stippling (BS), demonstration of Pb in blood and urine do not indicate Pb poisoning, but merely individual reactions to the presence of Pb, and individuals may show these changes without actually suffering from Pb poisoning. From a close study of the subject they concluded that estimation of the red cell porphyrin is of highest diagnostic value in this disease. They have, therefore, investigated 100 persons, 80 workers exposed to Pb risk in battery manufacture, in Pb foundries under bad conditions, and 20 engaged in other industries, for control. Attention was paid to the following: Hematocrit value (normal, 43-50%); hemoglobin (Hb) (normal, 14.5 g); mean corpuscular Hb concentration (MCHC) (normal, 30-32%); the erythrocytic protoporphyrin (PP) (normal, 30-40 µg/100 ml red cells), BS (normal, ≤1.5%), Pb in the urine (normal, <250 µg/l), plasma Fe (normal, 80-180 µg%); indirect bilirubin (normal, ≤10 mg/l) and the reticulocytes (normal, ≤1%). Tables show results in each of the 100 persons; one gives the percentages of the usual clinical signs, the Pb line being the commonest (50%); headache in 31; metallic taste in 30; pallor in 29 etc. Also tabulated are the percentages of cases in which the last 7 of the test results were increased, diminished, or remained normal, the percentages among 16 who had been in the Pb industry for 3 mo only, among 30 who had been in the plants for 1 yr, among 20 who had been there for >5 yr and among the 20 controls.

In summary, Pb, urinary Pb, bilirubin and reticulocytes were normal in all the controls, whereas in those exposed to Pb, the 1st 2 were increased; the figures for the other criteria varied. The

average increase in the 80 workers was most marked in the PP, more so than in the same individuals with increased urinary Pb. The authors' conclusion was that the former is the best single test of Pb poisoning and the grade of increase would serve well as a standard for the degree of intoxication for compensation cases. (97 references)

- 1537 Vigliani, E.C. (Univ. Milan, Italy): TREATMENT OF LEAD COLIC WITH CORTISONE AND CORTICOTROPIN. A.M.A. Archives of Industrial Hygiene and Occupational Medicine 10: 491-500 (Dec.), 1954.

Of 38 patients with Pb colic admitted to the Clinic del Lavoro of Milan, Italy, between 1947 and 1953, the first 19 were treated with Ca, 4 others were given dimercaprol (BAL), and the last 15 were treated with cortisone or corticotropin (ACTH). The clinical follow-up of the patients and the study of Pb metabolism indicated that the action of Ca was nonspecific, antispasmodic, and rapidly transient. BAL, though markedly affecting the Pb metabolism, was found to be a dangerous drug in Pb colic, having in some cases aggravated and prolonged the duration of pain. Cortisone and corticotropin showed a remarkably beneficial effect; pain disappeared within 1-2 days, and in some patients within a few hr. In patients with a positive reaction to the Thorn test, best results were achieved by continuous intravenous infusions of 15-20 mg of corticotropin in 500 cc of 2.5% dextrose given twice daily at a rate of 60 drops/min. The infusion of 1 l. of dextrose/day served also to maintain the fluid balance during the colic. Cortisone and corticotropin had no influence on Pb metabolism; their action is probably on the host and not on the poison. As in Pb colic the urinary output of 11-oxycorticosteroids is normal or high, it is believed that cortisone or corticotropin therapy does not fill a hormonal deficiency but increases a defense of the body already in action. It is possible that the best results in treatment of Pb colic will be obtained from the simultaneous use of drugs neutralizing and eliminating Pb and of hormones aiding the body in its defense against the poison. (From author's summary; 19 references)

- 1538 Vigliani, E.C. (Univ. Milan, Italy): Problemi di alimentazione per i lavoratori esposti all'azione di sostanze tossiche. (PROBLEM OF NUTRITION FOR WORKERS EXPOSED TO THE ACTION OF TOXIC SUBSTANCES.) Medicina del Lavoro 45:423-30 (Aug.-Sept.), 1954.

The problem of the most suitable diet for workers exposed to the risk of occupational poisoning is discussed. The author stresses first that no food can replace technical control, personal and environmental hygiene and sanitary provisions for the workers.

The effect of alkalizing or acidifying diets on Pb metabolism has not been definitely established. Milk is a supplementary food rich in proteins, but it has no antidotal action either against Pb or any other occupational poisons. Other occupational hazards considered for which certain dietary components are indicated, are: exposure to benzene, chlorinated aliphatic hydrocarbons, aromatic

amines, CO, and penicillin. (20 references)

- 1539 Villaume, J. (Haguenau, France): Saturnisme débutant diagnostiqué par ponction sternale. (STERNAL PUNCTURE IN DIAGNOSIS IN EARLY SATURNISM.) *Medecin d'Usine* 16: 366-8, 1954.

Pb poisoning may be diagnosed early by examination of the bone marrow material. In a workman exposed to the risk of Pb poisoning, who suffered from anemia and slight attacks of colic, no punctate basophilia could be demonstrated in the circulating erythrocytes, but in the bone marrow there were 20% red cells with punctate basophilia as seen in smears stained according to May-Grunwald-Giemsa, and confirmed by a method developed by K.B. Lehmann.

- 1540 Weaver, N.K.: INTEGRATION OF THE TOXICITY AND PERIODIC EXAMINATION PROGRAMS. *Medical Bulletin, Standard Oil Company (N.J.)* 14: 84-7 (Mar.), 1954.

The toxicity program at the Baton Rouge Refinery is reviewed with particular emphasis on the medical plan for the prevention and detection of illness due to exposure to industrial hazards. The author indicates that the examinations should be directed only toward the detection of chronic toxicity, since the acute manifestations cause the individual to seek medical attention. It is recommended to list all toxic exposures for the dispensary physician to be noted and to avoid questioning the sick patient. Simple indicators placed on the examination form of each patient will direct the attention of the examining physician to the appropriate points on the medical information of each toxic manifestation. The frequency of special toxicity examinations will depend on the inherent toxicity of the substance, the working conditions and the previous industrial medical experience with the hazardous situation.

In respect to TEL exposure, at the Baton Rouge Refinery certain employees are examined semiannually, and a test for stippled erythrocytes is done in addition to the usual laboratory work. In addition, these employees may receive regular examinations by DuPont and Ethyl physicians according to contract.

- 1541 Wieme, R.J. (Belgium): Een geval van acute loodintoxicatie. (A CASE OF ACUTE LEAD POISONING.) *Belgisch Tijdschrift voor Geneeskunde* 10:560-2, 1954.

A 57-yr-old man accidentally swallowed a soup-spoonful of a Pb subacetate solution equivalent to 3g Pb oxide. This was followed by vomiting and diarrhea within 24 hr. After a "vague" period he suffered from abdominal pains, anemia and extreme loss of strength, especially in the upper limbs. Hospitalized on the 10th day, the following findings resulted from a laboratory investigation: serious normochromic anemia, large number of stippled red cells, definite porphyrinuria and the beginning of a Pb line; only modest signs of renal irritation; no reflex aberrations; elimination of Pb was very variable: 300-400  $\mu\text{g}$  Pb/24 hr. Improvement set in 14 days. One month after hospitalization the patient had subjectively recovered; red blood cell count was 4,000,000/ $\text{mm}^2$ , basophilic stippling had disappeared, there still was a pronounced copro-

porphyrinuria, and Pb excreted in urine is still abnormal: 100-400  $\mu\text{g}$ /24 hr. He was treated with Becaptan (2 ampules/day) intravenously for 30 days. In the discussion the possibility of Pb poisoning through drinking water from Pb pipes which were used to ground electrical equipment producing a high voltage was mentioned. Galvanic currents may cause dissolution of Pb. A reported case was used as illustration. The question was raised why BAL was not used in the treatment, instead of Becaptan. The author answers that though BAL enhances urinary excretion there are strong doubts whether it improves the clinical progress. The ingested 3g Pb acetate = 3g Pb oxide is a high dose and the compound is very soluble. Becaptan is used without any danger.

- 1542 Wittgens, H., and Niederstadt, D. (Univ. Göttingen, Germany): Untersuchungen über den Wert der Vollmilch als angebliches Vorbeugungsmittel gegen gewerbliche Vergiftungen. (INVESTIGATIONS ON THE ALLEGED VALUE OF WHOLE MILK AS A PROPHYLACTIC AGENT IN INDUSTRIAL POISONINGS.) *Zentralblatt für Arbeitsmedizin und Arbeitsschutz* 4:185-91 (July), 1954.

The extensive literature on the subject of the prophylactic value of milk in industrial poisoning cases is reviewed and discussed. At one time the opinion that milk had this value was accepted throughout the world but it is here considered that the opinion was not based on actual observation and was only a belief. Later observers cast doubt on the tenability of this belief and in some experiments it was recorded that animals fed on milk suffered more readily from poisoning when Pb was administered to them than did the control animals without milk. Full details are given of the authors' experiments with rats including the variations in weight, hemoglobin and blood pictures in a period of 15 wk. The conclusion is reached that whole milk has no protective effect against Pb poisoning and that it is highly probable that it makes the poisoning more severe. This finding, which is in accord with the results of experiments of other workers, suggests that partaking of whole milk by workers in Pb and other forms of industrial poisoning is not to be recommended. For the protection of the workers reliance should be placed on known technical and hygienic precautions. (33 references)

- 1543 Wondrák, E. (Surg. Urol. Div. of OÜNZ, Litoměřice, Czechoslovakia): Ein seltene Fall von Selbstkatheterisierung. (Können Sphinkterkrämpfe bei chronischer Bleivergiftung zur Harnverhaltung führen?) (A RARE CASE OF AUTOCATHETERIZATION. (A QUESTION OF POSSIBILITY OF URINARY RETENTION CAUSED BY SPHINCTERAL SPASM IN CHRONIC LEAD POISONING.)) *Zeitschrift für Urologie* 47, No. 4:235-7, 1954.

A case of urinary retention caused by sphincter spasm is reported in a 51-yr-old mechanic special ist. The patient had been handling materials which consisted almost completely of pure Pb for >20 yr. He had suffered periodically with anuria since 1942 (during war duty) and had been catheterized in a hospital. Upon his return in 1945,



he had a glass tube made for self-catheterization. The present hospitalization was occasioned because during the current attack the glass tube broke and part of it remained in the urethra. Further investigations revealed that the man had suffered from colics and constipation, headaches and pain in the joints; however, these were not serious enough to keep him home from his well-paid job. A Pb line was noticed on the lower gums, and after 18 days in the hospital his blood Pb level was 0.135 mg% and on the 25th day it was still 0.126 mg%. The examinations suggested that he suffered from chronic Pb poisoning. Although contractures of the muscle are not uncommon in chronic Pb poisoning, the author could not find any literature data of urinary retention which resulted from sphincter spasm caused by chronic Pb poisoning. Observation of further similar cases would be necessary to clarify whether or not rare urological complications are attributable to chronic Pb intoxication. (17 references)

- 1544 Wyllie, J. (Queen's Univ., Kingston, Ontario, Canada): A FAMILY OUTBREAK OF LEAD POISONING FROM THE BURNING OF STORAGE BATTERY CASINGS. Canadian Medical Association Journal 70:287-90, 1954.

A family outbreak of Pb poisoning is described, due to inhalation of smoky fumes arising from discarded storage battery casings in an old cook stove in a slum dwelling. Three of the inmates, the father, a boy aged 14 and a daughter aged 10, did not complain of subjective symptoms, but one boy aged 7 died from Pb encephalopathy, another boy aged 11 had abdominal colic and the mother had paresis of the right wrist and a typical Pb line in the gums. Although the mother stated she had carried on this practice for the previous 3 winters without untoward effects, it is believed that intensity rather than duration of exposure was responsible for the outcome. A slaty-gray deposit scraped from the interior of the battery casings yielded ~90% Pb sulfate. The respiratory tract is the most important portal of entry for Pb into the human body; signs of intoxication develop more quickly than when 10 times as much Pb is ingested. (From author's summary)

- 1545 Yamaga, S., Saruta, K., and Furuya, H. (Yokohama Med. Coll., Japan): A SURVEY ON INDUSTRIAL LEAD POISONING. (REPORT II). Journal of Science of Labour (Japan) 30:178-82 (Mar.), 1954.

Seventy-four workers in an electric cable factory were divided into 2 groups according to Pb concentrations in the air of the work environment, 1.63 mg/m<sup>3</sup> and 0.20 mg/m<sup>3</sup>. Pb concentrations on the right hand, in the mouth, hemoglobin, red blood cells, reticulocytes, coproporphyrin in urine and in the whole blood were estimated. It was noted that, Pb concentrations both on the right hand and in the mouth did not differ between the 2 groups. Thus the degree of Pb poisoning could be considered to be influenced mainly by inhalation of the Pb-laden air. Manifestations of Pb intoxication were the same in both groups. The authors conclude that a 0.2 mg/m<sup>3</sup> Pb concentration is not free from danger and the threshold limit value of Pb concentration, 0.5 mg/m<sup>3</sup>, should be considered inadequate. (From authors' English summary)

quate. (From authors' English summary)

- 1546 Zeglio, P., and Vercellesi, P.Z. (Turin Inst. Ind. Med. of ENPI, Italy): Sul valore preventivo e diagnostico della piomboemia. (THE PREVENTIVE AND DIAGNOSTIC VALUE OF BLOOD LEAD DETERMINATION.) Rassegna di Medicina Industriale 23:406-10 (Nov.-Dec.), 1954.

In the authors' Institute, >2000 blood analyses were made since 1951 by use of spectrograph. After citing concentrations reported by other authors, results were obtained on 52 individuals not exposed to Pb (both sexes, age 15-62 yr) and 354 typographers (exposed for >1 yr). In those not exposed to Pb, 12 subjects showed no detectable concentrations; maximum value was 42 µg/100 ml blood, and the average was 18 µg/100 ml. There were no quantitative differences as to sex or age.

In the typographers, minimum value was 12 and the maximum, 58 µg/100 ml. None of these showed signs of intoxication. As based on observations on ~1600 cases in other industries, workers exposed to excessive absorption, but showing no signs may show from <30-100 µg/100 ml blood; those with typical but recent signs of poisoning always exhibit elevated levels, from 70-240 µg, most of them, from 100-150 µg/100 ml. The authors conclude that the average value in the Italian population is 20 µg/100 ml. Values twice as high as these are not considered unusual. In Pb workers the level of Pb in the blood is habitually elevated and varies with exposure and elimination. Values >70 µg/100 ml per se do not indicate Pb intoxication, but they do show excessive exposure. An elevated level of Pb in the blood can be considered a positive sign of poisoning in the presence of confirmatory findings. A low blood Pb level does not indicate the absence of intoxication if the individual has been removed from the exposure for some time and if other signs, symptoms and positive laboratory findings persist.

## 1955

- 1547 American Medical Association, Council on Pharmacy and Chemistry: NEW AND NONOFFICIAL REMEDIES. EDATHAMIL CALCIUM-DISODIUM. Journal of the American Medical Association 159:850-1, 1955.

The mechanism and safety of CaNa<sub>2</sub>EDTA therapy of Pb poisoning is described on the basis of animal experimentation. CaNa<sub>2</sub>EDTA is administered by iv drip in either isotonic NaCl solution or 5% dextrose solution in a concentration not to exceed 3% by diluting 5 ml of a 20% solution (1 g) to 33 ml. The maximum dose/4.5 kg (10 lb) of body weight is 0.17 g/hr, 0.33 g/day, or 1.67 g/wk. The maximum dose is 2.5 g/4.5 kg per course. It is advisable not to exceed 2 such courses, allowing 7 days rest between them. Interrupted courses are considered preferable to continuous therapy, and they should be in accordance with demonstrable increased titer of Pb in blood. A finding of >0.05 mg Pb/100 ml whole blood or 0.1 mg/l of a 24-hr specimen of urine is considered pathognomonic of Pb poisoning.

- 1548 American Medical Association Report of Chemical Laboratory: CHELATION AND SE-

QUESTRATION. Journal of the American Medical Association 158:43-4, 1955.  
The terminology used to describe the chemical action of the group of compounds, that are capable of forming stable complexes with multivalent positive ions, and some of the names that have been used to identify them have been the cause of some confusion and misunderstanding. The present meaning of the words "chelation" and "sequestration" is explained. Edathamil calcium disodium is the generic name given by the Council on Pharmacy and Chemistry to the  $\text{CaNa}_2$  salt of EDTA, which is used in the therapy of Pb poisoning.

- 1549 Atchabarov, B.A., Aldanazarov, A.T., Nikulicheva, V.S., Romakhov, A.A., and Sabdenova, Sh.S. (Acad. Sci. Kazakh SSR): Nekotorye dannye kompleksnogo izucheniya svintsovoi intoksikatsii. (SOME DATA OF A COMPLEX STUDY OF LEAD INTOXICATION.) Vestnik Akademii Nauk Kazakhskoi SSR 11, No. 6:89-94, 1955.

A survey of the current information on Pb poisoning is followed by a brief account of new work carried out on 666 workers in trades with high Pb risk. General observations were that in Pb poisoning there is arterial hypotension and venous hypertension. Generally, Pb poisoning leads to slowing of hippuric acid synthesis and increase of bilirubin, as well as a positive test in a few cases for urobilin in the blood. Usually, the nervous system shows disturbances before the circulatory system. Muscular weakness is one of the most common signs. Deafness also occurs frequently. Treatment with folic acid and Pentoxyl (used in some forms of anemia) gave favorable preliminary results.

- 1550 Battigelli, M. (Univ. Milan, Italy): L'intossicazione saturnina nei demolitori di accumulatori. (LEAD POISONING IN WORKERS ENGAGED AT THE DEMOLITION OF MATERIAL CONTAINING LEAD.) Medicina del Lavoro 46: 35-8 (Jan.), 1955.

Eighteen cases of Pb poisoning in workers (18-65 yr old, at work 1-48 mo) engaged in the demolition of motor car batteries and gasmeters are described. Of the affected, 6 presented a typical Pb colic, 4 had suffered colic before admittance to the hospital, the remaining were affected by toxic anemia, accompanied in a few cases by enteralgic manifestations. The mean value of blood Pb was found to be 110  $\mu\text{g}/100\text{ ml}$ , and urine Pb was 210  $\mu\text{g}/1$ . The cause of this high incidence of intoxication, in this type of work, was attributed to the high concentrations of Pb-containing dust in the atmosphere of work rooms (av 1.5-1.9  $\text{mg}/\text{m}^3$ ).

- 1551 Bell, R.F., Gilliland, J.C., and Dunn, W. S. (Univ. Colorado Med. Center, Denver): URINARY MERCURY AND LEAD EXCRETION IN A CASE OF MERCURIALISM. DIFFERENTIAL EXCRETION AFTER ADMINISTRATION OF EDATHAMIL CALCIUM AND DIMERCAPROL. A.M.A. Archives of Industrial Health 11:231-3 (Mar.), 1955.

A case of occupational Hg poisoning is described, in which the effect of administration first of EDTA and then of BAL on daily urinary Hg and Pb elimination was studied. The urinary Hg excretion decreased during EDTA therapy (0.23-0.06 mg), and

markedly increased with BAL (up to 0.48 mg). When it was noted that the urinary Hg was not affected by the administration of EDTA, determinations of the urinary Pb were done as a check on the activity of  $\text{CaEDTA}$  solutions. Pb excretion increased markedly during EDTA therapy (0.04-0.21 mg) and did not change significantly during BAL treatment.

- 1552 Bersworth, F.C., and Rubin, M.: ORGANO-METALLIC DETOXICANTS. U.S. Patent 2,698,823, Jan. 4, 1955, to F.C. Bersworth. Ca disodium ethylenediaminetetraacetic acid (EDTA) and other similar nontoxic compounds are useful in removing toxic metal compounds from the human body in cases of heavy metal poisoning. Preparations of EDTA, used intravenously, subcutaneously, orally, and superficially, solubilize Ni and Pb ions, with the liberation of Ca ions, as nontoxic complexes which are readily excreted. (From Chemical Abstracts 49:Abstract No. 4244, 1955)

- 1553 Bessman, S.P., and Layne, E.C., Jr. (Children's Hosp. Res. Found., Washington, D.C.): DISTRIBUTION OF LEAD IN BLOOD AS AFFECTED BY EDATHAMIL CALCIUM-DISODIUM. American Journal of the Diseases of Children 89:292-4, 1955.

Five patients (2 adults and 3 children 3-5 yr old) with history, physical examination, and X-ray changes suggestive of Pb poisoning were given EDTA, and the distribution of Pb in plasma and red cells was determined at intervals. EDTA caused an increase in plasma Pb and a marked shift of the ratio plasma Pb/cell Pb to values  $>1$ . Although the plasma Pb level rose manifold, the blood clearance of Pb varied only  $\sim 2$ -fold. The marked stimulation of Pb excretion seen with EDTA is therefore due mainly to the increased plasma level. It is suggested that EDTA renal excretion of Pb differs from that of EDTA. (From authors' summary) (15 references)

- 1554 Buckup, H. (Ind. Med. Inst. of State Ind. Med. Officers, Bochum, Germany): Arztliche Massnahmen zur Verhütung beruflicher Bleischädigungen. (MEDICAL CONTROL OF OCCUPATIONAL LEAD POISONING.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 5:1-9 (Jan.), 1955.

The occupational hazards of Pb and various measures for the prevention of poisoning are discussed. The diagnostic tests currently in use are evaluated. The author believes de Langen's rapid method for the determination of urinary porphyrins to be an ideal test for mass screening.

- 1555 Buckup, H., and Hesse, F.: Klimakuren zur Prophylaxe und Therapie von Gesundheitsschädigungen durch Industriegifte, insbesondere Blei. (CHANGE OF CLIMATE FOR THE PREVENTION AND THERAPY OF ILLNESS BY INDUSTRIAL POISONS, ESPECIALLY LEAD.) Berufsgenossenschaft 1955, No. 10:421-9.

The benefits of rest cures in the North Sea region for cases of incipient or established Pb poisoning are discussed.

- 1556 Capellini, A., Parmeggiani, L., Sartorelli, E., and Martelli, G.C. (Univ. Milan, Italy): Studio di 34 casi di intossica-

zione da arseniato di piombo in due fabbriche di insetticidi. (STUDY OF 34 CASES OF LEAD ARSENATE POISONING IN TWO FACTORIES FOR THE PRODUCTION OF INSECTICIDES.) *Medicina del Lavoro* 46:147-57 (Mar.), 1955.

Thirty-four cases of poisoning and 8 cases of high absorption of Pb arsenate occurred in 2 factories producing the insecticide. Repeated environmental investigations revealed very high concentrations of Pb and As in the air of workrooms. Up to 8 mg/m<sup>3</sup> of Pb were found in the blending and 11 mg/m<sup>3</sup> in the packaging departments. In 1 plant the intoxications were noted soon after a remarkable increase of production, during a breakout of influenza; in the other a few months after beginning operations. The average exposure prior to the appearance of the disturbances had varied from 2 mo in the packaging to 6 mo in the pressing departments. Findings consisted of abdominal pains with constipation or constipation alternating with diarrhea (seldom diarrhea alone), loss of appetite, dyspepsia, distinct pains or palpation of the cholecoduodenal region, mild normochromic anemia giving good response to liver extracts and vitamin B<sub>12</sub>. Cases with Burton's line, neurological manifestations and dermatitis were relatively rare. Coproporphyrins were increased, values being even >300 µg/100 ml. Urine Pb was >150 µg/l (up to 700 µg/l). Blood Pb was >65 µg/100 ml (185 µg/100 ml in 1 case). Values >500 µg/l of As were reached in the urine. Compared with the elimination of Pb, As disappeared rapidly from the urine (Pb elimination during work, av 120 µg/l; As elimination, 341 µg; 40 days after cessation of work, urine Pb was 181 µg; As 25 µg). In Pb arsenate poisoning, signs of Pb poisoning occur together with symptoms of As poisoning. Elimination of As from the organism is more intense in the presence of Pb. (From authors' summary; 32 references)

- 1557 Dantin Gallego, J. (Natl. Inst. Med. Ind. Safety, Madrid, Spain): Problemas clínicos en relación con el origen profesional o no profesional del plomo en la intoxicación saturnina. (CLINICAL PROBLEMS IN RELATION TO THE OCCUPATIONAL OR NONOCCUPATIONAL ORIGIN OF LEAD POISONING.) *Archiv für Gewerbepathologie und Gewerbehygiene* 13, No. 6:535-43, 1955.

As the example of difficulties encountered in the diagnosis of occupational diseases, the author chose Pb poisoning because of the frequency of its occurrence and need of treatment. The generally accepted diagnostic signs and symptoms are not specific, as they may occur in other conditions, ie, the blood picture (including stippled erythrocytes), the hepatic, neurologic, vascular and renal syndromes. Of these, the author does accept the Pb-induced liver disease, which generally is accompanied by a low Pb content in blood which he attributes to the heavy accumulation of Pb in the liver. He summarizes 171 cases of occupational and nonoccupational poisoning, in whom Pb was investigated; 40% of them showed anemia, and in 40% of these the Pb content in blood was <60 µg%. Among 59% with colic, only 18% were truly Pb-induced colics; in ~50% of the cases with Pb-induced hepatitis, blood Pb was <60 µg%, but ~80%

of Pb neuritis patients showed >60 µg% Pb in blood. The combination of hepatitis and neuritis was found in 2 cases. In 9 cases with vascular disorders, ~70% had blood Pb >60 µg%.

Of even greater interest were the laboratory findings: in only 2 cases was there considerable elimination of Pb in urine in the absence of Pb in blood. Usually, when elimination of Pb diminished, the blood Pb rose. No relationship between Pb in saliva and high blood Pb was found. There was uncertainty in relation to elimination via the bile, which never surpassed 30 µg%. In 3 cases, Pb was found in the spinal fluid (10, 14 and 15 µg%), all accompanied by high urinary Pb (110-239 µg%). The occupations of the persons investigated, the number showing active manifestations of Pb poisoning, the ranges, means, and standard deviations of their Pb content in blood are tabulated. Among them were 30 barmen, 16 of whom showed Pb poisoning (occupational or nonoccupational), with a mean of 59.9 µg% Pb in blood (20-120). Some cases of Pb poisoning of nonoccupational origin, mainly by consumption of carbonated water, heavy wine drinking, or for other cause (contaminated food), are briefly presented.

- 1558 Desoille, H., Albahary, C., Gajdos, A., and Gajdos-Török, M. (Inst. Ind. Hyg. Occup. Med., Paris, France): Recherches sur la valeur des signes biologiques précédant l'apparition du saturnisme clinique professionnel. (STUDIES ON THE VALUE OF BIOLOGICAL SIGNS PRECEDING THE APPEARANCE OF OCCUPATIONAL LEAD POISONING.) *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 16, No. 3:185-96, 1955.

The authors believe that the study of blood and urinary Pb levels is not applicable to the occupational situation, because of "normal" variations, mobilization, difficulty in estimating tissue levels, knowledge of pre-intoxication states, difficulty in collection of samples. They report studies on the urinary coproporphyrin (CP) levels, stippled cells, blood protoporphyrins (PP) and blood Pb levels as determined on rabbits given orally 3 times/wk 6 mg Pb in aqueous solution; 2 rabbits absorbed 20 mg and 2, 30 mg. Six rabbits received Pb intramuscularly. They found that urinary CP were first elevated, followed by stippling of erythrocytes then by rise in PP in blood. Twenty-three workers exposed to significant Pb risks, and 11 men exposed to a lower risk were also studied. (No reference is made to levels of exposure, to the nature of the offending Pb compound, or physical state of this exposure.)

The conclusions are: Animal studies are not useful for extrapolation to human data. They are useful only for the study of mechanisms of response to exposure. It seems that the appearance of stippled erythrocytes is the earliest sign of clinical value which is consistent. (The authors suggest the level of 40-50/100 white cells.) The variability caused in levels of urinary CP by other physical and disease states, and the failure of response to low levels of exposure, make this test of little value. For the latter reason, blood PP too are of little value. The relationship between stippling and porphyrins is so vari-

able as to be valueless in early stages of intoxication. The authors discard entirely the value of blood and urinary Pb values in the determination of early or subclinical Pb intoxication. The examination of the blood film, by its ease and convenience, appears to be the test of choice in the early diagnosis of subclinical Pb poisoning. (10 references)

- 1559** Dinischiotu, G.T., Nestorescu, B., Radulescu, I., Ionescu, C., Preda, N., and Roventa, A.: Cercetari asupra formelor chimice de eliminare ale plumbului urinar. (STUDIES OF THE CHEMICAL FORMS IN WHICH LEAD IS ELIMINATED IN THE URINE.) Medicina interna 7:64-71 (Oct.-Dec.), 1955. See Abstract No. 1899.

- 1560** Djurić, D. (Inst. Med. Res., Yugoslav Acad., Zagreb): Porfirinurija kod otrovanja olovom. (PORPHYRINURIA IN LEAD POISONING.) Arhiv za Higijenu Rada 6:315-25, 1955.

Chemical and physical properties and biosynthesis of porphyrins are described. Production of methemoglobin from porphyrins and influence of Pb on that process is discussed. Coporphyrin determination as a means of Pb-poisoning detection is reviewed. (32 references)

- 1561** Dorfman, S.I., and Shipitsyn, S.A. (Irkutsk Federal Med. Inst., USSR): Kolichestvennoe opredelenie nekotorykh metallov v golovnom mozgu cheloveka. (THE QUANTITATIVE DETERMINATION OF SOME METALS IN THE HUMAN BRAIN.) Biokhimiya 20, No. 2:136-9, 1955.

Samples of different parts of human brains of 50 persons who had died of accidents and of certain somatic diseases were subjected to chemical analysis and the results evaluated statistically. Brain tissues were washed free from blood, weighed, dried to constant weight, ashed and tested for Pb, Cu, Si, Mn, Mg, Fe and Ca. By means of a curve of concentration distribution, Pb content of the cerebral cortex was, in mg%, dry basis, 0.16; in the cerebellum, 0.25; in the hypophysis, 1.5. In the cerebral cortex values were practically the same for the pars posterior, central anterior convolution and the frontal pole.

- 1562** Dupelj, M. (Neurol. Psych. Clinic. Med. Coll., Zagreb, Yugoslavia): Slučaj olovnog polineuritisa. (CASE OF POLYNEURITIS CAUSED BY LEAD POISONING.) Neuropsihijatrija 3, No. 3-4:268-9, 1955.

A 48-yr-old farmer was admitted to the clinic with complaints of paresthesia of arms and legs. History revealed that he consumed 1 l. wine daily. Examination showed among other findings, muscular atrophy, and among laboratory tests, erythrocytes 3.5 million, hemoglobin 60, stippled erythrocytes 7,700/field, Pb in blood 67 µg%, and urinary porphyrin 266 µg%. These findings were considered to confirm the diagnosis of Pb poisoning as cause of the polyneuritis.

- 1563** Eilerson, P., Astrup, P., Fallentin, B., and Frost, J.: (TREATMENT OF LEAD POISON-

ING WITH ETHYLENEDIAMINETETRAACETATE.)

Ugeskr. laeger 117:124-7, 1955.

Four patients with Pb poisoning (3 with clinical signs of chronic Pb poisoning, the 4th with recent characteristic symptoms) were treated with iv infusion of 4 g CaNa<sub>2</sub>EDTA in 500 ml of 5% glucose solution daily for 2 days. Examination of urine for total Pb and inorganic Pb in 24-hr periods before, during, and after treatments showed marked increases during and immediately after the infusion. Daily examination of urinary Ca showed in 3 considerable rise during and after treatment. No toxic reactions were seen, and the patients were subjectively free from symptoms on discharge. In spite of the manifold increase in Pb excretion, the total amount excreted was small in comparison with the amount that had presumably accumulated in the tissues during long exposure to Pb. The greatest value of the treatment is therefore in acute intoxication. (From Journal of the American Medical Association 158:436 (Abstracts), 1955.)

- 1563a** Farris, G., and Sicca, U. (Univ. Genoa, Italy): Note istologiche sulle alterazioni gengivali da piombo in raffronto a quelle da mercurio e bismuto. Considerazioni critiche sulla specificita' dei metodi istochimici per il piombo. (HISTOLOGY OF THE LEAD LINE VS MERCURY AND BISMUTH LINES. CONSIDERATIONS OF THE APPLICATION OF HISTOCHEMICAL METHODS FOR LEAD.) Medicina del Lavoro 46:104-12 (Feb.), 1955.

Biopsies were made of the interdental papilla of 6 Pb poisoning patients showing gingival Pb line, of 3 luetics treated with Bi and 2 treated with Hg presenting a Bi and a Hg line respectively. Fragments of tissues were prepared for histologic and histochemical examinations. The most outstanding findings were an acanthosis and edema of the epithelium and a severe inflammatory process with vascular alterations of the corium. Metal grains were found also in the epithelium. It was shown that none of the histochemical methods tested can be applied alone to define the exact nature of a gingivitis caused by an accumulation of metal. (From authors' summary; 13 references)

- 1564** Fernández Rozes, F.: LEAD POISONING. AN OCCUPATIONAL DISEASE. Semana Med. (Buenos Aires) 1955, II:349-63, 465-82.

Symptoms, diagnosis, treatment, report of cases, and the legal aspects of Pb poisoning are discussed. (From Chemical Abstracts 50:1236, 1956)

- 1565** Foreman, H. (Univ. California, Los Alamos Scientific Lab., N.M.): CHELATING AGENTS. Industrial Medicine and Surgery 24:287-92 (July), 1955.

The structure, properties and requirements for therapeutic use of metal chelates are discussed. Included are BAL, citric acid, Na pyrocatechol disulfonate and EDTA. CaEDTA is discussed in detail and is recommended for treatment of Pb and Pu poisoning.

- 1566** Gallo, D. (Univ. Milan, Italy): Osservazioni sull'orletto gengivale di burton nei saturnini. (OBSERVATIONS ON BURTON'S BLUE LINE IN LEAD POISONING.) Medicina del

Lavoro 46:39-45 (Jan.), 1955.

The blue line was studied in 7 patients who were suffering from Pb poisoning. When examined under ultraviolet light of Wood's lamp, dental tartar gives a red fluorescence which stands out against the bluish color of the gum, and the blue line, when present, is clear-cut and contrasts with these other 2 colors. The blue line is itself made up of 2 sections, the more marginal of which is seen under magnification to consist of many dark blue spots; scaling of the teeth does not affect the appearance of this darker section. The rest of the blue line, ie, the part which is further away from the edge of the gum, is partly due to the dark color of the tartar which shows through from underneath the gum tissue. Its color may be uneven and show darker where there are gum pockets full of tartar; scaling of the teeth in front, by removing the tartar, lightens the color of this part of the blue line. In the absence of tartar, this 2nd part of the blue line may not be evident at all. The tartar which was obtained from 2 of the patients by scaling contained in one case 142 mg of tartar contained 15 µg of Pb and in the other, 2 µg Pb in 50 mg of tartar. The author considers that whereas the darker, more marginal, part of the blue line is evidence of Pb absorption and of its deposition in the tissues, the other, and lighter, section of the line is indicative only of exposure to Pb hazard.

- 1567 Gilsanz, V., Palacios, J.M., and Gilsanz Rico, G. (Univ. Clinic, Madrid, Spain): Tratamiento del saturnismo crónico con calcio E.D.T.A. (TREATMENT OF CHRONIC LEAD POISONING WITH CALCIUM ETHYLENEDIAMINETETRAACETATE (CaEDTA).) Revista Clínica Española 57:224-9 (May 31), 1955. Intravenous (iv) administration of CaEDTA to the patients was followed by an extremely rapid disappearance of all symptoms except radial nerve palsy, which is slow to disappear or does not respond to treatment. Anemia disappeared after a reticulocyte crisis. Urinary excretion of Pb increased remarkably. In a case of Pb poisoning colic CaEDTA gave relief of pain in 90 min. Intravenous doses of 935 mg/day were given to some patients for 22 days without causing toxic manifestations. A patient with radial nerve palsy whose other symptoms of Pb intoxication had been cured was given 2 g orally for 7 days. This resulted in digestive disturbances, a rise in serum Ca and P, and progressive anemia and leukopenia. (From authors' summary) (25 references)

- 1568 Giubileo, M. (Univ. Milan, Italy): Un caso di sindrome di Guillain-Barre' in un operaio esposto ad assorbimento di piombo. (A CASE OF GUILLAIN-BARRE SYNDROME IN A WORKER EXPOSED TO ABSORPTION OF LEAD.) Medicina del Lavoro 46:162-6 (Mar.), 1955. A 40-yr-old man, who for 17 yr had been engaged from 7-8 mo/yr as a painter using Pb paints, was struck by tetraparesis with absence of deep reflexes, paresthesias, albuminocytologic dissociation in the spinal fluid 1 mo after cessation of work. Treated with vitamin C and B-complex and galvanofaradic messages of the limbs, the man recovered completely within 2 mo. He was at first suspected to be affected by Pb polyneuritis, but the Pb eti-

ology of the disease was rejected because of absence of any sign of Pb poisoning or even of an excessive absorption of Pb as well as because of the fact that he was sound when he left the work and had enjoyed good health for over a month thereafter. Because of the rapid onset of the disease, the brief course and benign evolution, the localization (prevalent in the lower limbs), and the existence of an albumino-cytologic dissociation in the spinal fluid, the diagnosis of Guillain-Barre syndrome was made. The differential diagnostic criteria of Pb polyneuritis and Guillain-Barre syndrome are illustrated; the onset of the disease in this particular case is not to be related with Pb exposure. (From author's summary)

- 1569 Goldblatt, M.W. (Imperial Chem. Ind., Ltd., Ind. Hyg. Res. Lab., Welwyn, England): RESEARCH IN INDUSTRIAL HEALTH IN THE CHEMICAL INDUSTRY. British Journal of Industrial Medicine 12:1-20 (Jan.), 1955.

Health hazards in chemical industries are discussed from the point of view of diagnosis and control. Clinical and experimental aspects of Pb intoxication are treated in relative detail, especially mechanism and significance of blood changes. A table is presented showing time lost by workers with 60-65% Hb whose recovery took place away from factory, and of 15 who remained at work; another one shows period of recovery of Hb of a number of workers. Toxic concentrations of various gases, dusts, fumes, and metals in the atmosphere, as developed by the I.C.I. Industrial Products and Health Research Committee are tabulated according to concentrations causing severe toxic effects in persons exposed for times stated; concentrations which, if exposure continues for more than a short time, may lead to symptoms of illness; and concentrations in general atmosphere of plant greater than those given, indicating unsatisfactory conditions. In the case of Pb (and salts), the latter is given as 0.15 mg/m<sup>3</sup> at 20°C. (17 references)

- 1570 Gorn, L.E., and Fridlyand, I.G. (Leningrad Inst. Ind. Hyg. Occup. Dis.; Leningrad Inst. Adv. Educ. Physicians, USSR): O soderzhanii svintsy v moche zdorovykh lyudei. (CONTENT OF LEAD IN URINE OF HEALTHY PEOPLE.) Gigiena i Sanitariya 1955, No. 5:44-7. Polarographic analyses performed on 500 individuals who were not exposed to Pb gave the following results: average content of Pb in urine, 0.01 mg/l at 14-19 yr of age, 0.009 mg at 20-9, 0.010 mg at 30-9, 0.011 mg at 40-9, and 0.015 mg at 50 and over. A level of 0.03-0.04 mg/l is suggested as the borderline between normal and excessive levels.

- 1571 Gratsianskaya, L.N., and Rozentsvit, G.F. (Leningrad Natl. Inst. Ind. Hyg., Occup. Dis., USSR): Klinika rannikh form porazheniya perifericheskoi nervnoi sistemy pri khronicheskikh intoksikatsiyakh svintsom. (THE DIAGNOSIS OF EARLY DAMAGE TO THE PERIPHERAL NERVOUS SYSTEM IN CHRONIC LEAD POISONING.) Zhurnal Nevropatologii i Psikhiiatrii imeni S.S. Korsakova 55:748-9, 1955.

In view of good medical control in industries involving exposure to Pb, severe cases of Pb poisoning are only rarely observed in Russia. Of greater interest are incipient disorders of the nervous

system in chronic Pb poisoning; 42 such cases, mainly from storage battery manufacturing plants, had been diagnosed in the authors' Institute. The afflictions were vegetative neuralgia, vegetative polyneuritis, and mixed polyneuritis. The signs observed in these disturbances are discussed and stated that they do not always occur together with the other general signs of chronic poisoning. Often the nervous disturbances will be observed in the absence of other signs; 12 such cases were seen. In other cases, the presence of Pb pallor, Pb line, etc., supported the diagnosis. Final diagnosis of Pb polyneuritis is most often made when other signs are present; hence it is a delayed diagnosis. The need for early recognition of involvement of the nervous system, treatment by removal from exposure, vitamin B and C administration, are emphasized.

- 1572 Grigor'eva, L.V. (USSR Inst. Advanced Med. Educ., Leningrad): Bytovoe svintsovoe otravlenie, simuliruyushchee "ostriy zhivot." (LEAD POISONING IN EVERY-DAY LIFE SIMULATING "ACUTE ABDOMEN.") Vestnik Khirurgii imeni I.I. Grekova 76, No. 10:111-3, 1955.

The author points to the difficulty of diagnosing Pb poisoning in cases where occupational history of exposure does not exist. She describes briefly 6 cases, hospitalized for surgery from 1949-1954, with predominantly gastric signs. The finding of anemia with stippled erythrocytes led to a search for Pb exposure; this was found in the use of cranberry preserves stored in glazed earthenware. The diagnoses upon hospitalization had been acute cholecystitis, acute appendicitis in 3 cases, acute pancreatitis, and no diagnosis. Therapy included injections of atropine, morphine, oral administration of ascorbic acid and Ca chloride. The principal signs of chronic Pb poisoning are described briefly.

- 1573 Harada, A., Orita, Z., and Hamami, T. (Univ. Kyoto, Japan): STUDIES ON THE EFFECT OF VITAMIN B<sub>12</sub> AND FOLIC ACID UPON THE BLOOD PICTURES OF LEAD WORKERS. Japanese Journal of the Nation's Health 24: 143-59, 1955.

The administration of vitamin B<sub>12</sub> in combination with folic acid to Pb workers resulted in an improvement of the blood picture not only by increasing erythrocyte count, hemoglobin content and specific gravity of whole blood, but by decreasing reticulocyte, basophilic, and polychromic erythrocyte counts; there was also restoration of the Price-Jones curve to normal. These effects were also obtained by administration of vitamin B<sub>12</sub> alone. Cessation of administration of vitamin B<sub>12</sub> with folic acid, the blood picture became gradually worse, but resumption of vitamin dosage again brought recovery. In this case also vitamin B<sub>12</sub> administered alone gave the same results. (From authors' English summary)

- 1574 Hausdorf, G.: Blei im Blut. (LEAD IN BLOOD). Deut. med. J. 1955:739-41. Observations on Pb workers in accumulator factories are reported. Basophilic stippling of the erythrocytes was demonstrable in some of the work-

ers as an indication of Pb inhalation a few days after beginning work. In general, the author does not regard basophilic stippling as proof of Pb absorption. Only when coproporphyrin in the urine is clearly increased, is the assumption of a Pb absorption justified, although Pb poisoning cannot yet be said to exist. For diagnosis, determination of the Pb content in blood is necessary (80 µg% is considered as the limit value). The author recommends the dithizone method for Pb determination, weighing the blood in a quartz crucible, ashing with acid, separating Pb from other metals by solution in ammonium acetate and extracting with dithizone, then photometric comparison with Pb standards. In the treatment of Pb injury, "Mosatil"-Bayer (Ca Na salt of ethylenediaminetetraacetic acid) effected a decrease in the blood Pb from 185 µg-73 µg% within 8 days. Medicinal prophylaxis is by administration of sulfhydryl-Ca tablets. To what extent these prevent actual damage, without leading to carelessness, cannot yet be said. (From Deutsche Zeitschrift für die Gesamte Gerichtliche Medizin 45:436 (Abstracts), 1956)

- 1575 Henderson, D.A. (Queensland Inst. Med. Research, Brisbane, Australia): CHRONIC NEPHRITIS IN QUEENSLAND. Australasian Annals of Medicine 4:163-77 (Aug.), 1955. A high mortality from chronic nephritis in Queensland since 1890 is reported. At the height (1931) ~160 persons between the ages of 10-60 yr died from this disease in excess of the normal rate. The mortality has begun to decline in the youngest groups first and if the present trend continues, should drop in the 50-59 yr group to that of other Australian states by 1990. The excess mortality is explained by the action of a nephrotoxic agent on the children which started to act about 1870 and is gradually diminishing since 1920. It affected the kidneys leading to chronic nephritis within 10-40 yr. The author will publish evidence in a future paper that excessive Pb absorption in childhood is responsible for this phenomenon.

- 1576 Horiuchi, K., Fukumura, S., Ida N., and Yoshida, Y.: STATISTICAL STUDIES ON THE URINE COPROPORPHYRIN EXCRETION IN JAPANESE ADULTS. Osaka City Medical Journal 2:73-84 (June), 1955. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 1, April 1949-March 1959, pp. 206-17.

Since increased coproporphyrin (CP) elimination occurs in various diseases, especially of the liver which may also be involved in Pb poisoning, the authors wished to establish limits excreted by healthy Japanese adults who were not exposed to Pb, benzene, or other materials that increase CP excretion. The 3-yr study involved 417 male subjects, 16-66 yr and 392 females 15-60. CP was determined by the method of Schwartz et al (1951). The results showed frequency distribution to follow a logarithmic normal type: 95 subjects/100 excreted <78.3 µg/day and 99 males excreted <114.6 µg/day. The authors consider that these values would be applicable to a much larger similar population since the frequency distribution of the

samples followed a statistical law. No significant differences were obtained among yearly and monthly average values nor any age differences in males. The data obtained for the female subjects are reported separately. (23 references)

- 1577 Horiuchi, K., Ida, N., Yoshida, Y., Suekane, M., and Wada, N. (Osaka City Univ., Japan): INDUSTRIAL LEAD POISONING. VIII. A SURVEY ON THE ACTUAL CONDITIONS IN THE LEAD INDUSTRY. 2. LABORATORY TESTS WITH LEAD WORKERS. *Igaku to Seibutsugaku* 35:230-4, 1955.

Blood Pb contents tend to increase in workers working in high atmospheric Pb conditions. The urinary coprophorphyrin excretion is the most simple and the most useful indication of the degree of exposure to Pb. (From Chemical Abstracts 52:1003, 1958)

- 1578 Horiuchi, K., Ida, N., Yoshida, Y., Suekane, M., and Wada, N.: SURVEY ON THE ACTUAL CONDITION OF LEAD INDUSTRIES. 2. RESULTS OF LABORATORY TESTS ON LEAD WORKERS. *Medicine and Biology (Japan)* 35: 230-4 (June), 1955. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School. Vol. 1, April 1949-March 1959, p. 34.

- 1579 Hunter, D.: THE DISEASES OF OCCUPATIONS. Boston, Little, Brown and Company, 1955, 1046 pp.

This text is essentially a history of the clinical aspects and of disease in relation to occupation from the primitive conditions still prevailing, in some parts of the world, and from ancient times to the modern. The author's point of view is that of the general physician, since he had never held a post as factory doctor. His aim has been to put together "something of what is known about occupational diseases in order to lay down a basis upon which the practising doctor may build."

Exposure to Pb (pp 203-55) is handled under the chapter on the ancient metals where the history of uses is first reviewed, followed by 19th century legislation; then follow description of the work of the 1st medical inspectors of factories in England, France, Germany and US; exposure hazards illustrated in photographs; diagnostic criteria, signs of various types, and results of experimental and clinical observations on the physiology and pathology and treatment based on classic works in this century. The history of poisoning by TEL is then reviewed, and the section ends with the presentation of 4 cases of Pb poisoning which occurred in 1930 (1) and in 1934 (2 cases).

- 1580 Imbert, M. (Macon, France): Observations sur des cas d'intoxication saturnine dans une poterie. (OBSERVATIONS OF CASES OF LEAD POISONING IN A POTTERY PLANT.) *Med. Usine* 17, No. 10:508-9, 1955.

Pb poisoning (anemia, Pb colics) is described in workers who immersed earthenware into glaze, containing minium, and in workers who put this ware into the oven for baking. Prophylaxis: in the 1st case wearing of rubber gloves, in the 2nd case

dustproof masks. (From *Excerpta Medica*, Sect. 17, 2:Abstr. No. 3511, 1956)

- 1581 Jamnicki, A., Kilibarda, M., and Ilijev, N.: Zapazanja o promjenama krvnog pritiska kod kronicne ekspozicije olovu. (THE INFLUENCE OF CHRONIC EXPOSURE TO LEAD ON BLOOD PRESSURE.) *Arhiv Hig. Rada Zagreb* 6, No. 1:23-7, 1955.

The purpose of this investigation was to find out whether chronic exposure to Pb increases the blood pressure. A group of 46 workers in a storage battery factory was examined. The concentration of Pb in air has been previously estimated (*Arh. hig. rada*, 2/1951/19) to vary from 0-2 mg/m<sup>3</sup>, most frequently from 0.2-0.4 mg/m<sup>3</sup>. In the present investigation the exposure to Pb has been measured by the concentration of Pb in blood, the coprophorphyrin level in urine and the number of stippled cells. The control group consisted of 46 metal workers with no known previous exposure to Pb, the same examination being performed on this group except for the determination of Pb in blood. Both groups were examined under the same conditions and were balanced with respect to age. The measurements of the systolic blood pressure gave an arithmetic mean of 106 mm Hg in the experimental group (exposed to Pb) and 116 in the control group. Thus the hypothesis that the chronic exposure to Pb increases the blood pressure cannot be accepted on the basis of this evidence. (From *Bulletin of Hygiene* 30:1083, 1955)

- 1582 Kehoe, R.A. (Univ. Cincinnati, O.): MISUSE OF EDATHAMIL CALCIUM-DISODIUM FOR PROPHYLAXIS OF LEAD POISONING. Report to the Council on Industrial Health and Council on Pharmacy and Chemistry. *Journal of the American Medical Association* 157:341-2 (Jan. 22), 1955.

In his introduction, the author points to the enthusiasm that has greeted the development of a satisfactory compound of EDTA (CaNa<sub>2</sub>) for clinical trial in the treatment of Pb poisoning; this focuses attention to the fact that despite the availability of methods for the detection and control of hazardous absorption of Pb in industrial workers and others, a high incidence of Pb encephalopathy in children and dangerous absorption in industry still exists. He then warns against the suggested misuse of this promising therapeutic agent as a preventive agent, administered orally. Such application is reminiscent of the former attempts by physicians and others to relieve the effects of current excessive absorption of Pb with milk, etc, for the purpose of "fixation" of Pb in the skeleton, followed periodically by prophylactic "mobilization," as based on the investigations of Aub et al (1926). Because of the inadequacies of analytical methods at the time, it was believed mistakenly that these opposed effects on Pb metabolism could be affected by shifts in the Ca metabolism in the corresponding direction. The fault of any such method is that they were often used in place of environmental control.

Kehoe points out that the iv or im administration of EDTA in limited dosage and over brief periods of time is essentially safe, and that the drug is well tolerated by adults and children. It



combines with Pb in the soft tissues and is rapidly excreted, mainly via the kidney. As it is unable to penetrate into the erythrocytes, the Pb content in blood is not reduced as promptly and completely as by use of BAL. Administered orally, it is comparatively poorly absorbed from the gastrointestinal tract. Although there is a slight to moderate increase in urinary excretion of Pb, there is a corresponding decrease in fecal excretion. Thus, if a significant increase in elimination of Pb were to be achieved, the virtually continuous use of the drug would be required. As there is no prediction of the consequences of such a regimen, the subjection of men to it, except for cautious investigation under proper safeguards, could only be regarded as rash and irresponsible. (14 references)

- 1583** Klopp, H.W. (Reutlingen, Germany): Verkehrtsehen nach kurzdauernder Erblindung. (REVERSED VISION AFTER TRANSIENT BLINDNESS.) *Nervenarzt* 26, No. 10:438-41, 1955.

The patient was first seen by the author in 1951 in connection with chronic Pb poisoning. The man, 49 yr old, had worked since 1929 with Pb cables and later, as a truck driver, was in contact with Pb-gasoline. Colic, occurring at night, and the loss of all fingernails in 1942 were attributed to Pb intoxication. The patient complained of repeated weakness of the right leg, causing him to fall occasionally. In the course of years, loss of sensation occurred in the right hand and both legs, followed during the war by a variable but pronounced motor weakness of the arms. These symptoms were evident to the author in a tendency to fall during Romberg's test. The patient had in earlier years suffered from hazy vision, and more recently noted decrease in libido. The course of illness showed an intermittently progressive character leading to the suspicion of a chronic encephalomyelitis disseminata. However, the history and the findings of 2 examinations justified the author to assume that the neurologic disturbances also were sequelae of Pb poisoning. The patient was of average nutritional condition; blood pressure 155/80 mm Hg. Examination showed positive Romberg's sign, lessened strength on the right side and spotty lessened sensibility in both legs; the fundus was normal, a presbyopia bilaterally was corrected. EEG could not be done for technical reasons and the patient would not submit to spinal fluid and cerebral examination. Psychiatrically, the patient appeared poor in initiative and somewhat depressed; mental ability was only slightly reduced. In 1954 during a follow-up examination, there was distinct uncertainty upon Romberg's test; the right hand showed some extensor weakness, the muscle tone was reduced; sure reflex differences could not be observed. Arteriogram showed no disorder in the cerebral vessels. The patient reported that he had not noticed for several years any visual disturbances, but reported an attack having taken place in the Spring of 1948 of sudden blindness, followed soon thereafter by reversed vision ("the world was upside down"); this righted itself in 3 consecutive stages. This episode is discussed by the author extensively on the basis of reported cases and possible causation, and on the basis of C.H. Sattler's opinion (published in

Schieck-Brückner: *Kurzes Handbuch der Ophthalmologie*, Vol. VII, Berlin, Springer, 1932) that in acute Pb poisoning a centrally related blindness can occur which is not accompanied by any changes in the fundus, while in chronic poisoning a papilloretinitis can lead to blindness, and on that of Elschnig (not documented) that in the course of a transient blindness after Pb poisoning a retinal spasm was seen, the author feels justified in suggesting chronic Pb poisoning as the cause of the above symptom complex. He supposes the interplay of 3 factors: a right cerebellar focus, transient loss of sight, and vascular spasm. He assumes that the decisive correction of the reversed visual field proceeded from the right cerebellar focus.

- 1584** Kovalev, M.M.: (QUALITATIVE SPECTRAL ANALYSIS OF DRINKING WATER AND URINARY CALCULI.) *Klin. Med.* 33, No. 11:54-6, 1955. Spectral analysis of urinary calculi obtained from the parenchyma of the kidneys revealed the presence of most of the trace elements found in drinking water. The calculi contained Al, Ti, Va, Ni, Pb, Li, Cr, Mn, Cu, Mo, Sr, Si, Ag, Fe, Bi, Zn, and Ba. This suggests the possibility of drinking water being the causative factor in formation of calculi. (From Chemical Abstracts 50:7290, 1956)

- 1585** Kremer, H.U., and Frank, M.N. (Philadelphia General Hosp., Pa.): COEXISTING MYXEDEME AND CHRONIC PLUMBISM. *Annals of Internal Medicine* 42, No. 5:1130-6, 1955. A 70-yr-old cabinetmaker was admitted in 1950 for the 6th time for anemia and weakness; in previous admissions, angina pectoris was also present. Inquiry showed that from 1914-17 he had worked as an automobile mechanic spraying Pb-containing paint; in 1917 he had had an exploratory laparotomy for "gallbladder colic," when no intraabdominal pathology was found. His father had died of "painter's colic." There was no exposure to Pb after 1917. Upon examination, neurologic opinion was a "classic case of myxedema." Laboratory findings included stippled cells, 0.25%-1.2% normal bone marrow with stippling; Pb in blood 0.07-0.11 mg% (normal in authors' laboratory, 0.01-0.03 mg%, by Letonoff and Reinhold's method, 1940); in an addendum, it is noted that urinary excretion of Pb before 5 g CaEDTA iv was 0.0033 mg/24 hr, and after, 1.2 mg/24 hr. In discussing the case, the authors state that this was evidently a low-grade chronic Pb poisoning which has continued to be active for 36 yr after first exposure, and that myxedema did not appear until that time. Although the patient had had no contact with Pb within those years, he still had a significant elevation of blood Pb level in 3 analyses. They conclude that the presence of significant amounts of Pb in the blood had toxic effect on the hemopoietic and nervous systems. (16 references)

- 1586** Lauer, D.J. (Jones & Laughlin Steel Corp., Gateway Center, Pittsburgh, Pa.): CLINICAL LEAD INTOXICATION FROM BRASS-FOUNDRY OPERATIONS. *A.M.A. Archives of Industrial Health* 11:107-12 (Feb.), 1955. Over a 2-yr period 219 brass-foundry workers were observed; of these, 37 suffered at least once from



acute Pb poisoning.

The foundry was equipped with an abundance of exhaust ventilation but this was ineptly planned and resulted in unpredictable diffusion patterns of fumes and dust. In spite of efforts to correct the situation, an acute outbreak of Pb intoxication occurred, culminating in 23 cases of acute illness in a 3-wk period.

Though no racial difference was demonstrated, 25 of the 37 were negroes who generally worked in more highly polluted areas. The length of exposure ranged from  $<1/2$ -6 yr. The frequency of symptoms, as analyzed and tabulated, showed abdominal pain, colic, weakness and fatigue to be the most prominent symptoms in all. Among the physical signs, the Pb line was the most consistent; and muscle weakness occurred frequently; others were wrist drop, tremors, convulsions, stupor, and ataxia, the latter persisting long after other signs had disappeared.

The author discusses the diagnostic problems by pointing to the nonspecificity of the Pb syndrome, as shown in the tables. The occupational history also may be misleading. Laboratory findings are most helpful in confirming a diagnosis. In illustration he presents urinary Pb values of 2 groups of men (total 101) sampled at time of employment. There was no history of recent exposure to Pb.

Their mean Pb values were 0.0767 and 0.073 mg/l; this indicated that industrial workers may show slightly higher values than those who are never exposed to Pb. The urinary Pb of the men with Pb poisoning had a mean of 0.572 mg/l, and a range of 0.11-2.9. The Pb blood levels were 0.08-1.7 mg/100 g; stippled cells, 3000-27,000/million; hemoglobin, 9-15. The author concludes that although the stippling of erythrocytes is not specific for Pb in an individual, but when found in a group of workers in a single shop it is specific for practical purposes. Coproporphyrinuria determinations can be utilized in the same manner and as a parallel to the stippled erythrocytes count. In addition to the above aids in differential diagnosis, trends in absentee records can be useful in many ways, as a change in the normal disease ratio (eg, respiratory/gastrointestinal disease  $\approx 2.5/1$ ) may furnish a clue.

- 1587 Manville, I.A., and Moser, R. (Portland, Ore.): RECENT DEVELOPMENTS IN THE CARE OF WORKERS EXPOSED TO LEAD. THE EFFECT OF THE CALCIUM CHELATE OF DISODIUM ETHYLENE-DIAMINE-TETRAACETIC ACID ON LEAD IN THE BLOOD AND URINE OF BATTERY WORKERS. A.M.A. Archives of Industrial Health 12:528-38 (Nov.), 1955.

CaNa<sub>2</sub>EDTA in tablet form (250 mg or 500 mg/tablet) was given to 2 groups of battery-plant workers, 5 men in 1 group and 7 in the other, over a period of 2 and 3 wk. (In spite of precautions by engineering measures, exposure was to 0.04-0.16 mg Pb/m<sup>3</sup> in most operations and to 1.06 in the pasting operation; 3 of the 12 workers had history of episodes of acute Pb poisoning.) The dosage was 60 mg/kg body weight/day in divided doses for the 1st 5 days of each week. Physical examination and blood and urine chemistry studies were done at the start of the experiment and at the end of each

week. Subjective symptoms of constipation, anorexia, and early fatigability cleared rapidly and, in most cases, were relieved completely. The amount of Pb in the blood showed a steady decline, but in only 2 instances did it reach normal levels. The actual decrease was from an av of 90.6-70.4  $\mu$ g/100 ml. Body weight and red cell count were unaffected. Hemoglobin showed a slight but definite increase, from 81.6-87.2%. Porphyrinuria cleared entirely in 3 wk, while stippling of red cells diminished from an av of 0.55-0.18%. Total Pb in urine showed an average increase by the end of the 1st wk from 280-560  $\mu$ g/day and at the end of the 3rd wk to 690  $\mu$ g, from an av of 210-430  $\mu$ g/l.

The authors sum up this experience by stating that enough EDTA is absorbed from the intestinal tract to cause a lowering of blood Pb in 3 wk and a decided increase in urinary Pb with no sign of any deleterious effect to the patients. Three weeks is insufficient time for EDTA, as administered, to eliminate enough Pb so that, with a continual absorption of Pb, a dynamic equilibrium (a stabilized, minimal blood and urine level below toxic limits) can be established. Until future work proves this to be unnecessary, it is recommended that EDTA be given intermittently by mouth, along with a potent vitamin and mineral formula, administered during intervals in treatment.

In an addendum, the authors report an acute case of Pb poisoning treated with iv administered EDTA. Since in this case, which preceded the above experiment, the analytical results on the urine did not give the huge increase they had expected, they came to the conclusion that Pb was being eliminated in the urine in such firm combination with EDTA, that the method used (Cholak et al) was incapable of breaking it down. Therefore, they destroyed the organic matter by oxidation with nitric-sulfuric-perchloric acid wet ashing and then were able to recover the Pb quantitatively by the usual colorimetric method.

- 1588 Markus, A.C., and Spencer, A.G. (Univ. Coll. Hosp., London, England): TREATMENT OF CHRONIC LEAD-POISONING WITH CALCIUM DISODIUM VERSENATE. British Medical Journal 2:883-5 (Oct. 8), 1955.

The title drug was used in treating 3 cases of chronic Pb poisoning which were referred by the same factory, and which were caused by vitreous enamelling. Two 4-day courses of CaNa<sub>2</sub>EDTA were given, separated by 2 rest days. It was given iv as 2 g dissolved in 1 l of normal saline over 9 hr. Parathormone was given during the 2nd course, but without advantage. EDTA caused a sharp increase of Pb urine; headaches, tremor, and colic were rapidly relieved. A return of colic was relieved in 30 min by restarting the EDTA drip. Excess urinary coproporphyrin disappeared. The Ca salt of EDTA is used, as EDTA alone might chelate the body Ca and cause hypocalcemic tetany. No toxic effects were observed. (19 references)

- 1589 Mazaury, E. (Reg. Soc. Med. Ind. Hyg. of Montpellier, Viviez, France): Saturnisme et plombémie. (SATURNISM AND LEAD IN THE BLOOD.) Montpellier médical 48:581-7 (Dec.), 1955.

Various questions concerning blood Pb levels in Pb poisoning are examined: Methods of measuring blood Pb levels (dithizone, Kohn-Abrest, electrolytic and spectrographic); blood Pb levels as indicator of Pb poisoning compared to other signs (Burton's line, stippled erythrocytes, porphyrinuria); the fluctuations of Pb levels in blood (the level, although varying at certain intervals depending on Pb storage and elimination, is believed to reflect the severity of Pb poisoning to some degree); causes of error in blood analysis; reliability of results: i.e., different results obtained by 3 methods (dithizone, and Cu and Bi spectrography). In the author's experience, results obtained by dithizone were 8 times higher than those obtained by Bi spectrography on the same blood specimens. Due to the imprecision of analysis, the author does not believe blood Pb levels to be an infallible diagnostic tool but valuable only in confirming and monitoring the presence of Pb intoxication.

- 1590 Mellemgård, K., and Sørensen, G.: (ACUTE LEAD INTOXICATION TREATED WITH ETHYLENE-DIAMINETETRAACETIC ACID.) Ugeskr. laeger 117:127-9 (Feb. 3), 1955.

Few cases of acute Pb poisoning treated with EDTA have been published. In the instance described, in a 17-yr-old girl with acute Pb intoxication after ingestion of Pb oxide, 2 g  $\text{CaNa}_2\text{EDTA}$  in 5% glucose was administered intravenously daily for 6 days. During the first 2 days the excretion of Pb in the urine was greatly increased and thereafter moderately increased. The amount eliminated was only a small amount of the Pb deposited in the organism. The continued increased Pb excretion a month after treatment ended and the persisting anemia also showed that not all the Pb had been excreted. EDTA can apparently combine with only a certain mobile fraction, probably the circulating Pb. The treatment is thus first and foremost indicated in acute cases. Intermittent treatment may perhaps be useful in chronic cases. (From Journal of the American Medical Association 158: 436, (Abstracts), 1955)

- 1591 Mokranjac, M.S., and Radmić, S. (Farm. faculty, Belgrade, Yugoslavia): NORMAL CONTENT OF LEAD IN HUMAN BLOOD. Glasnik Khem. Drushtva, Beograd 20:563-8, 1955.

A study was made of the quantity of Pb contained in the blood of the citizens of Belgrade, in contrast to that of the country people from various parts of Yugoslavia, by a method previously described (Mokranjac and Radmić, 1954). The blood Pb content of Belgradians was 30-50  $\mu\text{g}/100\text{ ml}$ , while in the blood of country people it averaged 31.5  $\mu\text{g}/100\text{ ml}$  of blood. In citizens exposed occupationally to Pb, the average content was  $\sim 100\text{ }\mu\text{g}$ . It was concluded that in the regions investigated, content of Pb  $> 50\text{ }\mu\text{g}/100\text{ ml}$  of blood should not be considered as normal. (From Chemical Abstracts 52:15696, 1958)

- 1592 Owada, K., Ida, N., Horiguchi, S., and Wada, N.: EFFECTS OF VITAMIN  $\text{B}_{12}$  ADMINISTRATION ON THE RESULTS OF LABORATORY TESTS FOR LEAD OR DYE-STUFF WORKERS. Public Health (Japan) 18:40-2 (Sept.), 1955. In Contributions from the Department of Pre-

ventive Medicine and Public Health, Osaka City University Medical School. Vol. 1, April 1949-March-1959, p. 34.

- 1593 Paparopoli, G. (Univ. Palermo, Italy): Ricerche sulle plasmoproteine nel saturnismo. (PLASMA PROTEINS IN LEAD POISONING.) Bollettino della Societa Italiana di Biologia Sperimentale 31:1426-8, 1955.

Fifteen patients with mild Pb poisoning were examined either at the workplace (ceramics plant) or at the author's Institute (typographers, painters). The patients, 35-55 yr old, had been employed for 10-30 yr. They complained of digestive disturbances; frequently slight blood disorder was observed; blood pressure was normal; 60% exhibited a slight liver enlargement. In 8, X rays showed catarrhal gastroduodenitis and in 4, cholecystic dysfunction. In order to explore liver function, the protein content of blood was examined by paper electrophoresis. The results gave normal values for the various fractions, only in the case of  $\gamma$ -globulin was there some slight increase over the normal. The author concludes that in Pb poisoning, at least in mild cases, the plasma protein picture is not modified.

- 1594 Paparopoli, G., and Terranova, S. (Univ. Palermo, Italy): Rilievi clinico-strumentali sull'apparato cardiovascolare in soggetti con piccolo saturnismo. (CARDIO-VASCULAR EXAMINATIONS OF SUBJECTS WITH MILD LEAD INTOXICATION.) Folia Medica (Naples) 38:1080-98, 1955.

Data were collected of clinical, laboratory, electrocardiographic and ballistocardiographic examinations conducted in a ceramics plant, on a group of 30 workers, 21-66 yr old and employed for 5-50 yr. Many of the workers showed Burton's line, enlarged liver and damage of the cardiovascular system (50%) which was prevalent in men  $> 50$  yr of age. Basophilic stippling was found in some of the subjects and in 10 men tested, urinary Pb and coproporphyrin ranged from 100-260  $\mu\text{g}$  and 60-140  $\mu\text{g}$ , respectively. The findings indicated in most cases an attenuated form of Pb intoxication. (13 references)

- 1595 Parmeggiani, L., and Zurlo, N. (Univ. Milan, Italy): Sul rischio di saturnismo nelle operazioni di trafileria e di tempra a piombo. (ON THE HAZARD OF LEAD POISONING IN DRAWING AND LEAD PATENTING OPERATIONS.) Medicina del Lavoro 46, No. 3: 176-84, 1955.

From 1945-1954, 194 cases of Pb poisoning were hospitalized in the Clinica del Lavoro. Of these, 12 were workers who had been engaged in cold drawing and Pb patenting operations. Atmospheric contamination of Pb was determined in 2 mills, and 22 men engaged at work were examined. The main source of contamination was found to be the Pb dust formed on the surface of the wire immediately after Pb coating. The hazard is concentrated in some of the working areas (at the outlet of the wires from the Pb bath, at the handling of the skeins, at the reels, at the dies). The same hazard is produced by die-dressing of rubber tubes with Pb coating and by all operations involving

the cold working of Pb in which particulates of dust from surface cracks due to mechanical and thermal stresses set up during processing are profusely dispersed. Six cases of Pb colic, 5 cases of anemia, and 1 case of wrist-drop are described. The importance of the hazard of Pb poisoning from these operations is emphasized.

- 1596 Passow, H., and Tillmann, K. (Univ. Hamburg, Germany): Untersuchungen über den Kaliumverlust bleivergifteter Menschen-erythrocyten. (POTASSIUM LOSS OF LEAD POISONED HUMAN ERYTHROCYTES) Pflüger's Archiv für die Gesamte Physiologie des Menschen und der Tiere 262:23-36, 1955.

In the presence of Pb the erythrocytes lose K and become less resistant to hemolysis by hypotonic saline. The effect increased with the concentration of Pb. At constant Pb concentration, decreased pH increased K loss. The effect was attributed to an action on the cell membrane. The action of Pb was reversible.

- 1597 Piazza, G. (Univ. Padua, Italy): I substrati organici della dispepsia saturnina. (ORGANIC SUBSTRATES OF SATURNINE DYSPEPSIA.) Quaderni di Radiologia 20:585-92, 1955.

The author concludes from his review of the literature that the term of saturnine dyspepsia is usually used to delineate a subjective symptomatic complex of the gastrointestinal tract in chronic Pb poisoning. However, this term is too general since saturnine dyspepsia includes only inflammation of the esophagus, stomach, duodenum and probably jejunum.

- 1598 Piazza, G., and Ruffato, C. (Univ. Padua, Italy): Rilievi radiologici sull'apparato digerente in malatti professionali di non frequente riscontro. (X-RAY FINDINGS ON THE DIGESTIVE SYSTEM IN RARELY ENCOUNTERED OCCUPATIONAL DISEASES.) Medicina del Lavoro 46:498-503 (Aug.-Sept.), 1955.

Radiological alterations of the digestive system as they occur in some of the industrial intoxications (C disulfide, TEL, P, Br, Cd, CO, phenol and formaldehyde), by distinguishing alterations of the folds of the mucosa and modifications of the motility and of tone. The various patterns observed are interpreted to be an unbalance of the vegetative nervous system. (From authors' summary) (28 references)

- 1599 Piccoli, P. (Univ. Naples, Italy): La reazione di flocculazione alcool-sublimato e la velocità di eritrosedimentazione nell'intossicazione professionale da piombo. (ALCOHOL-MERCURIC DICHLORIDE FLOCCULATION AND ERYTHROCYTE SEDIMENTATION RATE IN OCCUPATIONAL LEAD POISONING.) Folia Medica (Naples) 38:494-501 (May), 1955.

On the basis of 20 cases of Pb poisoning (these are shown individually as to age, occupation, climate data and results of above tests), the author found that both reactions are positive in many cases and show parallelism.

- 1600 Pinto Grote, C. (Inst. Physiol. Pathol.,

Tenerife, Spain): Intoxicación por tetraetilo de plomo. (TETRAETHYLLEAD POISONING.) Revista Clínica Española 59:44-6 (Oct. 15), 1955.

A 34-yr-old male chemist who was working with TEL intermittently for periods of months, exhibited cyanosis of the skin, mucosa and extremities, spasms interchanging with muscular hypotonia, interosseous atrophy, tachycardia and some diarrhea. Blood tests showed 4,000,000 erythrocytes, 8,400 leukocytes, 1% polynuclear basophilic cells. He reported that he had had similar spells previously. Urinalysis on 3 different days yielded a Pb content of 0, 0.135 and 1.21 mg/l, respectively. Treatment is discussed. Although he was removed from further exposure to TEL, he suffered a slight relapse with identical symptoms.

- 1601 Pletscher, A. (Univ. Basel, Switzerland): Zur Behandlung der Bleivergiftung mit Calcium-Äthyldiamin-tetraacetat. (TREATMENT OF LEAD POISONING WITH CALCIUM ETHYLENEDIAMINETETRAACETATE.) Schweizerische Medizinische Wochenschrift 85:128-31 (Feb. 5), 1955.

Two workers in a Pb foundry developed chronic Pb poisoning. Case 1 had no subjective complaints and clinical findings showed 8/1000 basophilic stippling (BS) 33% reticulocytes, 4.05 million red cells, 71% Hb, 73.5 µg% coproporphyrin (CP) in urine, 140 µg% Pb in blood, 4 µg Pb/l urine and a clear Pb line. Case 2 suffered from fatigue, headache, slight abdominal pains, nervousness, and pains in the joints. Clinical examination showed esophageal diverticulum and hypoacidity of the gastric juice, 83% Hb, 8/1000 BS, 20% reticulocytes, 5.75 million red cells, 17.2 µg% CP in urine, 5 µg% Pb in blood, 42 µg% Pb in stool, 44 µg Pb/l in urine, and a clear Pb line. The patients were treated intravenously daily for 45 days with 2.5-g doses of CaEDTA (50% solution) and then they went back to work. They were examined at the end of the treatment and 18 wk later. BS and CP had dropped to zero at the end of treatment and then increased again after 18 wk. Reticulocytes decreased during treatment. Hb and red cells stayed the same. The Pb blood level in Case 1 decreased to normal while in Case 2 it increased from normal to pathologic values during treatment. After 18 wk, the fecal Pb concentration had increased, while both blood and urine Pb concentrations were normal. In Case 1, there was a manifest intoxication and in Case 2 a latent intoxication. Possible explanations for increased fecal Pb were (1) method error, (2) increased oral Pb absorption after concluding the CaEDTA treatment, (3) mobilization of Pb from stable depots by CaEDTA. The author tended toward the third explanation. Intermittent CaEDTA treatments were suggested as having better results than one single treatment.

- 1602 Pollet, L., Gaultier, M., Moreau, J., and Valt, J. (Soc. Ind. Med. Hyg., Paris, France): Note sur le traitement des coliques de plomb par la chlorpromazine (largactil). (NOTE ON THE TREATMENT OF LEAD COLIC WITH CHLORPROMAZINE (LARGACTIL).) Proceedings of the Society of Industrial Medicine and Hygiene. Archives des Mal-

adies Professionnelles de Médecine du Travail et de Sécurité Sociale 16, No. 3: 247-8, 1955.

While 5 patients treated by the usual methods (atropine) only had relief after the 3rd day, those treated with chlorpromazine appeared to have relief more rapidly. Two of 3 cases were treated by combined methods, and within a few hours obtained relief. One treated with chlorpromazine alone also was relieved as rapidly. Intestinal transit time was not shortened by this treatment.

- 1603 Portheine, F., and Zimmermann, H. (Inst. Hyg. Ruhr area, Gelsenkirchen, Germany): Erfahrungen und Ergebnisse bei der Bestimmung und Beurteilung des Bleigehaltes von 3000 Blutproben. (DETERMINATION AND EVALUATION OF THE LEAD CONTENT OF 3000 BLOOD SAMPLES.) Klinische Wochenschrift 33:474-7, 1955.

On the basis of their numerous investigations the authors came to conclusion that the determination of Pb content of blood by wet digestion with nitric acid-sulfuric acid does not prevent loss in comparison with dry ashing. Their own experiments to clarify possible Pb loss are described. The dithizone method based on that of Cholak, et al, as used by the authors, is not described. By this method, their Pb values were lower than those obtained by other authors. The Pb quantities designated as "normal" are accordingly graded lower by the authors. According to their method, values up to 40 µg% of blood are considered "normal," contents of 40-70 µg% are regarded as elevated Pb absorption. A Pb hazard exists at values >60 µg%. Even though the analysis gives an insight into the momentary level of toxic concentrations of Pb in blood, the authors are of the opinion "that often one can arrive at a prognosis in an individual case only after full consideration of the complicated intermediate Pb metabolism and sometimes possibly only on the basis of control and Pb-exposure experiments."

- 1604 Puccini, C. (Univ. Florence, Italy): Gli avvelenamenti da arseniato di piombo; A proposito di una intossicazione collettiva con particolare riguardo all'anemia emolitica da arseniato di piombo. (POISONING BY LEAD ARSENATE. MASS POISONING WITH PARTICULAR REFERENCE TO HEMOLYTIC ANEMIA DUE TO LEAD ARSENATE.) Minerva Medico-legale (Torino) 75:77-84 (May-June), 1955.

Members of 2 peasant families (8 persons, 20-64 yr old) fell ill after eating home baked bread. The symptoms were regarded as gastroenteritis and the physician prescribed a diet of white bread. The symptoms then disappeared but reappeared after they started eating the home made bread again. The symptoms were vomiting, diarrhea, nausea, diffuse abdominal pains, facial edema, weakness and headaches. A 64-yr-old woman died 15 days after the first episode. Two others developed symptoms of hemolytic anemia. Examination of the bread, flour and yeast showed positive reaction for Pb and As; in the grain, no traces were detected. The white, flour-like powder, Pb arsenate, used as insecticide had been accidentally mixed with the flour. (From author's summary; 54 references)

- 1605 Reinl, W. (State Ind. Physician, Nordrhein, Düsseldorf, Germany): Zur modernen Therapie der Bleivergiftung. (Ein Beitrag zur Behandlung mit Calciumdinatriumäthylendiamintetraessigsäure.) (MODERN THERAPY OF LEAD POISONING. (CONTRIBUTION TO THE TREATMENT WITH CALCIUM DISODIUM ETHYLENE DIAMINETETRAACETIC ACID.)) Archiv für Gewerbepathologie und Gewerbehygiene 13, No. 7:721-35, 1955.

Following a review of the literature, own experiences in treatment of Pb poisoning with EDTA are described. The course and results in 4 cases are tabulated.

The author concludes as follows: "Mosatil" corresponds in its effectiveness to the "Versene" used in USA. It is well tolerated and there are no side effects, nor are blood pressure and Ca metabolism altered. In spite of the unequaled effectiveness of eliminating Pb, no acute exacerbation of symptoms occurs. The elimination is greatest in the 1st 3 hr. The effectiveness in removal of signs and symptoms is emphasized. The extent to which EDTA treatment should be accompanied by additional therapy will be evident with further experience. The author considers that additional medication with Carlsbad salt may be advisable. (60 references)

- 1606 Rieders, F. (Jefferson Med. Coll., Philadelphia, Pa.): EFFECTS OF INTRAVENOUS DISODIUM CALCIUM ETHYLENEDIAMINE TETRAACETATE (EDTA) ON URINARY EXCRETION OF Pb, Fe, Cu, AND Zn IN MAN. Federation Proceedings 14: Abstract No. 1235 (Mar.), 1955.

Slow, intravenous administration of EDTA in dosage of 0.1 mg/kg body weight as 1% solution in 5% glucose markedly enhances urinary excretion of Pb, Fe, Cu and Zn. The amounts of these metals in 24-hr urine specimens after administration of the drug were as follows (mg/l of urine, corrected to a specific gravity of 1.020). In 11 normal controls, Pb 0.126-0.614; Fe 0.43-1.07; Cu 0.544-1.461; Zn 12.6-32.1. In 17 men exposed to Pb but free of signs or symptoms of Pb poisoning and showing Pb levels <0.60 mg/100 ml whole blood, Pb 1.934-6.878; Fe 0.331-0.972; Cu 0.483-1.228; Zn 14.2-40.2. In 6 individuals with hemochromatosis, Pb 0.133-0.731; Fe 8.11-28.5; Cu 0.286-1.714; Zn 10.3-35.7. In 5 individuals with transfusion hemosiderosis, Pb 0.382-0.659; Fe, 14.3-31.5; Cu 0.622-1.631; Zn 12.9-36.5. In 5 individuals with Wilson's disease, Pb 0.107-0.681; Fe 0.63-1.15; Cu 0.769-2.841; Zn 16.9-44.1. The possibility of using EDTA as an aid in the diagnosis of Pb poisoning and in Fe storage diseases will be discussed. Implications of the enhanced excretion of Cu and Zn will also be considered. (From author's abstract)

- 1607 Rieders, F., and Brieger, H. (Jefferson Med. Coll., Philadelphia, Pa.): EDATHAMIL DISODIUM CALCIUM (Na<sub>2</sub>CaEDTA): ABSORPTION BY THE ORAL ROUTE - INTERACTIONS WITH METALS IN VIVO - DIAGNOSTIC AND THERAPEUTIC USE. Proceedings of Seventh Annual Meeting of the American Academy of Occupational Medicine, Philadelphia, Pa., Feb. 10-12, 1955, pp. 83-4.

Orally administered  $\text{CaNa}_2\text{EDTA}$  is apparently not absorbed as such. Its total effect is a transfer of metal from the intestinal to the urinary route of excretion without appreciable removal of metal from the tissues. Experimental evidence supporting this statement is presented. Increases of urinary Pb excretion by 1 parenteral administration of  $\text{Na}_2\text{CaEDTA}$  are much greater in Pb poisoning than in other pathologic or normal conditions and hence are of diagnostic significance. In chronic occupational Pb poisoning, intravenous treatment with 1 infusion/wk mobilizes more Pb/infusion than if the drug is given daily. Clinical improvement under such intermittent therapy is as rapid and as lasting as under continuous therapy. The effect of this reagent on excretion of Fe, Cu, and Zn is discussed briefly.

- 1608 Rieders, F., Dunnington, W.G., and Breiger, H. (Jefferson Med. Coll. Philadelphia, Pa.): THE EFFICACY OF EDATHAMIL CALCIUM DISODIUM IN THE TREATMENT OF OCCUPATIONAL LEAD POISONING. *Industrial Medicine and Surgery* 24:195-202 (May), 1955.

The evaluation of treatment of chronic Pb poisoning with  $\text{CaNa}_2\text{EDTA}$  was made on the basis of 9 cases, selected from a total of 37 patients, using 2 different schedules: Series 1, 5 cases received the drug daily by intravenous drip as follows: (1) 3 g in 300 ml 5% glucose, over a 3-hr period, for 10 days followed by a 2nd course for 8 days after an interval of 7 days; (2) 5 g in 500 ml 5% glucose, over 5-hr, for 5 days; and after a rest of 7 days, another course over 4 days; (3) as in 2, for 6 days, followed 11 days later by a 4-day course; (4) and (5) as in 2 over 5-6 hr, followed 10 and 20 days later, respectively, by another 5-day course. Series 2, treatment at intervals of 2 or more days of 4 additional patients as follows: (6) 4 infusions of 5 g EDTA in 500 ml 5% glucose over 4-5 1/2 hr, at 5, 3, and 3-day intervals; (7) 5 infusions as in 6, over 4 1/2-6 hr, at 3-day intervals; (8) 4 infusions of 4 g in 400 ml 5% glucose over 4-5 hr, at 5-day intervals; (9) 5 infusions of 6 g in 300 ml 5% glucose over 6-8 hr, at 3, 3, 4, 7, and 7-day intervals. The work history, complaints, and findings before and after treatment are briefly stated for each of the patients. Eight figures and 5 tables show urinary and blood Pb, coproporphyrinuria, and calculated values of mobilized Pb in terms of PbEDTA in body, in circulation, and excreted.

The 2 types of treatment schedules appeared to be fully comparable with respect to the rate and extent of clinical improvement. The average number of mg Pb mobilized by each mg EDTA administered increased as the interval between treatments was increased up to ~7 days.

The authors conclude that parenteral administration of EDTA is rapidly and lastingly effective in relieving symptoms and signs of chronic poisoning and its acute episodes. Improvement continues after cessation of therapy, and there are no side effects. The rapid and marked decrease of urinary coproporphyrin excretion is most striking, indicating that toxic effects of Pb on the erythrocytic cells are arrested when EDTA is administered. However, treatment at weekly intervals appears to offer the following advantages over daily treat-

ment: (1) greater efficiency of the individual dose with respect to Pb excretion; (2) administration on an outpatient basis, necessitating little interruption of employment; (3) lessened likelihood of depletion of essential trace metals which may be chelated by EDTA and excreted along with Pb; (4) lessened chances for the development of phlebitis; (5) possibility of more or less complete deleading of soft tissues by periodic removal of Pb accumulated in the course of metabolic turnover of skeletal stores. (33 references)

- 1609 Rossi, L. (Univ. Naples, Italy): La piombemia e la piomburia nei normali e nei saturnini. (LEAD IN BLOOD AND URINE IN NORMAL PERSONS AND IN LEAD POISONING.) *Folia Medica (Naples)* 38:1099-1108 (Oct.), 1955.

In view of conflicting data on the normal levels of Pb in blood and urine, reported in the literature, the author obtained such values on 100 healthy subjects not exposed to Pb, using a method developed in his laboratory; this is a colorimetric method, the results of which are read on the Beckman spectrophotometer. The results showed levels of 10-90  $\mu\text{g}/100$  ml blood and 10-130  $\mu\text{g}/24$  hr urine. More than half of the subjects showed from 40-60 and only 15 had 70-90  $\mu\text{g}/100$  ml blood; as to urinary Pb, most showed 30-70 and only 8 eliminated >100  $\mu\text{g}/24$  hr. Of 260 workers exposed to Pb, 64 with poisoning showed blood Pb from 30-210  $\mu\text{g}/100$  ml (overall range 10-140  $\mu\text{g}$ ) and urine Pb ranging from 50-800  $\mu\text{g}/24$  hr. The author concludes that even in persons with Pb poisoning some cases showed normal values, and that those exposed to Pb rarely gave strictly pathologic values. For this reason he considers that the blood Pb test for the determination of whether an abnormal absorption of Pb exists is of little importance. (18 references)

- 1610 Saita, G., and Arrigoni Martelli, E. (Univ. Milan, Italy): Aspetto, decorso e trattamento dell'anemia saturnina in 103 intossicati ricoverati nella Clinica del Lavoro dal 1948 al giugno 1954. (APPEARANCE, EVOLUTION AND TREATMENT OF ANEMIA IN 103 CASES OF LEAD POISONING HOSPITALIZED AT THE CLINICA DEL LAVORO FROM 1948 TO JUNE 1954.) *Medicina del Lavoro* 46:199-210 (March), 1955.

The appearance and evolution of anemia was studied in 106 cases of Pb poisoning hospitalized in the authors' Clinic from 1948-June 1954. Findings were as follows: In 66 cases of the acute phase of Pb colic anemia was evident by 62% Hb, and red cells 3.2 million; in 37 cases of chronic poisoning, Hb was 67%, red cells 3.5 million. Red cells were never <2 million red cells. Stippled cells (SC) were always present in the colic cases. Reticulocytes and SC were more numerous in cases of colic than in the chronic cases. On the average their increase was proportional to the severity of the anemia, but in individual cases the values for the SC were widely scattered.

Anemia appeared early in several cases (a few months and 1 case, a few days following exposure to Pb). It improved in most of the cases during hospitalization (4-6 wk). However, only ~18% reached normal values; 18% remained stationary

and a decrease, though slight, was sometimes noted. SC diminished with improvement of anemia, but they rarely disappeared completely during hospitalization. (From authors' summary)

- 1611 Saita, G., and Gattoni, L. (Univ. Milan, Italy): La prova da carico con tromexan nel saturnismo. (TOLERANCE TEST WITH TROMEXAN IN LEAD POISONING.) *Medicina del Lavoro* 46:623-7 (Nov.), 1955.

The tolerance test using a single dose of 300 mg Tromexan was performed in 6 cases of Pb poisoning (2 with acute colic, 4 with chronic poisoning) showing normal prothrombin activity. The fall of prothrombin activity at the 24th hr was greater than in normal subjects and at the 48th hr, recovery was only partial.

A previous investigation had shown the frequency of a decrease in the prothrombin activity in Pb poisoning. This study indicated to the authors that even in those cases of Pb poisoning in which prothrombin activity is normal, the existence of a latent defect of the factors of the prothrombin complex and of a delay in a return to normal can be demonstrated.

- 1612 Saita, G., Gattoni, L., and Sartorelli, E. (Univ. Milan, Italy): Le modificazioni dell'attività protrombinica nel saturnismo. Azione della vitamina K. (MODIFICATIONS OF PROTHROMBIN ACTIVITY IN LEAD POISONING. ACTION OF VITAMIN K.) *Medicina del Lavoro* 46:541-8 (Oct.), 1955.

The behavior of prothrombin activity was studied (by the method of Quick) in 15 cases of Pb colic and in 24 cases of chronic Pb poisoning. In addition, in 8 cases of colic and 10 of chronic poisoning, changes in factor V and factor VII were followed. In more than half of the cases of chronic Pb poisoning the prothrombin activity was decreased (values of 50-75%); even more in number were the cases deficient in factor VII. During Pb colic the number of cases showing a decrease of prothrombin activity was higher than in chronic Pb poisoning; the decrease was sometimes more evident (40%) and reduction of factor VII was almost constant. The decrease of prothrombin activity was sometimes transitory during colic and values returned spontaneously to normal some time after the colic was over. Modifications of factor V were infrequent and slight. With administration of vitamin K a rapid return to normal values was observed in some cases; in other cases increases were slight and return to normal was delayed. Only in some cases of Pb poisoning did decrease of prothrombin activity indicate slight functional liver damage; in other cases the decrease was caused by a reduced supply of vitamin K. (46 references)

- 1613 Saita, G., Moreo, L., and Petrocchi, V. (Univ. Milan, Italy): Sideremia e transferrinemia nel saturnismo professionale. Il quadro biochimico dell'anemia saturnina. (SERUM IRON AND UNSATURATED IRON BINDING CAPACITY IN OCCUPATIONAL LEAD POISONING. THE BIOCHEMICAL PATTERN OF ANEMIA DUE TO LEAD POISONING.) *Medicina del Lavoro* 46:463-72 (Aug.-Sept.), 1955.

Twenty-five cases of occupational Pb poisoning (6 with Pb colic, 10 with recent chronic Pb poisoning and 9 with protracted chronic Pb poisoning) were studied as to the behavior of serum Fe and of the unsaturated Fe binding capacity (UFBC). Almost all the cases showed increase in serum Fe, decrease of the UFBC and slight decrease of the total Fe binding capacity (TFBC); values were normal only in 3 cases of chronic Pb poisoning. The increase of serum Fe was much more marked in the cases of Pb colic than in the cases of chronic Pb poisoning, both recent and protracted. The UFBC showed a decrease with an increase of the serum Fe. Free blood protoporphyrin was determined for the completion of the biochemical pattern of the anemia due to Pb poisoning and was always found to be greatly increased, the values in the cases of colic and in the cases of chronic Pb poisoning being very similar.

Therefore, no close relationship exists between the increase of serum Fe and the increase of the blood protoporphyrins. In cases of colic the increase of the serum Fe is not only due to the inhibition of the binding between the Fe and porphyrin, but also to hyperhemolysis, as shown by the increase in hemoglobin metabolism. It is useless to treat Pb anemia with Fe because its biochemical pattern never shows a state of hyposiderosis. (20 references)

- 1614 Saita, G., Moreo, L., and Sartorelli, E. (Univ. Milan, Italy): La vitamina B<sub>12</sub> nel saturnismo: azione sulla crisi ematica, sulla punteggiatura basofila e sul ricambio porfirinico. (VITAMIN B<sub>12</sub> IN LEAD POISONING: ITS ACTION ON THE BLOOD PICTURE, ON THE STIPPLED CELLS AND ON THE PORPHYRIN METABOLISM.) *Medicina del Lavoro* 46:404-10 (June-July), 1955.

The sequelae noted during treatment of 9 cases of anemia due to Pb poisoning with very high doses of vitamin B<sub>12</sub> (500 µg on alternate days for 24 days) were: (1) Average increase of erythrocytes of 12.5%; slight increase of the reticulocytes after 1-2 injections. (2) Rapid and considerable disappearance of stippled erythrocytes. (3) Rapid disappearance of blood coproporphyrin (CP), delayed disappearance was noted only in 1 case following a transitory high increase; progressive decrease of urine CP; in 3 cases after a temporary increase; considerable increase of blood protoporphyrin (PP) followed by a decrease down to levels below those prior to treatment.

This behavior is interpreted as an initial removal of the inhibitory action of the Pb on the maturation of CP to PP followed by the removal of inhibition to the binding of PP with Fe. However, the normalizing action of vitamin B<sub>12</sub> on porphyrin metabolism is not so efficient as that of other vitamins (vitamin PP and its amide), and the increase of blood cells is below that produced by highly active liver extracts. (From authors' summary) (21 references)

- 1615 Saita, G. (Univ. Messina, Italy): Ricerche sul comportamento del potere lisozimico e della colesterolemia nel saturnismo professionale. (LYSOZYME AND BLOOD CHOLESTEROL IN OCCUPATIONAL LEAD POISON-

ING.) *Folia Medica* (Naples) 38:718-26 (July), 1955.

Lysozyme activity was determined in the blood serum of 12 workers afflicted with chronic Pb poisoning by its lytic action at various dilutions on *Micrococcus lysodeikticus*. There was a marked decrease in lysozyme activity as compared with normal persons. The cholesterol in the serum increased in direct proportion with the time of exposure to Pb. A relation to the reticuloendothelial system was advanced.

- 1616 Salvini, M. (Univ. Padua, Italy): Il chelato calcico dell'etilendiaminotetraacetato disodico nel trattamento del saturnismo. (THE CALCIUM CHELATE OF DI-SODIUM ETHYLENEDIAMINE TETRAACETATE IN THE TREATMENT OF SATURNISM.) *Folia Medica* (Naples) 38, No. 2:111-26, 1955.

Six volunteers were treated iv with a daily dose of 1 g  $\text{CaNa}_2\text{EDTA}$  in 10% aqueous solution for 7 days; of the 9 workers exposed to Pb and hospitalized because of suspected poisoning, although they showed no clinical signs, 5 received the EDTA orally at 4g/day, and 4 received the same dose for 4 days and then were treated iv the same as the volunteers. No untoward manifestations other than diuresis were noted during the treatment and an observation period of 1 mo. In the subjects exposed to Pb, urinary Pb excretion increased while the excretion of coproporphyrins and the number of stippled erythrocytes decreased until normal values were reached when EDTA was administered iv, increased urinary Pb excretion became evident during the first 24 hr and reached a maximum on the 1st-2nd day. In oral treatment with EDTA the maximum Pb excretion was reached on the 3rd-5th day. The initiation of iv treatment after 4 days of oral administration showed that the 16 g of EDTA did not produce the displacement of chelatable Pb in the organism of such magnitude as would have diminished the effectiveness of 1 or 2 g EDTA iv. From this, the author concludes that present knowledge indicates that iv administration of the drug is preferable; also, that the slow and controlled infusion of isotonic dextrose solution is not compulsory, because the direct injection iv of hypertonic solutions was devoid of side effects.

- 1617 Salvini, M. (Univ. Padua, Italy): Piomburia, porfirinuria ed emazie granulobasofile nel trattamento con EDTA. Contributo alla diagnosi del saturnismo. (EXCRETION OF LEAD IN THE URINE: PORPHYRINURIA AND STIPPLED CELLS IN TREATMENT WITH EDTA. CONTRIBUTION TO THE DIAGNOSIS OF LEAD POISONING.) *Minerva Medica* 46, No. 31: 1119-22, 1955.

In a study of 16 cases treated with  $\text{CaNa}_2\text{EDTA}$  the author points out 3 different phases characterized by urinary Pb excretion, coproporphyrinuria (CPU) and number of stippled cells (SC) as follows: Immediate (increase in daily elimination of Pb in relation to chelatable Pb); delayed (decrease toward normal values of CPU and number of SC); post-treatment, (variable changes in CPU, urinary Pb and number of SC daily). Each stage can be interpreted diagnostically, particularly the post

treatment results. Treatment with EDTA also provides a practical means for the diagnosis of sub-clinical Pb poisoning. (16 references)

- 1618 Salvini, M., and Vidali, U. (Univ. Padua, Italy): La eliminazione urinaria del piombo nella fase successiva al trattamento con EDTA. (URINARY ELIMINATION OF LEAD FOLLOWING TREATMENT WITH EDTA.) *Folia Medica* (Naples) 38, No. 6:579-92, 1955.

A daily dose of 1 g  $\text{CaNa}_2\text{EDTA}$  was administered iv to 3 patients suffering from Pb poisoning, for 6 successive days, and to 2 patients for 12 and 3 days, respectively. The case histories are described for each of those patients. The urinary elimination of free and chelated Pb was determined spectrophotometrically. Free Pb appeared immediately after cessation of the treatment while the excretion of Pb chelate continued for some days. The authors conclude that the excretion of Pb chelate in man and experimental animals (rabbit) lasts longer than excretion of Ca chelate. (12 references)

- 1619 Shay, D.E., Haddox, J.H., and Richmond, J.L. (Baltimore Coll. Dent. Surg., Univ. Maryland, Baltimore): INORGANIC QUALITATIVE AND QUANTITATIVE ANALYSIS OF GREEN STAIN. *Journal of the American Dental Association* 50:156-60, 1955.

Green stain of teeth, dried at 100°, contained >10% Ca; 1-10% K, Na, Si, Mg, P; <1% Al, Fe, Pb, Mn, B, Cu, Ag, Ti, Ni, Ba, Sr, as determined by examination of the arc spectrograph in a projection comparator densitometer. Both green stain and brown stain contained Ca, Fe, Si, Mg, Pb, Mn, P, Ag, Na. The chemical elements found only in green stain were Al, Ba, Ni, B, Cu, Ti, Sr, K, and Sn and Cl only in brown stain.

- 1620 Shiels, D.O.: THE COMPARATIVE EFFECTS OF RADIATION AND OF LEAD ON CERTAIN ASPECTS OF THE STRUCTURE OF LYMPHOID CELLS. *Australasian Ann. of Med.* 4, No. 2:145-8, 1955.

The author has previously shown that, for a group of people exposed to stray X-radiation, the mean ratio of monocytes plus large lymphocytes to small lymphocytes was significantly greater than the value for persons not so exposed; further, that the mean percentage of lymphocytes which showed granules in the protoplasm (Leishman staining) was significantly less in the irradiated group (Shiels, 1954). The present paper deals with similar examinations of the systemic effects of Pb in the system and of Pb poisoning. Regarding the latter, it was found that the mean percentage of lymphocytes which show granules in the protoplasm is significantly greater than in a group of normal persons. The ratio mentioned in the text (above) for irradiated people was found to be higher than for a group of people with Pb poisoning. (From *Bulletin of Hygiene* 30:1087, 1955)

- 1621 Shiels, D.O. (Dept. Health, Melbourne, Victoria, Australia): INDUSTRIAL LEAD POISONING IN RELATION TO CLIMATE. *Australasian Annals of Medicine* 4:178-82 (Aug.),

1955.

Studies carried out in Melbourne revealed that there is a greater incidence of industrial Pb poisoning in the colder than in the hotter months. The author also studied the relationship between the climate, as measured by the maximum annual temperature, and the fraction of the total of those subjects with urinary Pb content  $\geq 0.3$  mg/l who had Pb poisoning. When the number of those who had Pb poisoning was expressed as a fraction of those with urinary Pb content of 0.3 mg/l or over, the fraction was 1.00 for those experiencing Pb exposure in the hot climate and 0.622 for those in the temperate climate. In earlier studies the author had shown the importance of sweat as a means for the elimination of Pb. One may assume that in a hot climate the daily excretion of fluid was of the order of 1 l. of urine and 2.5-3.0 l of sweat/day. With 0.3 mg/l of Pb in the urine and a like concentration in the sweat, the total daily excretion in fluids would be  $>1$  mg of Pb. In the temperate climate the daily excretion of fluid may be assumed to be of the order of 1.5 l of urine and 0.5 l of sweat. With a concentration of 0.3 mg/l of Pb in the urine and a like concentration in the sweat, the total daily excretion in body fluids would be 0.6 mg of Pb. In the former case the blood, organs and tissues of the body would be in contact with  $>1$  mg of Pb/day and, in the latter, with 0.6 mg of Pb. There would thus be a greater chance of finding cases of Pb poisoning among persons excreting 0.3 mg/l of urine in the hot climate than among those excreting 0.3 mg/l in the temperate climate. On the other hand, from a constant amount of Pb absorbed daily, more would be excreted in body fluids in the hotter months than in the colder, so that there would be less storage in the tissues. There would therefore be less chance of Pb poisoning developing in the summer than in the winter if the conditions of exposure were the same.

- 1622 Sidbury, J.B., Jr. (Emory Univ. School Med., Atlanta, Ga.): LEAD POISONING. TREATMENT WITH DISODIUM CALCIUM ETHYLENE-DIAMINETETRAACETATE. American Journal of Medicine 18:932-46 (June), 1955.

The mechanism of action of EDTA in Pb poisoning and its pharmacologic properties are described. The results of treatment of 9 patients with Pb poisoning (1 child, the others adult) indicated that  $\text{CaNa}_2\text{EDTA}$  is superior to previous modes of therapy. Pb poisoning was established by history, physical examination and laboratory findings, including determination of the Pb content of blood and urine. Dosage for adults by iv route was 1 g on 1st day, 2 g/day thereafter for a total of 5 days, in divided doses twice/day in 250 ml 5% glucose. For children, 30 mg/kg twice daily. Oral administration for both children and adults was 30 mg/kg body weight before breakfast and supper with liberal amounts of water. The 2nd plan called for 0.4 g EDTA diluted to 5 or 10 ml with saline iv once or twice daily, either as outpatients or in the hospital, depending on the severity of disease. Symptoms were relieved and a marked increase in the urinary excretion of Pb was effected. A suggested dosage regimen which is convenient for administration in the doctor's

office or in the plant dispensary is presented. The different routes of administration and their limitations are discussed. No toxic reactions have been encountered from the use of EDTA in  $>35$  patients. The role of internist and the general practitioner in the diagnosis and treatment of Pb poisoning is emphasized. The importance of early recognition is accentuated by the availability of an effective agent for treatment which, it is believed, will prevent the permanent sequelae of Pb poisoning if appropriate therapy is instituted early. (58 references)

- 1623 Skripnichenko, Z.M. (Ukrainian Res. Inst. Eye Dis., USSR): O rannei diagnostike khronicheskogo porazheniya svintsovym benzinom. (EARLY DIAGNOSIS OF CHRONIC INTOXICATION BY LEADED GASOLINE.) Oftalmologicheskii Zhurnal 4:231-2, 1955.

The author had followed 18-25-yr-old workers exposed to Pb-containing gasoline for 3 mo-6 yr; most of them, 32, had been so exposed for 3 yr. All of them exhibited deficit in vision, especially adaptation to light, before any other indicators, such as blood pressure, etc, showed any deviations from normal. The disturbances included also changes in color perception and those of "elastotonometric" tracings. It is recommended that eye examinations be performed every 3 mo in workers exposed to Pb-gasoline.

- 1624 Timofeev, N.N., Spivak, L.I., and Deiniichenko, I.M. (S.M. Kirov Inst. War Med., USSR): O narusheniyakh vysshei nervnoi deyatel'nosti pri otravlenii tetraetilsvintsom. (DISORDERS OF THE HIGHER NERVOUS FUNCTION IN TETRAETHYLLEAD POISONING.) Zhurnal Nevropatologii i Psikhiiatrii 55:781-9, 1955.

Neurological tests on male patients (23-43 yr old) with chronic TEL poisoning are described. The motor reflexes were studied on 24 patients to whom the association method was also applied; electroencephalograms were taken in 14 cases, knee reflexes were registered in 11, chronaxy in 7 cases and tactile observations were made on 30 patients. The diagrams and case histories are analyzed and used for classification of the individual patients into 2 groups: (1) those in an advanced stage and (2) those in a mild stage of poisoning. (15 references)

- 1625 Vidoni, G.: Su di un caso di avvelenamento mortale da piombo tetraetile. (A CASE OF FATAL TETRAETHYL LEAD INTOXICATION.) Medicina Legale e delle Assicurazioni 3, No. 1-2:1121-8, 1955.

A 23-yr-old man had been working in a TEL plant for 2 yr without showing any clinical signs at the regular physical tests by the plant physician when he collapsed at work. The diagnosis was "hematoma in the frontal parietal region and possible skull fracture," resulting from a contradictory report of a fall. He died 3 days later. Interrogation of attending physicians revealed that the patient was not lucid upon admission to the hospital. He complained of headache, had tremors and chills, then exhibited psychomotor excitation with delirium. He also told that for 2 nights before his



accident he had felt excited and had not slept. The night before his death the state of his psychomotor excitement became so intense that he had to be restrained by force. Shortly before death he became comatose. The gross and histologic necropsy findings are described. The changes in the brain are stated to duplicate those found earlier in TEL poisoning in man by Bini and Bollea (1947) and in animals by Lacroix (1942). Chemical tests revealed a significant amount of Pb in the brain. On the basis of these findings death was attributed to chronic TEL poisoning.

- 1626 Vouk, V.B., Voloder, K., Weber, O.A., and Purec, L. (Inst. Ind. Hyg., Yugoslav Acad. Sciences & Arts, Zagreb, Yugoslavia): NORMAL VALUES OF LEAD CONCENTRATION IN HUMAN BLOOD. *Arhiv za Higijenu Rada i Toksikologiju* 6:277-87, 1955.

An investigation is reported which was undertaken to establish the range of normal values of Pb concentration in the blood of the population living in Zagreb and environs. Two 5-ml samples of venous blood were taken from each of 100 men and 95 women chosen at random. Analyses for Pb were performed by a monocolor dithizone method. The results were statistically evaluated and shown in tables and graphs. The final conclusion was that for the population of Zagreb and its environs a value of Pb in blood exceeding 60 µg/100 ml would indicate an abnormal exposure to Pb, probably of occupational origin. A slight difference between urban and rural populations was considered of no practical significance, possibly being due to urban persons eating more canned food. (20 references)

- 1627 Wade, J.F., Jr., and Burnum, J.F. (Med. Coll. Alabama; Vet. Admin. Hosp., Birmingham): TREATMENT OF ACUTE AND CHRONIC LEAD POISONING WITH DISODIUM CALCIUM VERSENATE. *Annals of Internal Medicine* 42: 251-9, 1955.

Five patients with acute or chronic Pb intoxication successfully treated with  $\text{CaNa}_2\text{EDTA}$  are reported. EDTA produced a marked increase in urinary Pb excretion which was maximal during the first 12 hr of therapy. Loss of body Pb into the urine was accompanied by: (1) rapid and striking amelioration of all signs and symptoms, including an "acute abdomen"; (2) disappearance of gingival Pb line; (3) return to normal values of basophilic stippled red blood cells and serum indirect bilirubin; (4) no immediate reversal of decreased erythrocyte osmotic fragility. No toxic effects from  $\text{CaEDTA}$  were observed. EDTA affords a safe and effective means of therapy of acute and chronic Pb poisoning. (From authors' summary; 16 references)

- 1628 Wagner, K.H. (Acad. Justus Liebig High School, Giessen, Germany): LEAD CONTENT OF SULFITE YEAST. *Voeding* 16:753-7, 127-31, 1955.

When 30-100 g Brewers' or sulfite yeast were fed daily to men and animals for at least 30 days, no toxic symptoms developed following feeding of Brewers' yeast, but pathologic symptoms were noted soon after feeding 75-100 g sulfite yeast.

Sulfite yeast was found to contain 15-64 mg Pb/kg. The amount of Pb causing toxic symptoms in man varied from 1-2 mg/day. (From Chemical Abstracts 54:7884, 1960)

- 1629 Wilentz, W.C., and Meola, A. (Perth Amboy, N.J.): "PLUMBO-PHOBIA": RECENT TREND IN FREQUENCY OF INDUSTRIAL LEAD POISONING. *American Practitioner and Digest of Treatment* 6:355-7 (Mar.), 1955.

The survey of industrial Pb intoxication cases at the National Lead Co. covers the period from 1939-1953, during which period of the 450-650 men employed only 85 were treated for Pb poisoning. Of these 43 were hospitalized and the others treated as ambulant patients. The largest number treated during any 1 yr was 19, 9 of whom were hospitalized. Close cooperation of the executive, engineering and other departments resulted in the fact that over the last 3 yr (1952-1955) no cases of Pb poisoning have occurred. It has been estimated that in New Jersey of the 20,000 men occupied in the various Pb industries from 1941-1952, 689 cases of Pb were reported, the largest number reported during any 1 yr was 94 (1942), and the smallest group was 22 (1950). There has been a steadily decreasing trend in the statistics.

The authors include a table showing the number of Pb poisoning cases in 38 states from 1948-1952; the same downward trend is noted there for the whole country, with only 20 fatal cases among the total of 2337. There were 25 totally disabled, 209 with partial permanent disability, and 2083 with temporary disability. In 1936, 132 deaths occurred; in 1942, 71; in 1943, 47.

- 1630 Wyllie, J. (Queen's Univ., Kingston, Ontario, Canada): URINARY PORPHYRINS IN LEAD ABSORPTION. *A.M.A. Archives of Industrial Health* 12:396-405 (Oct.), 1955.

The author describes a method for the determination of porphyrins in urine, as well as an apparatus constructed at the University. The method was applied to the determination of urinary porphyrins in presumably normal subjects, in employees with mild exposure to Pb (repair of auto bodies and glazing wall tiles) and those liable to severe exposure in a storage-battery plant.

The results obtained showed that in porphyrin analysis of morning urine samples from normal persons, urines with a strongly positive qualitative test for urobilinogen generally had high uroporphyrin (UP) values. There was evidence that this feature occurs in persons on a high-vegetable diet as well as in certain liver diseases. In a correlation of stippled cell counts with quantitative coproporphyrin (CP) determinations in employees mildly exposed to Pb for the first time, it was found that as the stippled cell counts increased to 1000 and 1500/1,000,000 erythrocytes, the urinary CP values tended to increase. Employees with a mild exposure to Pb for several years had higher urinary CP and UP values than those found in normal persons. Employees liable to a severe exposure to Pb showed high values for urinary CP as the stippled cell counts exceeded 1000 or 1500/1,000,000 erythrocytes. The UP values were also increased. The author considered it interesting that in this type of exposure the CP/UP ratio increased from

the normal 1:1 or 2:1 to 3:1 and even reached 6:1.

- 1631 Yamamoto, T. (Osaka City Univ. Med. School, Japan): THE LEAD CONTENT IN DAILY FOOD IN JAPAN. Journal of the Osaka City Medical Center 4, No. 3:308-32; English Summary, 359, 1955.

Pb in food was analyzed from the public health viewpoint, to study the total amount of Pb ingested daily in a typical diet in Japan. The results were as follows: Fresh fruits contained a considerable amount of Pb. They may become contaminated with Pb from agricultural insecticides. Washing the fruit with running water was apparently effective in reducing the Pb content. Pb ranging from 30-180 µg/kg was found in fresh small fish. Canned foods contained rather large amounts of Pb, which in part is attributed to contamination by Pb in the solder used to cement the seams of a can. From the results of these chemical analyses, it was possible to calculate, approximately, a total amount of Pb ingested daily in a typical diet. It may be assumed that the amount of Pb ingested in food excluding water by a normal Japanese adult in ordinary circumstances is an average of ~190 µg daily. A total amount of Pb ingested in food and water daily by a normal individual in ordinary urban circumstances may be ~240-320 µg on the basis of analysis of several kinds of usual cooked meals. (23 references)

- 1632 Zambrano, A. (Inst. Ind. Med., Italy): L'azione del calcio etilendiamino tetraacetato sulla eliminazione urinaria del piombo e delle coproporfirine e sulla concentrazione ematica del piombo. (THE ACTION OF CALCIUM ETHYLENEDIAMINE TETRAACETATE ON THE URINARY ELIMINATION OF LEAD AND COPROPORPHYRINS AND ON THE CONCENTRATION OF LEAD IN BLOOD.) Abstracts of Meeting of the Campana Society of Legal and Industrial Medicine. Medicina del Lavoro 46:283 (Apr.), 1955.

EDTA was administered to 6 workers exposed to Pb risk who exhibited a clinical picture of mild intoxication, with distinct rise in urinary Pb, and urinary coproporphyrins, and lesser changes in blood Pb. Experiments with rabbits are also under way. In rabbits the changes in the electrolyte balance are being studied as well. No changes in the electrolyte balance were observed in the animals; however, there was progressive diminution of alkaline phosphatase values as a result of Pb intoxication and progressive increase in values as a result of EDTA administration.

- 1633 Zambrano, A., and Rossi, L: (EDATHAMIL CALCIUM-DISODIUM IN TREATMENT OF OCCUPATIONAL LEAD POISONING.) Riforma Med. 69:398-404, 1955.

Good results in treating Pb poisoning with  $\text{CaNa}_2\text{EDTA}$  were obtained in 6 Pb workers who were given the drug iv in a 20% hypertonic solution in daily doses of 2 g for 7 consecutive days. Some patients received a 2nd course of treatment after a 7-day treatment-free period. No side-effects were noted. The urinary excretion of Pb increased and that of coproporphyrin decreased progressively, while the Pb blood levels were changed only slightly.  $\text{CaNa}_2$

EDTA acts to make a Pb complex by exchanging the Ca contained in its molecule for Pb to form a chelate, which does not have the toxic action peculiar to the free metal. The effectiveness of  $\text{CaNa}_2\text{EDTA}$  in Pb poisoning is definitely greater than that of other agents that have been used for the purpose, but greater clinical experience with the drug is needed. (From Journal of the American Medical Association 159:229, (abstracts), 1955.)

- 1634 Zambrano, A., Rossi, L., and Mantovano, S. (Univ. Naples, Italy): Il calcio disodico versentao nella diagnosi di saturnismo professionale. (EDATHAMIL CALCIUM-DISODIUM IN DIAGNOSIS OF OCCUPATIONAL LEAD POISONING.) Folia Medica (Naples) 38: 1248-59 (Nov.), 1955.

The determination of Pb in the urine after administration of  $\text{CaNa}_2$  versenate gives more reliable results than in the blood. After daily injection of 2 g of the salt in hypertonic solution the determination is performed daily for 3 or 4 days. Normal persons never excrete >0.25 mg/day; persons exposed to Pb absorption or with Pb poisoning excrete always >0.5 mg/day. (13 references)

## 1956

- 1635 Aldanazarov, A.T., and Sabdenova, Sh.S.: (EXPERIMENTAL FOLIC ACID AND PENTOXYL THERAPY OF LEAD POISONED PATIENTS.) Trudy inst. Kraevoi Patol., Akad. Nauk. Kazakh. S.S.R. 4:120-7, 1956.

Sixty-six patients suffering from Pb poisoning were treated with folic acid in doses of 0.01 g 3 times daily and with pentoxyl in doses of 0.2 g also 3 times daily. Results indicated that either one of the 2 drugs and particularly the combination of the 2 rapidly obviated symptoms of anemia in Pb poisoning. (From Referat. Zhur. Khim., Biol. Khim. 1957, Abstr. No. 24079; Chemical Abstracts 52:6614, 1958)

- 1636 Aleksieva, Ts., and Kiryakov, K. (Sci. Res. Inst. Ind. Hyg. Occup. Dis., Bulgaria): Vurkhu olovnoto vuzdeistvie pri boyadzhiite, raboteshchi s minium. (EFFECTS OF LEAD ON PAINTERS USING MINIMUM.) Suvremenna Meditsina 7, No. 4:61-6, 1956.

The work processes and the occurrence of Pb poisoning among 164 painters of transport equipment (railroad cars, etc) were studied. The amount of minium handled daily was on the average of 1-1.5 kg/day and in some, up to 15-20 kg. The workers examined ranged from >20->60 yr with up to >20 yr service. The frequency of complaints, and the various findings are described and shown in tables. About 15% of the workers showed incipient poisoning, and fully developed chronic poisoning occurred in 1% (those who had worked for a long time). Nervous system disorders predominated in most and 1 showed hemiplegia. The authors conclude with recommendations for improvement of working conditions.

- 1637 Anonymous: LEAD POISONING. AN UNUSUAL CASE REPORT. A.M.A. Archives of Industrial Health 14:408-9 (Oct.), 1956.  
A man and his wife in an eastern city both com-

plained of generalized aching, nausea, some vomiting, and gastric pains. The wife was constipated, while the husband had some diarrhea. Blood and urine examination revealed that both were suffering from Pb poisoning which was traced to some recently purchased brightly colored highball glasses. The glasses had been used for highballs or similar drinks 3 or 4 times a week, and 2 or 3 drinks were consumed at each occasion over a period of about 1 hr. Three consecutive tests were tried on new glasses, using a solution of 20% alcohol and soft drink. The liquid was left in the glass for 15 min, then ashed with  $\text{HNO}_3$  and analyzed by the dithizone method. The 1st test showed 11.0, the 2nd 7.0 and the 3rd 3.0 mg Pb/sample. The manufacturer of the glasses submitted a list of consignees to whom the glasses had been shipped and health directors of the States concerned have been notified.

- 1638 Anonymous: URINARY PORPHYRINS AND LEAD TOXICITY. Nutrition Reviews 14:100-1, 1956.

Studies of the relationship of porphyrinuria to Pb poisoning are reviewed. It is concluded that these studies may provide a clue to the mechanisms of Pb toxicity which is at least as significant as the existence of a reliable sensitive test for detection of Pb toxicity.

- 1639 Asgar, K. (Univ. Michigan, Ann Arbor): CHEMICAL ANALYSIS OF HUMAN TEETH. Journal of Dental Research 35:742-8, 1956.

The dentin (D) and the enamel (E) of teeth from Americans (A) and Greeks (G) were analyzed separately; each sample was derived from 10 teeth. The percentages found were: Ca, DA 30.25, EA 36.16, DG 26.21, EG 32.83; Mg, DA 0.75, EA 0.96, DG 0.43, EG 0.54; P, DA 13.25, EA 16.37, DG 12.51, EG 14.58;  $\text{CO}_2$ , DA 3.54, EA 4.80, DG 3.51, EG 2.27. Spectroscopic examination revealed that both the enamel and the dentin of teeth of both nationalities contained Pb, Zn, Si, Ag, Cu, Fe, Al, Sn, Na, Cl, F, but in different concentrations. (24 references)

- 1640 Bekkering, J.H.Th. (Municipal General Hosp., Rotterdam, Netherlands): De Behandeling van Loodintoxicatie met calcium-versenaat (Dinatrium-calcium-ethyleen-diamino-tetra-acetaat): (LEAD POISONING TREATED WITH CALCIUM VERSENAATE (DISODIUM CALCIUM ETHYLENEDIAMINE TETRAACETATE.)) Nederlands Tijdschrift voor Geneeskunde 100:3078-82 (Oct. 27), 1956.

$\text{CaNa}_2\text{EDTA}$  as a new drug for the treatment of Pb poisoning is discussed after a survey of the conventional methods of treatment. The advantages of the EDTA are compared with drugs formerly used, eg, vitamin D, Ca, BAL. The author summarizes the practical value of EDTA and points to its property of forming complex compounds with many metals. The recommended dosage differs greatly. For children 1 g/15 kg body weight/day, for adults 1-4 g/day. He presents 2 cases of chronic Pb intoxication treated with EDTA and notes that the drug considerably increased the urinary elimination of Pb.

- 1641 Belknap, E.L. (Marquette Univ. School Med., Milwaukee, Wisc.): NEW METHODS OF DELEADING HEAVY LEAD ABSORPTION USING CALCIUM MONO SODIUM ETHYLENE DIAMINE TETRAACETATE (EDTA). Henry Ford Hospital Medical Bulletin 4:210-3 (Dec.), 1956.

$\text{CaEDTA}$  was used by the author in 7 cases of Pb poisoning under hospital control (5 ml iv diluted in 250 ml of 5% glucose in distilled water over a period of 20 min twice a day for 5 days, followed by rest period of 2 days, with resumption of 5-day course; then 2-day rest period and 4-day course as before), and in 13 outpatients with heavy Pb absorption but no evidence of disabling Pb intoxication. These men were treated in the doctor's office 1 hr each day: 5 ml  $\text{CaEDTA}$  iv for 20 min, rest for 30-45 min. No untoward symptoms were seen. Pb lines of gums disappeared, stippled cells dropped markedly.

Intravenous  $\text{CaEDTA}$  is believed to be effective and safe as a deleading agent, but is to be considered an emergency measure. Proper engineering protective devices to prevent Pb exposure and Pb absorption are still the best treatment.

- 1642 Bell, R.F., Gilliland, J.C., Boland, J.R., and Sullivan, B.R. (Univ. Colorado Med. Center, Denver): EFFECT OF ORAL EDATHAMIL CALCIUM-DISODIUM ON URINARY AND FECAL LEAD EXCRETION. COMPARATIVE EXCRETORY STUDIES WITH INTRAVENOUS THERAPY. A.M.A. Archives of Industrial Health 13:366-71 (Apr.), 1956.

It is concluded from this study of the fecal and urinary Pb excretions of 3 Pb-poisoning cases treated daily with 3 g of  $\text{CaNa}_2\text{EDTA}$  orally or iv, that: (1) Oral administration given while men are out of exposure causes a significant increase in both the fecal and the urinary Pb excretion. There is a 2-1/2-3-fold increase in the combined urinary and fecal Pb excretion with oral administration. (2) In these cases the combined fecal and urinary Pb-excretion response is approximately 2/3 as much on oral as on iv therapy. (3) There is a marked shift to urinary Pb excretion with both oral and in iv therapy. This shift is much greater with iv therapy. (4) Data on these cases suggest that fecal Pb excretion is diminished during iv therapy, but uncontrolled environmental factors may be the cause of this observation. (From authors' summary)

- 1643 Berdan, C., Preda, N., Pompilian, V., and Ionescu, C.: Cercetări asupra expunerii la plumb și asupra saturnis-mului într-o întreprindere poligrafică. (INVESTIGATIONS INTO EXPOSURE TO LEAD AND LEAD POISONING IN A PRINTING WORKS.) Igiena (Bucharest) 5, No. 3:56-64, 1956.

A study was made of the possibilities of Pb poisoning in a printing works. Emphasis is laid on the importance of intermittent diffusion of the toxic substance during the cleaning of machines, etc, when the Pb concentration in the air is higher. Of all cases, 27.5% were found in the stereotype department. The clinical picture is that of chronic progressive Pb poisoning. (From Excerpta Medica Section XVII, 4:2848, 1958)

- 1644 Beritić, T., and Fališevac, J. (Inst. Occup. Hyg. Acad., Zagreb, Yugoslavia): Bleiencephalopathie und schwere Bleivergiftungen durch den Genuss bleihaltigen Weines. (LEAD ENCEPHALOPATHY AND SEVERE LEAD POISONING BY INGESTION OF LEAD-CONTAINING WINE.) Archiv für Toxikologie Fühner-Wieland's Sammlung von Vergiftungsfällen 16:8-15, 1956.

Three cases of poisoning by wine containing large amounts of Pb, one of them with fatal outcome, are described. The wine had been stored or cooked in glazed earthenware. In 1 case acute encephalopathy developed, in the 2nd gastroenteric symptoms, in the 3rd paralysis. For verification, wine was placed and heated in the jugs used in the households of the victims. Pb concentrations found were 1.94, 4.95, and 14.1 mg/100 ml. The authors point out that in contrast to occupational poisoning, the alimentary intoxication most often does not come to light until the classical symptoms become evident.

- 1645 Beritić, T., and Vandekar, M. (Yugoslav Acad. Sci., Zagreb): SOME OBSERVATIONS ON THE MORPHOLOGY OF ERYTHROPOIETIC CELLS IN HUMAN LEAD POISONING. Blood 11:114-22, 1956.

Morphologic changes of erythropoietic cells in the bone marrow of 19 Pb intoxicated patients are reported. Of these, 17 were male, 2 female; all but 2 were occupational in origin and the others were due to food contamination from Pb-glazed earthenware. All were admitted to the hospital with colic; 3 also had Pb palsy. In addition to clinical manifestations the toxic action of Pb was verified by the laboratory findings: high Pb blood values (59-195 µg/100 ml) increased coproporphyrinuria, and characteristic findings in peripheral blood. Qualitative changes of erythroblasts were constantly present in all smears examined. Abnormalities most frequently observed were: (a) basophilic stippling, (b) polyploidy, (c) nuclear alterations ("karyorrhexis"), and (d) aberrant chromosomes. The mechanism by which these changes might be brought about is discussed; the role of interruption of cytokinesis and karyokinesis is emphasized. (33 references)

- 1646 Blanke, R.V. (Chicago, Ill.): CORRELATION OF URINARY COPROPORPHYRIN III WITH LEAD INTOXICATION. Journal of Forensic Sciences 1:79-87 (July), 1956.

Coproporphyrin (CP) was determined quantitatively by the method of Schwartz et al (1951) and qualitatively by a modified McCord method (1951). Pb was determined in urine by polarography. Details of the methods were given. Comparison of the qualitative CP test with the quantitative CP test (22 cases; normal <180 µg/day) and the urinary Pb test (140 cases; normal <80 µg/l) showed that the qualitative CP test could differentiate sufficiently between normal and abnormal excretion of CP, so that it should be of value as an aid in the diagnosis of Pb poisoning.

- 1647 Brown, W.J.: LABORATORY DIAGNOSIS IN LEAD ABSORPTION AND INTOXICATION. Australasian J. Med. Technol. 2, No. 1:21-3, 1956.

Discussion. (From Chemical Abstracts 50:11415, 1956)

- 1648 Brudevold, F., and Steadman, L.T. (Univ. Rochester, N.Y.): THE DISTRIBUTION OF LEAD IN HUMAN ENAMEL. Journal of Dental Research 35:430-7 (June), 1956.

The distribution of Pb was determined in pooled ground samples of successive layers of enamel from unerupted and erupted teeth and in some mottled teeth of people of different ages. Pb was present in the enamel of both unerupted and erupted teeth. The Pb concentration was higher in the surface enamel of fully formed unerupted teeth than in that of incompletely formed ones and in the outer enamel of erupted teeth compared with that of unerupted ones. Pb increased with age in the outer enamel, and in the over 50-yr-group reached a maximum of 550 ppm. In all groups of teeth the highest Pb content was found in the outermost enamel layer; decreasing Pb amounts were found in the subsurface layers until a constant level was reached which represented the concentration in the bulk of the enamel. This level was ~ 30 ppm in teeth of young persons and ~ 90 ppm in those of persons >50 yr of age. The enamel of mottled teeth contained less Pb than that of normal erupted teeth. The significance of these relatively high concentrations of Pb in the outer enamel has not yet been established. (From authors' summary; 31 references)

- 1649 Buckup, H. (Bochum, Germany): Die heutige Form der Bleierkrankung und ihre Verhütung. (THE PRESENT FORM OF LEAD POISONING AND ITS PREVENTION.) Taschenbuch der Prophylaktischen Medizin, 10 pp.

In his discussion of Pb poisoning, the author points out that while it still constitutes a large percentage of occupational diseases, the cases observed today are generally mild and frequently are caused by other disease states, principally inflammatory rheumatism; accordingly, they may be superimposed and could lead to severe liver damage. In the prevention of poisoning, emphasis is now laid on technical and organizational measures. However, methodical and critically evaluated medical examinations represent part of the program. Nutritional factors also can have a decisive influence on susceptibility to Pb.

- 1650 Butt, E.M., Nussbaum, R.E., Gilmour, T.C., and Di Dio, S.L. (Los Angeles Co. Hosp.; Univ. S. California School Med.; Univ. California, Los Angeles): TRACE METAL PATTERNS IN DISEASE STATES. I. HEMOCHROMATOSIS AND REFRACTORY ANEMIA. American Journal of Clinical Pathology 26:225-42, 1956.

Spectrographic analyses of liver tissue reveal increased amounts of Pb, Mo, Cu, and Ca associated with Fe storage of hemochromatosis and refractory anemia. Zn and Mn levels are unaffected while Al values are decreased. This pattern is also found in other Fe-storage diseases, and can be reproduced in rats and rabbits by the administration of Fe.

- 1651 Carlin, C.E., and Ferrándiz, J.J. (Dept.

Hyg. Ind. SCISP-MSPAS, Lima, Peru): Algunas consideraciones sobre saturnismo entre los trabajadores de una fundición. (SOME CONSIDERATIONS ON LEAD POISONING AMONG WORKERS IN A FOUNDRY.) Revista de Medicina Experimental 10:43-52, 1956.

Complete medical examinations, including X-rays and laboratory tests, were performed on 1,468 persons employed in all departments of a foundry where metal containing Pb was smelted. There was definite evidence of Pb poisoning in 138 employees. In 247 others there was evidence of Pb absorption but no symptoms of poisoning. In each of these groups there were 3 who had worked in the foundry for only 1 mo. The commonest symptoms in the 138 poisoning cases, most of whom were 25-29 yr old, were: abdominal pain 85; headache 58; general weakness 46; vomiting 26; metallic taste 24; anorexia 21; constipation 15. Two were seen during a severe attack of Pb colic. The signs observed, as tabulated, were: In 78, gingival Pb line; in 58, jaundice; in 57, pallor; in 29, exaggerated reflexes; in 22, diminished muscular strength <32 kg on Oschner's dynamometer; in 12, increased systolic blood pressure (140+mm). The authors point out that all were at work at the time of the examinations. Laboratory findings in the poisoning cases compared with those in a group of 100 whose work did not expose them to Pb fumes and who in clinical examination appeared to be normal, showed the arithmetic mean in the amount of hemoglobin (Hb), hematocrit test and red cell count to be significantly lower in the poisoning group than in the normal. But in both groups the range was considerable for all 3 tests. The maxima in the poisoning group overlapped the maxima in the normals. The arithmetic mean of Pb in blood of the poisoning cases was 0.162 mg/100 g of whole blood; in the urine it was 0.507 mg/l (taken in 100 ml samples). Porphyrinuria was regarded as an early diagnostic sign of Pb poisoning. It preceded the appearance of basophilic stippling (BS) of the red cells. The diagnosis in the 247 who were exposed to Pb but were not suffering from poisoning was based on exposure to Pb, the absence of signs and generally of symptoms, the presence of slight changes in the blood picture such as some erythrocytopenia, some reduction in Hb, the presence of BS grade I, and of Pb in the blood and urine just above the normal limit. They were subclinical cases. In the 138 definite cases there were signs and symptoms of poisoning, BC grade III, anisocytosis, poikilocytosis and Pb in the blood and urine above the normal maxima.

The authors conclude that Pb in the blood is a better guide to plumbism than Pb in the urine. But for accurate diagnosis laboratory findings are not enough. The history and clinical examination are equally important. The main point is that among the 1,468 at work in this foundry 138 cases of Pb poisoning were discovered. (12 references)

1652 De Caturla Jiménez, M. (Ins. Bd., Min. Labor, Havana, Cuba): Diagnostico y pronostico de la intoxicación por el plomo industrial (saturnismo). (THE DIAGNOSIS AND PROGNOSIS OF OCCUPATIONAL LEAD POISONING.) Med. latina 15:3, 1956.

Pb poisoning is one of the most frequent occupa-

tional diseases in Cuba. Based on his experience the author considers 700-800 stippled cells/1,000,000 and a Pb concentration of 60 µg in the blood and 150 µg in the urine as threshold values. He does not recognize hypertonia, kidney damage and gastrointestinal ulcers as consequences of Pb poisoning, nor liver cirrhosis and multiple sclerosis as sequelae of Pb poisoning. The possibility of an appendicitis or an acute inflammatory process in the abdominal cavity in Pb workers should not be overlooked; diagnosis of Pb colic in such cases may lead to fatal outcome. (From Zentralblatt für Arbeitsmedizin und Arbeitsschutz 7:258 (Abstracts), 1957)

1653 Chaidron, E. (Military Hosp., Brussels, Belgium): A propos d'une maladie professionnelle méconnue parmi le personnel travaillant dans les services de radio-diagnostic. (A MISUNDERSTOOD OCCUPATIONAL DISEASE AMONG PERSONNEL IN THE RADIODIAGNOSTIC SERVICE.) Journal Belge de Radiologie 39, No. 6:932-41, 1956.

Attention was drawn to the possibility of Pb poisoning in personnel of a diagnostic X-ray department by direct contact of hands or skin with Pb cassettes and plates. In the author's department, 11 out of 20 people showed basophilic stippling (BS) of 10-240/10,000 red cells. No Burton lines were found, but some patients complained of abdominal pains, diarrhea or constipation. The people were instructed to wash their hands before eating and the Pb materials were covered or coated. A distinct improvement in the blood picture was observed after 2 mo. Another case of increased BS (50-100/10,000 red cells) was found in another radiologic unit, causing the author to recommend that BS determinations be included in the normal hematologic examination. The author pointed out that abnormal blood pictures in radiology workers have been attributed to X-rays, but the possibility of Pb poisoning could be checked if the following tests were run: blood and urine Pb content, coproporphyrin, determination of modifications in the chronaxy of extensors, BS counts by means of a dark-ground condenser. There were as many intoxications in smokers as in non-smokers. The main cause was thought to be ingestion of Pb through the mouth, but the possibility of absorption through the skin was mentioned, as well as the possibility of sensitization of the skin by developing and fixing baths.

The author recommends a periodic check of the quality of protective gloves, better ventilation of the examination and development rooms, and treatment of Pb poisoning with vitamin C, nicotinamide, K iodide and Na bicarbonate. He concluded that milk did not prevent Pb poisoning.

1654 Clarkson, T.W., and Kench, J.E. (Univ. Manchester, England): URINARY EXCRETION OF AMINO ACIDS BY MEN ABSORBING HEAVY METALS. Biochemical Journal 62:361-72, 1956.

Single urinary specimens were collected from each of 50 men in a light-engineering plant (used as controls) from heavy-metal workers variously exposed to Pb, Hg, U and Cd. The Pb workers were drawn from a Pb accumulator factory (exposed main-

ly to Pb oxide dust), a smelting works (Pb fume), and a Pb chromate factory (mainly acidic and basic Pb chromates, Pb oxide, nitrate and sulfate). Hg workers were engaged in the repair of dc meters or in the manufacture of inhaling organic Hg insecticides. The U workers were exposed to a gaseous U, the Cd group was exposed to Cd oxide in the alkaline accumulator industry.

The subjects of this study showed no clinical evidence of renal disease. There were large increases of urinary amino-N in Cd workers with lesser changes in the other groups. The mean total amino-N/g of creatinine of the controls was 52 mg. The amino acid pattern observed in the controls was in many respects similar to previous descriptions by other authors. Virtually absent were methionine, aspartic acid, hydroxylysine, ornithine, citrulline, arginine, proline and hydroxyproline.

Three of the 8 workers (Pb smelters) excreted increased amounts of amino-N. Alanine, threonine, methylhistidine and tyrosine were present in abnormal quantities. Of 16 Pb accumulator workers, 3 contained elevated total amino-N and individual amino acids; alanine and serine seemed to be most frequently affected. Workers exposed to Pb chromates were normal. Only 1 of the 6 specimens from the Hg-exposed workers had a raised amino-N and all exposed to organic Hg were normal. Total amino-N values of U workers currently exposed were significantly higher than of those previously but not currently exposed. In the currently exposed workers, 5 out of 10 specimens contained abnormal amounts of total amino-N. The greatest divergence from normal was observed in the samples from Cd-exposed workers, both in total amino-N and in individual amino acids. The urinary concentration of threonine and serine reached peak values 33 and 9-5 times the corresponding mean values of the controls.

The authors conclude that U and Cd are far more potent in the production of aminoaciduria than Hg and Pb. Raised urinary amino-N occurred with only 20 µg of U and Cd/l of urine, whereas Pb and Hg excreted in quantities up to 500 µg/l may not alter the amino acid pattern. Although these figures are not a measure of the quantity of heavy metal remaining and producing effects in the tissues, and, with Pb at least, most of the absorbed metal is permanently retained, it is nevertheless evident that the reabsorptive pathways for amino acids in the renal tubules are not markedly sensitive to Pb or Hg. Many workers in this series, in whom no aminoaciduria was present, showed characteristic effects of Pb absorption (colic, basophilic stippled cells) but the changes noted were confined mainly to increases in alanine by Pb and glycine by Hg. (54 references.)

- 1655 Crepet, M., Gobbato, F., Martino, P., and Siracusa, F. (Univ. Turin, Italy): La nefropatia saturnina. (SATURNINE KIDNEY DISEASE.) *Minerva Nefrologica* 3, No. 3: 69-79, 1956.

In this report, using the same case material as in the 1953 publication, the hemodynamics and renal function were studied. The patients were divided into 2 groups: (1) cases observed during an acute attack (colic) and (2) patients observed during

the chronic phase of the disease. In the 1st group, a reduction of the renal flow was found due to the increased resistance of the glomerular afferent arterioles. This ischemia was in most cases readily reversible after the colic. In the 2nd group, a reduction of the renal flow was frequently demonstrated (50%) both in hyper- and normotensives. The interrelations between acute, functional renal disease, due to acute poisoning and chronic arteriosclerotic renal disease are discussed. The hypothesis is advanced that the hypertension frequently observed in patients with chronic Pb poisoning may be of renal origin. (From authors' summary; 34 references)

- 1656 Crepet, M., Gobbato, F., and Scansetti, G. (Univ. Turin, Italy): Le alterazioni cardiovascolari nei lavoratori del piombo. (CARDIOVASCULAR CHANGES IN LEAD WORKERS.) *Minerva Medica* 47:1910-8 (Dec. 8), 1956.

Seventy-three workers exposed to Pb for 4 mo-54 yr were examined, some during periodic visits to the plants, but most of them were seen while hospitalized for Pb poisoning or after discharge from the hospital. Complete hematology was performed and porphyrins in blood and urine were determined in all, and in some, Pb in blood and urine. Cardiac function was studied by routine clinical tests and correlated in all cases with EKG's. Circulation and peripheral resistance were examined by sphygmograph, renal vascular resistance and renal function were also followed in those found to have nephrosclerosis. The results of the investigation led the authors to the following conclusions: Cardiovascular changes occur with considerable frequency in persons with acute or chronic Pb poisoning. In the initial stages of the disease, the circulatory disorders are of a functional nature (arteriolar spasm), and, as such, are reversible. Clinically they appear in the form of transient arterial hypertension and by certain changes of the renal, cerebral, coronary, etc, changes which are observed with greater or lesser frequency during colic. Cardiac changes are particularly Pb-induced angina pectoris, encountered not infrequently in young workers and are most probably due to a spasm of the coronary vessels. In advanced stages of the disease, the vascular changes are of organic nature and are irreversible. Benign hypertension was found in 38.5% of the cases; in 21.2% cardiac complications with disorders of coronary circulation were found. Among the rarer forms were obliterant endarteritis of B rger's disease type. This was found in 1 of the 53 cases with poisoning. (40 references)

- 1657 Danaraj, W.: LEAD ENCEPHALOPATHY. *Proc. Alumni Assoc., Malaya*. 9:107-20 (June), 1956.

Four cases of Pb encephalopathy are reported with clinical particulars, the results of blood, urine and X-ray examinations and the investigations which were carried out to discover the source of the Pb poisoning. In 2 cases the investigations were unsuccessful, but in the other 2 Pb storage batteries were discovered to be the cause of the poisoning. One of the patients had supplemented his earnings as a farmer by taking part in the recovery of Pb from accumulator plates which were

broken up and melted down in a "kuali" over an open wood fire. Evidence of Pb intoxication was found in 3 other individuals who had worked in the same place. The other patient, an 11-yr-old Chinese boy, lived with his parents, a brother and a baby sister in the ground floor of a shop-house where his father had been engaged for years in storage battery repair, which consisted in scraping, repasting and soldering the Pb plates carried out under very unsanitary conditions in the room that was used for eating, sleeping and living. X-ray photographs of the brother and baby sister are reproduced to show the Pb lines in the bones. Of interest is the mention of sources of Pb, other than occupational, which have caused plumbism in reported cases in Malaya, ie, (1) Chinese face powders which were found to contain up to 50% Pb carbonate (see Bulletin of Hygiene 5:891, 1930) and in 1 instance 70% red Pb oxide, and (2) a sample of "chu sha," a Chinese medicine powder adulterated with up to 34% Pb. Reference is made to the possibility that black market "chandu" (opium prepared for smoking) and "chandu" dross may cause Pb poisoning through adulteration with Pb to increase the weight. (From Bulletin of Hygiene 32: 52-3, 1957)

- 1658** Dinevich, L.S.: TRACE-ELEMENT CONTENT OF MOTHER'S MILK. Sbornik Trudov Moldavsk. Nauch.-Issledovatel. Inst. Epidemiol., Mikrobiol. i Gigieny 1956, No. 2:187-96.

The method of emission spectral analysis was used. Results are expressed in % in ash: Mn  $10^{-5}$ - $10^{-4}$ ; Cu  $10^{-3}$ - $10^{-2}$ ; Ti  $10^{-3}$ - $10^{-2}$ ; Pb  $10^{-3}$ - $10^{-2}$ ; Cr  $10^{-3}$ - $10^{-2}$ ; Si  $10^{-2}$ - $10^{-1}$ ; Al  $10^{-2}$ - $10^{-2}$ ; Ag  $10^{-5}$ - $10^{-4}$ ; in cases with hypogalactia Mn, Cu, Ti, Pb, and Ag were lowered. (From Referat. Zhur. Khim., 1958, Abstract No. 9132; Chemical Abstracts 52:16539, 1958)

- 1659** Dror, K.: (LEAD POISONING.) Harefuah 51, No. 7:161-4, 1956.

The clinical aspects, diagnosis, treatment, prevention and medico-legal aspects of Pb poisoning are discussed. (English Summary)

- 1660** Feil, A. (Inst. Hygiene, Paris, France): Un signe important pour le diagnostic du saturnisme; les hématies à granulations basophiles. I. and II. (IMPORTANT SIGN IN THE DIAGNOSIS OF LEAD POISONING; ERYTHROCYTES WITH BASOPHIL GRANULATIONS. I. AND II.). Médecin d'Usine 18, No. 5:215-6, 219-20, 223-4, 226, 1956. Ibid. 19, No. 4/6:379, 381-2, 385-6, 389-92, 1957.

The author introduces the reprinting of an earlier paper as follows: "Judging by the numerous articles published on the subject, erythrocytes with basophil granulations or stippled erythrocytes as they are observed in Pb poisoning, have aroused great interest. However, the opinions of the authors differ widely as to the techniques of detecting them, the method of counting, and their importance for diagnosis and prognosis. We think that it might be of interest to reprint the article which we published in La Semaine des Hôpitaux de Paris, March 26, 1926, almost 30 yr ago now. We reproduce it as it was published, because in general it still expresses our present thoughts on

the value of a sign to which we have devoted numerous investigations, many of which have not yet been published. This is a study of the Institute of Industrial Hygiene (Medical College of Paris) directed by Heim de Balsac."

- 1661** Garretón, U.I., Godoy, B.L., Valenzuela, R.A., Pinto, A.A., Geraldino, S.M., and González, R.: Bronquitis crónica en 8 casos de intoxicación plúmbica. (CHRONIC BRONCHITIS IN 8 CASES OF LEAD POISONING.) An. Méd. Concepción 13, Nos. 3/4:143-50, 1956.

The authors give details of respiratory complications in 8 patients with Pb poisoning. The poisoning was the result of working in an enclosed space on the cutting up of steel sheets, coated with Pb paint, by means of an oxy-acetylene blowpipe. Clouds of Pb-containing vapor were inhaled. The working day was 12 hr. The authors are surprised that they can find no reference in the literature of Pb poisoning to the effect of the inhalation of Pb fumes on the lungs. The 8 charts are reproductions of the summaries of the case papers of each of the patients and show graphically the symptoms, physical signs, amount of sputum, bacteriological and radioscopic findings and the results of bronchoscopy. The age range was 19-39 yr. The length of exposure to the Pb fumes had been between 30-167 days. The investigations were made 3-6 mo after the exposure had ended. In 7 men the symptoms of lung involvement appeared between 2-12 wk from the date the work was started and while still working there, but in the 8th man not until 6 wk after the work had been abandoned. The first symptom was a dry cough followed within a few days by expectoration. The sputum varied in quantity and was the color of Pb or black, turning to yellow in 2. In 4 there were no physical signs or radiological abnormalities in the lungs. The laboratory reports showed, in most, hemolytic streptococci or Staphylococcus albus; in 6 Pb, either metallic, Pb oxide or Pb sulfide, was found in the sputum; in amount it varied from 37.7 to 85.5  $\mu$ g/100 ml of the sample. Particles of Pb were seen microscopically in the sputum. Progress was observed by bronchoscopy. At the first examination there was generally diffuse congestion in the lower third of the trachea and in the main bronchi, together with patches of diffuse edematous inflammation several centimeters in size in the lung tissue. In 5 of the patients these cleared up. The treatment given was antibiotics for 7-10 days, followed by Meticorten (prednisone) for 30 and then "balsams" for 10 days. But the cessation of exposure to Pb fumes was no doubt an important contributory factor in the improvement. It is suggested that fumes, possibly nitrous, from the blowpipe accentuated the harmful effect of the Pb and made the bronchitic inflammation irreversible in some cases, especially where there was a preceding bacteriological infection of the lungs. The medico-legal importance of discovering and treating such cases early is emphasized. (From Bulletin of Hygiene 33:52, 1958)

- 1662** Gherardi, M. (Univ. Parma, Italy): Impiego del versenato disodico calcico

nel trattamento del personale esposto all'azione del piombo tetraetile. (DISODIUM CALCIUM VERSENATE IN THE TREATMENT OF PERSONS EXPOSED TO TETRAETHYLLEAD.) Folia Medica (Naples) 39, No. 4:349-64, 1956.

Persons exposed occupationally to TEL but showing no signs of poisoning were treated daily with 0.5-1 g  $\text{Na}_2\text{Ca}$  versenate given iv for 5-7 days in 10% solution. There was no undesirable effect of the treatment and increased excretion of Pb in the urine was observed. The amount of Pb stored in the organisms of such workers was small. It is mentioned that in the early phase of poisoning with TEL  $\beta$ -mercaptoethylamine is useful as it neutralizes the compound directly, whereas the versenate does not have a direct action on the organic compound. (18 references)

- 1663** Giammarco, R. (Bussi Div. Montecatini Soc., Pescara, Italy): Importanza dell'avvicendamento mensile nei reparti di produzione del piombotetraetile attraverso l'esperienza di cinque anni di osservazione clinica. (IMPORTANCE OF MONTHLY SHIFTS IN LEAD TETRAETHYL PRODUCTION DEPARTMENTS, AS SEEN AFTER FIVE YEARS OF CLINICAL EXAMINATION.) Medicina del Lavoro 47:539-47 (Oct.), 1956.

This is a report of the medical surveillance of ~200 workers, some of whom were veterans in TEL production work going back to prewar days, over a 56-mo period. The frequency of subjective symptoms and objective signs, laboratory examination results, and measures of prevention and treatment are discussed at length. Among the most frequent complaints were insomnia, asthenia, neuromuscular pain, nausea with attempts at vomiting, tremors, low blood pressure, and loss of weight. Urobilinuria was an early sign. The excretion of Pb with the urine was never  $>300 \mu\text{g}/\text{l}$ . Technical prevention lowered the concentration in the air to  $<150 \mu\text{g}/\text{m}^3$ . However, as far as reducing clinical symptoms were concerned, the best results were obtained by alternating the working groups for 1 mo at TEL production and for 1 mo at work in the open air. Tabulation of the frequency of complaints before this rotation went into effect (1949-51), when it was partially practiced (1952), and when fully practiced (1953) showed clearly the effectiveness of the measure. (20 references)

- 1664** Giannattasio, R.C. (Kings County Hosp., Brooklyn, N.Y.): BAL THERAPY IN LEAD POISONING. New York State Journal of Medicine 56, No. 22:3510-1, 1956.

The literature concerning treatment of plumbism with BAL and  $\text{CaNa}_2\text{EDTA}$  is reviewed. BAL is considered by the author as the preferable therapeutic agent in acute Pb encephalopathy. It should be administered im in a dose of 4 mg/kg body weight as a 10% solution in benzyl benzoate and oil every 4 hr around the clock for 10-20 days. Treatment should not end after control of the acute phase but ought to be continued with either BAL (in courses of 10-20 days) or with  $\text{CaNa}_2\text{EDTA}$  (in oral doses of 50-75 mg/kg/day for 5-9 days, followed by a repeat course after 2 days' rest). A continuous program of deleading

with BAL or  $\text{CaNa}_2\text{EDTA}$  should be instituted for chronic plumbism.

- 1665** Giel, C.P., Kleinfeld, M., and Messite, J. (Div. Ind. Hyg., New York State Dept. Labor, New York): LEAD TOXICITY IN A STORAGE-BATTERY PLANT. A.M.A. Archives of Industrial Health 13:321-5 (Apr.), 1956.

A medical and environmental study of a storage-battery plant known to have areas of hazardous exposure to Pb is described. Air analyses since 1951 had shown concentrations exceeding permissible limits (up to  $0.65 \text{ mg Pb}/\text{m}^3$ ). In spite of this, from 1949-1953 cases of Pb intoxication were infrequently identified; 3 were diagnosed, with 1 needing hospitalization. There were some transfers from exposed areas because of high stippled cell counts and mild illness. In 1955, the time of this study, medical evaluation, including laboratory findings of 29 workers, disclosed the presence of Pb toxicity of a mild form in 12. The sudden rise in the incidence of Pb intoxication during the period from Nov. 1954-Mar. 1955 is attributed to the increased quantity and rate of production per worker as a result of extensive layoffs and to the transfer to hazardous areas of persons not previously exposed to Pb.

The authors conclude that this study emphasizes the need for the industrial physician to be alert to such socioeconomic changes and to intensify his control program at such times. The mild, insidious nature of Pb intoxication to low-grade cumulative exposure seen today is emphasized. Recommendations for the control of the Pb hazard in this plant, incorporating medical and engineering phases, were outlined.

- 1666** Giel, C.P., Kleinfeld, M., and Messite, J. (New York State Dept. Labor, New York): LEAD TOXICITY IN A STORAGE-BATTERY PLANT. New York State Department of Labor Monthly Review Division of Industrial Hygiene and Safety Standards 35:21-4, 1956.

See preceding abstract.

- 1667** Glömme, J., and Swensson, Å. (Karolinska Inst., Stockholm, Sweden): Behandling av akut och kronisk blyförgiftning med EDTA. (TREATMENT OF ACUTE AND CHRONIC LEAD POISONING WITH EDTA.) Svenska Lakartidningen (Stockholm) 53:753-60 (Mar. 23), 1956.

The treatment of Pb poisoning including use of BAL before discovery of the effectiveness of EDTA in 1948 is discussed. Two cases, one of acute and one of chronic, poisoning, treated with  $\text{CaEDTA}$  (Mosatil) are described. The author concludes that this drug is effective in both types of poisoning, and considers that it could be used also as a preventive of Pb poisoning.

- 1668** Gonsette, R., and Montanini, R. (Army Gen. Neuropsychiatry, Charleroi, Belgium): À propos d'une intoxication au plomb d'allure familiale; aspects cliniques et électroencéphalographiques. (A CASE OF LEAD POISONING IN A FAMILY; CLINICAL AND ELECTROENCEPHALOGRAPHIC ASPECTS.) Acta Neurologica et Psychiatrica Belgica 56:



813-26, 1956.

Pb intoxication in a family, due to Pb-contaminated drinking water, was reported. Although the exposure was the same, the individual members reacted differently. The 54-yr-old father developed Pb encephalopathy without peripheral manifestations. The 52-yr-old mother showed the typical intestinal syndrome and a severe polyneuritis, but the deep osteotendinous reflexes were unchanged. The 4 children had no subjective complaints but a clinical test revealed the presence of stippled cells in the blood and irregularities in the EEG. The authors conclude that some individual or external factors may induce different clinical reactions under identical circumstances of poisoning. The persistence of bone-sinew-reflexes despite severe polyneuritis suggests, in addition to the nervous and muscular lesions, a medullar lesion. Based on the fact that various EEG's were taken during the intoxication process (the first mentioned in the literature) and compared with others taken in intoxication cases by various agents affecting the central nervous system, the authors insist on the usefulness of EEG's, as they reveal slight changes even when no clinical symptoms are found. (38 references.)

- 1669 Granati, A., Scavo, D., and Peruzzi, A.D. (Univ. Rome, Italy): Il ricambio protidico nel saturnismo professionale cronico. Nota I. Le alterazioni della protidemia serica. (PROTEIN REPLACEMENT IN CHRONIC OCCUPATIONAL LEAD POISONING. I. BLOOD PROTEIN CHANGES.) *Folia Medica (Naples)* 39:853-63, 1956.

Electrophoretic determinations in 14 persons with occupational Pb poisoning showed a general reduction in total protein and in serum albumin and a relative increase in globulin. The  $\alpha_2$ - and  $\beta$ -globulins,  $\beta$ -lipoproteins, and  $\alpha$ - and  $\beta$ -glycoproteins were particularly increased.

- 1670 Graziani, G., Pecora, L., and Rossi, L. (Univ. Naples, Italy): Ferro serico e saturnismo. Nota V. - Il comportamento della transferrina e della protoporfirina libera eritrocitaria nel saturnismo professionale. (SERUM IRON AND LEAD POISONING. V. BEHAVIOR OF TRANSFERRIN AND FREE PROTOPORPHYRIN IN THE ERYTHROCYTES IN OCCUPATIONAL LEAD POISONING.) *Folia Medica (Naples)* 39:217-31 (Mar.), 1956.

Oral administration of Fe to 16 normal persons produced a progressive increase in serum Fe with a maximum after 4-6 hr. The transferrin decreased proportionally, the total Fe-binding capacity remaining almost constant. The percentage saturation of transferrin with Fe increased from an av of 28% to a maximum of 74%. The percentage saturation of transferrin in persons with Pb poisoning was higher (av 44.5%) from the beginning, in accord with a higher Fe content of the serum. The maximum obtained after 4 and 6 hr was 78 and 77%, respectively. After iv administration of Fe the percentage saturation in normal persons increased from 34 to 100% within 3 min, dropped to 86% at 30 min, to 66% at 3 hr, and to 48% at 6 hr. The corresponding figures in Pb poisoning were 44, 98, 80, 63, and 52%. The free erythrocyte protoporphyrin (PP) was normally 30-40  $\mu$ g/100 ml cells. In most cases of Pb poisoning an increase to an av of 140  $\mu$ g was found. There was no parallelism between PP and the increase on Fe of the serum. The authors conclude that the anemia in Pb poisoning is characterized by high blood Fe and high blood PP, giving a picture resembling that of a plastic anemia of inhibition.

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- 1671 Groth, O., and Rigner, K.G.: Ny blyförgiftningsriek. (A NEW RISK OF LEAD POISONING.) *Nordisk Hyg. Tidsskr.* 37, No. 9/10: 238-41, 1956.

Two cases of severe Pb poisoning occurring in workers at a small workshop producing Pb glass reflectors are described, the clinical picture being typical in both cases. Pb and coproporphyrin were found in the urine, and blood examination showed basophilic stippling of the red cells and a transient thrombocytopenia. Inspection of the workshop showed that protection against Pb dust was grossly inadequate and that personal hygiene was below the standard required for Pb workers. These cases illustrate that the occupational risk can be great when new methods are used or new products are manufactured in small workshops, especially when knowledge of the risks involved is lacking. (From *Bulletin of Hygiene* 32:157, 1957)

- 1672 Gryglewicz, E.: Zapobiegawcze stosowanie etyleno-dwuamino-czterooctanu-dwusodowo-wapniowego w stanach przedłożowicznych. (PREVENTIVE APPLICATION OF ETHYLENEDIAMINE TETRAACETIC ACID CALCIUM-DISODIUM IN PRE-PLUMBIC STATES.) *Polski Tygodnik Lekarski* 11:817-21 (May 7), 1956.

- 1673 Hadengue, A., Albahary, C., and Le Breton, R. (France): Hématies ponctuées chez des ouvriers exposés au cuivre et au cadmium. Imprégnation saturnine méconnue. (BASOPHIL STIPPLING IN WORKERS EXPOSED TO COPPER AND CADMIUM. IGNORED EXPOSURE TO LEAD.) Proceedings of the Society for Industrial Medicine and Hygiene, Paris. *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 17:472-7 (Sept.-Oct.), 1956.

The authors point out that the demonstration of basophilic erythrocytes is specific for exposure to Pb. Two cases are presented, in one of which a bronze polisher, and in the other a worker exposed to Cd salts, exhibited signs of Pb poisoning. Animal experiments using the metallic dusts, to which the men had been exposed, also produced increase in basophilic cells. Chemical analysis of the dusts showed Pb contamination to the extent of 1.9% in the one case, and "far from negligible" amounts in the other.

- 1674 Hancox, N. (Liverpool Univ., England): THE OSTEOCLAST. In G.H. Bourne, ed.: *The Biochemistry and Physiology of Bone*, New York, Academic Press, 1956, pp. 213-50.

In this chapter in discussing the stimuli of osteoclasts (p 234-5), the author summarizes certain facts as follows: 1. injury or damage to bone results in the appearance of osteoclasts; 2. me-

chanical pressure has the same effect; 3. injections of the parathyroid gland or even mere propinquity to gland substance lead to intense osteoclastic absorption; 4. certain substances of known chemical constitution acting by parenteral injection or by local diffusion can be made to produce a similar effect. One of these substances is Pb salts. Essential change in all these conditions is the appearance of large numbers of osteoclasts and an absorption of bone in all parts of the skeleton.

- 1675 Hanusová, V., and Michalová, C.: SOME NEW NOTIONS ON HIGHER NERVOUS ACTIVITY AND SOME HUMORAL FACTORS IN PERSONS WORKING WITH LEAD. *Časopis lékařů českých* 95: 1409-12, 1956.

The authors investigated the higher nervous activity, ascorbic acid, and cholesterol (as humoral factors) in 23 persons exposed to toxic effects of Pb. The examinations of higher nervous activities were brought into relationship with laboratory and clinical findings. Changes in higher nervous activity were more frequent than pathological laboratory findings. A significant deficit of ascorbic acid was found in almost all exposed subjects (20), with no difference between manifest and symptomless cases of intoxication. No relationship was found between ascorbic acid deficit and cholesterol. A hypothesis is advanced that the deficiency of vitamin C is due to direct effect of Pb on the oxidation processes in tissues and not caused by any disorder of the functional system: central nervous system, adrenals, which regulate the steroid hormone balance. (From Abstracts Prague Institute of Industrial Hygiene and Occupational Diseases, Science Reports 1952-56, p. 38)

- 1676 Herrera, J.M.: Algunas observaciones histopatológicas en la intoxicación saturnina; a propósito de dos casos mortales en un episodio colectivo de intoxicación con tetraetilato de plomo. (SEVERAL HISTOPATHOLOGIC OBSERVATIONS ON CHRONIC LEAD POISONING: TWO FATAL CASES IN A MASS POISONING WITH TETRAETHYL LEAD.) *Archivos Médicos Panameños* 5, No. 1:8-23, 1956.

A mass intoxication of 18 workers occupied with cleaning out the sediment in a tank that had been filled with TEL-containing aviation gasoline is described. Two fatal cases were subjected to histopathology. Regressive disturbances of the central nerve cells, frequently preceded by pseudo-hypertrophic manifestations, and toxic damage of the oligodendroglia were observed. The interstitial cells showed alterations without exhibiting signs of the characteristic progressive reaction lability of the mesodermic component. Damage was also noted in the endothelium, the adventitial cells and the components of the perivascular reticulum in the small blood vessels. Similar effects have been described in intoxications by other metals and their salts. It is assumed that a large part of the damage is reversible since 16 subjects of the group reached complete remission of the neurologic and psychic symptoms. (23 references)

- 1677 Holeček, V.: Vylučování koproporfyrynu močí při otravě olovem. I. Hladina precursoru koproporfyrynu a preformovaného koproporfyrynu v čerstvé moči. II. Rozložení isomeru koproporfyrynu I a III v moči. (EXCRETION OF URINARY COPROPORPHYRIN IN LEAD POISONING. I. LEVEL OF THE PRECURSOR OF COPROPORPHYRIN AND PREFORMED COPROPORPHYRIN AND PREFORMED COPROPORPHYRIN IN FRESH URINE. II. DISTRIBUTION OF URINARY COPROPORPHYRIN ISOMERS I AND III. *Pracovní Lékařství* 8:333-6, 415-9, 1956.

See Abstract No. 1802.

- 1678 Horiuchi, K., Yamamoto, T., and Tamori, E.: STUDIES ON THE INDUSTRIAL LEAD POISONING. 1. ABSORPTION, TRANSPORTATION, DEPOSITION, AND EXCRETION OF LEAD. 2. A STUDY ON THE LEAD CONTENT IN DAILY FOOD IN JAPAN. *Osaka City Medical Journal* 3:84-113 (June), 1956. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School. Vol. 1, April 1949-March 1959, pp. 95-124.

The Pb content of a number of fresh and processed Japanese foods was determined by ashing, chemical treatment, and finally a modified dithizone method. Values of Pb were tabulated in  $\mu\text{g/kg}$  for fresh and dried materials, and compared with literature data. From these values was calculated the daily Pb intake from typical Japanese menus, with tabulation of the foods, weights, protein contents, caloric values, and estimated Pb contents. For 4 menus given the calculated average daily intake in  $\mu\text{g}$  was: 112.6-146.5, 37.3-60.8, 63.8-84.0, 206.7-265.7. Additional theoretical diets were made up according to results of a Japanese national nutrition survey. For these diets, the Pb contents were estimated from food values; then the meals were ashed and total Pb determined. Foods, weights, protein, fat, caloric, and Pb contents were tabulated. Daily intake of Pb in  $\mu\text{g}$  was: 5-mo bottle-fed infants, estimated 32.7-48.7, determined 61.2, estimated 75.2-135.5, determined 146.1; 10-mo weanling, estimated 49.9-104.1, determined 126.0; 3-4-yr-old, estimated 86.6-137.3, determined 157.6, estimated 94.4-155.3, determined 169.7; 10-yr-old, estimated 122.3-225.4, determined 254.6; ordinary adults, estimated 99.4-171.8, determined 238.7, estimated 117.0-195.9, determined 317.6, estimated 96.6-178.9, determined 273.5; laborers, estimated 91.3-247.8, determined 299.1; hard laborers, estimated 153.3-407.1, determined 454.7.

Conclusions from the study were that: Fresh meat, fruit, and vegetables contain comparatively a large amount of Pb; the Pb content decreases somewhat after washing with water; a fairly large amount is found in the intestines of some kinds of small fish; the Pb content in perishables increases as a rule after they are dressed or cooked; a large amount of Pb is present in canned and bottled foods. The approximate Pb content in a daily menu for adults was calculated to be an av 105-139  $\mu\text{g}$ . The oral intake could be set at  $\sim 239$ -318  $\mu\text{g}$ , and the total intake by adults through respiratory and digestive tracts, at  $\sim 200$ -400  $\mu\text{g}$  daily. (15 references)

- 1679 Kitzmiller, K.V.: THE ORGAN SYSTEMS IN RELATION TO OCCUPATIONAL MEDICINE. THE HEMOPOIETIC SYSTEM. Proceedings of Eighth Annual Meeting of the American Academy of Occupational Medicine, Cincinnati, Ohio, Feb. 15-17, 1956, pp. 20-5.

The influence of industrial and environmental conditions on blood and blood-forming organs, and interpretation of findings are discussed. The necessity of establishing a range of normal values for any industrial group based on surveys of such a population, as well as that of unexposed or control groups is stressed. In the Pb trades, confidence remains in the role of stippled cells (SC) as an index of Pb absorption in comparison with similar counts on persons unexposed to Pb. A progressive increase in SC over a period of several weeks requires, however, quantitative analysis of Pb in blood and urine, as well as periodic blood counts and Hb determinations. Once anemia develops, the presence or absence of SC alone is insufficient for the diagnosis of Pb poisoning. Correlation of all diagnostic aids, including porphyrin determinations, is recommended. (12 references)

- 1680 Koch, H.J., Smith, E.R., Shimp, N.F., and Connor, J. (Sloan-Kettering Inst. for Cancer Res., New York, N.Y.): ANALYSIS OF TRACE ELEMENTS IN HUMAN TISSUES. I. NORMAL TISSUES. Cancer 9, No. 3:499-511, 1956.

The analytical methods used for the determination of trace elements in human tissues and fluids in this study and the precision of each method is first reported. The concentrations of Al, Bi, Cd, Cr, Co, Cu, Ga, Pb, Mo, Ni, Sn, Ti, V and Zn in 20 different organs from 8 normal human subjects and normal blood values for Cr, Co, Cu, Pb and Zn are given in graphs and discussed as follows: For Al, negligible amounts were found in liver and spleen when compared with the concentration in the lungs. Bi was detected only in 1 bladder sample in a concentration of 10 µg/g ash. For Cd, the highest concentration was found in the kidney (which was 5-7 times that in the liver) and increased with age, the next highest was in the liver. Cr was detected in all organs studied, with highest concentration in the small intestine and thyroid; as plasma 0.7-5.2 µg Cr/100 ml (mean, 2.2 µg ± 1.2) was found. The concentration of Co in the organs was very low, the highest value of 30 µg/g ash being in the kidney. The highest mean of Cu was in the liver and the highest maximal, in the prostate. Ca was found only in 2 lung samples in the amount of 3.5 and 6 µg/g ash, respectively. Fe is shown only in a graph, indicating highest values in muscle (>20,000 µg/g ash). Spectrochemical analysis of 17 plasma samples for Pb gave a range of 0.7-7.7 µg/100 ml, mean 3.9 ± 2.0 µg. All organs studied contained detectable amounts of Pb, the highest concentration being in bone. Mo was found in the liver and lung, small amounts in kidney, muscle, spleen and small intestine. Ni in plasma ranged from 1-8.5 µg/100 ml mean 3.0 ± 1.9 µg. Ni occurred in all tissues studied, bladder and small intestine showing the highest level. Sn also was present in all tissues studied, with highest amounts in bladder, lung, liver,

prostate. Ti was detected only in 2 subjects; in one of them only in the lungs (140 µg/g ash), in the other in all organs studied (70-550 µg/g ash). V was found only in 1 lung sample in the amount of 11 µg/g ash. Zn was present in most organs, mainly prostate (2000-15,000 µg/g ash). (40 references)

- 1681 Larens, W. (Univ. Heidelberg, Germany): Zum Krankheitsbild der Bleiencephalopathie. (CLINICAL ASPECTS OF LEAD ENCEPHALOPATHY.) Nervenarzt 27:229-32 (May), 1956.

The case of a 43-yr-old worker in a paint factory, who was admitted to the hospital with acute cerebral involvement, is described. His main job had been in the removal of old paint, by sandblasting, from tanks and steel structures. In the 2 yr he had done this, physical examinations showed no disorders of any sort. More recently, he and 2 other men had to use cutting torches on a job where sandblasting could not be done. Although they wore respirators, all 3 became afflicted with gastric disorders, and in his case, the disturbances led to 2 epileptic attacks. Acute Pb encephalitis was the diagnosis on the basis of the acute nature of the illness, of blood findings, Pb line, Pb in blood of 119 µg% and 333 µg% in urine. Spinal puncture showed 77 µg% Pb in spinal fluid.

The author reviews the pathologic findings in Pb encephalopathy, and in closing points to the danger of removing paint from steel structures by use of cutting torches in enclosed areas.

- 1682 LeBlond, C.P., and Greulich, R.C. (McGill Univ., Montreal, Canada): AUTORADIOGRAPHIC STUDIES OF BONE FORMATION AND GROWTH. In G.H. Bourne, ed.: The Biochemistry and Physiology of Bone, Academic Press, New York, 1956, pp. 325-58.

This chapter examines information related to the dual type of growth of bone (from minerals and matrix) obtained by the use of the autoradiographic (or radioautographic) technique. Pioneer isotopic investigations of mineral acquisition by bone were carried out using Pb isotopes (radium D, thorium B). However, these have become obsolete by the use of less physiological "bone-seeking" elements and recent comprehensive works on the subject have been carried out either with <sup>32</sup>P or <sup>45</sup>Ca, <sup>45</sup>Ca being generally preferred (p. 325).

- 1683 Lecocq, J., and Guyotjeannin, C. (France): Le dosage de l'urée sanguine dans la prévention du saturnisme professionnel. (DETERMINATION OF BLOOD UREA IN THE PREVENTION OF OCCUPATIONAL LEAD POISONING.) Proceedings of the Society of Industrial Medicine and Hygiene, Paris. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 17:466-9 (Sept.-Oct.), 1956.

In 1952, the authors had called attention to the proposal that the determination of urea in blood could constitute a valuable diagnostic sign for the prevention of Pb poisoning, but emphasized the difficulty of interpretation of results. Since this test has become obligatory under the law adopted in 1955 for preemployment examinations for

work involving Pb exposure, they repeat their earlier caution. The basis of their objection is that an abnormal level may be due to some passing phase in metabolism; free sweating may be a cause, or abnormal protein diet, especially if associated with alcoholism. Attention to diet may easily abate the abnormal level. An industrial doctor, examining for work entailing a Pb hazard, should proceed with caution. A refusal to pass the individual may label him with a low capacity for employment and do him harm in the labor market. The same applies to removal from the hazard to safer work. The doctor must proceed carefully, pass the person and keep a watch on his further health. Notes on 24 instances are cited: Some with exposure to Pb and an abnormally high level of urea which became normal under dietary control; some with high blood pressure or chronic nephritis with no abnormal level of urea; some with Pb exposure but no signs of Pb absorption, but an abnormally high urea level; some intended to face a Pb hazard who were found to have an abnormally high level; and some with Pb absorption and a high level. What should be regarded as a dangerous limit has not been decided.

- 1684 Lowicki, N. (Duisburg-Hamborn): Das Schrifttum über die Bleikrankheit aus den Jahren 1949-1952. (BIBLIOGRAPHY ON LEAD POISONING FOR THE YEARS 1949-1952.) Clausthal-Zellerfeld, Schriften der Gesellschaft Deutscher Metalhütten- und Bergleute e.V., No. 5, 1956, 73 pp.

A survey is presented of the literature on Pb poisoning. The large number of 246 references indicates that in spite of measures for the control of poisoning, this disease still maintains its predominance among the occupational diseases. The listing of the references is preceded by a critical review of Pb hazards, diagnosis, treatment, prevention, as well as Pb poisoning in animals. (From Zentralblatt für Arbeitsmedizin und Arbeitsschutz 6:268 (Book Reviews), 1956)

- 1685 Masiak, M.: Wykrycie ołowiu w kamieniach nerkowych wydalonych w przebiegu choroby Recklinghausena. (PRESENCE OF LEAD IN RENAL CALCULI ELIMINATED IN RECKLINGHAUSEN'S DISEASE OF BONE.) Pol. Ty. Lek. 11:1708-10, 1956.

Renal and urinary calculi from a 40-yr-old woman with Recklinghausen's disease of bone were examined by spectral analysis. In addition to Ca and Mg phosphates, they contained Pb, Mn and Si. The Pb was presumably derived from breakdown of the bone tissue in which it had been stored as a result of occupational exposure (the patient worked in a printing shop). This is further evidence of the formation of renal calculi from minerals liberated by the destruction of bone. (From Excerpta Medica, Sect. II, 10:Abstr. No. 2895, 1957)

- 1686 Merklen, A. (Xertigny, France): J'aurais dû penser au saturnisme. (I THOUGHT OF LEAD POISONING.) Revue Médicale de Nancy 81:334-5 (Apr.), 1956.

Two cases of Pb poisoning are described. In one, a pregnant woman was examined in January and miscarried soon thereafter. She was pale, thin,

tired, had abdominal pains and was hospitalized for appendicitis. Surgery showed no inflamed appendix and no signs of intestinal obstruction. In March, the author "subconsciously" diagnosed the case as Pb poisoning. The husband affirmed, "My wife is fond of dandelions which she cuts during the day and leaves overnight in vinegar in a salad bowl with a Pb spoon." A Burton line was found and the patient died a few days later. Case 2 was a woman who suffered from minor intestinal obstruction and pain in the legs. Surgery revealed a gangrenous appendix with pus around the gallbladder. She suffered from gradual weakening of vision and increased blood urea, which was diagnosed as an "amaurosis by a central vascular spasm of uremic origin." Five years later, symptoms were vomiting, constipation, buzzing in the ears and she was treated with drugs for renal insufficiency. The next year, her hands were bent and a diagnosis of Pb poisoning caused by the water pipes was made.

- 1687 Merlevede, R.: Perturbations biochimiques en toxicologie industrielle. Le mécanisme des intoxications dues au plomb, aux hydrocarbures volatils et au sulfure de carbone. (BIOCHEMICAL CHANGES IN INDUSTRIAL TOXICOLOGY: MECHANISM OF POISONING BY LEAD, VOLATILE HYDROCARBONS AND CARBON DISULPHIDE.) Arch. belges méd. sociale, hyg. méd. du travail et méd. légale 14:194-222 (Apr.), 1956.

The author has undertaken a study of the biochemical changes and the mechanism of intoxication due to some of the principal causal agents of compensable industrial disease in certain sections of Belgian industry: Pb, volatile hydrocarbons and C disulphide.

The 1st symptoms of Pb poisoning occur when the blood Pb reaches a level of 70-80 g/100 ml. When absorbed into the blood, Pb combines with the SH groups in the red corpuscles, and Pb anemia is attributed partly to hemolysis and partly to urinary elimination of coproporphyrin III, necessary for the synthesis of hemoglobin. Pb in the form of tertiary phosphate ( $Pb_2(PO_4)_2$ ) is deposited to the extent of 90-95% in the bones. The recent method of mobilizing Pb from the bones by the chelating agent CaEDTA is based on the capacity of this salt to form a non-toxic Pb complex which is eliminated unaltered by the kidney. Subjective symptoms disappear within 24 hr of a dosage of 1 g, and basophil granulation and coproporphyrinuria after 2 or possibly 3 5-day courses. Longstanding lesions, such as toxic nephritis with hypertension and nerve palsies, are considered irreversible. (From Bulletin of Hygiene 32:51-2, 1957)

- 1688 Meyers, G.B. (Electric Storage Battery Co., Philadelphia, Pa.): LEAD ABSORPTION EXPERIENCES IN THE MANUFACTURE OF ELECTRIC STORAGE BATTERIES. Industrial Medicine and Surgery 25:4-9 (Jan.), 1956.

There is considerable exposure to Pb in the manufacture of electric storage batteries. To determine the extent of Pb absorption, the author reviewed the records of 1379 Pb workers who had processed 41,870,000 lb Pb over a 24-mo period. He starts with the premise that Pb control consists

basically of the control of Pb in the environment (ventilation, protective clothing and respirators where needed, good housekeeping and clean eating, clothing change and bathing facilities); education of supervisors and personnel; an adequate medical program.

Two departments with relatively high and low amounts of Pb in air were chosen for evaluation of stippled erythrocytes, urinary Pb, and porphyrin values with the following, respectively, indicating above average levels: >12 cells/50 oil emulsion fields (Wright's stain);  $\geq 0.12$  mg/l freshly voided urine; specimens examined under UV light showing pink fluorescence of surface ring were considered to give positive porphyrin reaction. Air concentrations  $>1.5$  mg/10 m<sup>3</sup> (dithizone method) were considered above average. Urine analyses were done every 4-8 wk on all workers, and in the study areas findings were closely related to Pb in air.

For the program, Pb levels of 0.01-0.06 mg/l are taken as nonoccupational normal absorption; 0.06-0.15 as occupational normal absorption; 0.15-0.20 as hazardous absorption, and higher levels to represent Pb intoxication. Workers with 0.15 mg/l are rechecked at 2-4 wk intervals. Those with  $>0.20$  mg/l are subjected to blood Pb determination, hemoglobin, erythrocyte counts, routine urinalysis, history and physical examination. This is repeated at 1-4 wk intervals until a safe Pb level is reached. Criteria for blood Pb findings are based on: 0.02-0.04 mg% nonoccupational normal absorption; 0.04-0.07 mg% occupational normal; 0.07-0.08 mg% occupational hazardous;  $\geq 0.0$  mg% Pb intoxication.

The authors conclude that urine Pb determinations are superior to stippled erythrocyte counts or porphyrin determinations for screening Pb workers. Pb workers should be examined routinely for urinary Pb excretion at intervals of 4-8 wk or more often if indicated. About 85% of the Pb workers at his plant have urine Pb excretion of  $<0.15$  mg/l. A hazardous Pb absorption zone of urine Pb levels from 0.15-0.20 mg/l and of blood Pb levels from 0.07-0.08 mg/100 ml is useful and practical in a Pb absorption control program. Approximately 12% of the Pb workers in the plant described have urinary Pb excretion of 0.15-0.20 mg/l. Blood Pb determinations are necessary to supplement urinary Pb findings. Approximately 6% of these Pb workers require such examination. Less than 3% of these Pb workers required a complete work-up because of excessive Pb absorption. Under such a program, signs and symptoms of hazardous Pb absorption and of early Pb intoxication are scanty. Transfer to a non-Pb job is all the treatment required in a hazardous Pb absorption or in early Pb intoxication. Lost time due to a Pb intoxication can be eliminated by early diagnosis.

- 1689** Minogue, S.J. (Sydney, Australia): KORSAKOFF'S DISEASE DUE TO LEAD AND ARSENIC POISONING. *Medical Journal of Australia* 2:16-7 (July 7), 1956.

Three middle-aged women with a history of alcoholism showed signs and symptoms of Korsakoff's disease. However, restlessness persisted for weeks, acute exacerbations of symptoms occurred repeatedly and the peripheral neuritis was also atypical.

The Pb and As levels in the urine were well above normal in all 3 patients; in one case the Pb level was up to 0.37 mg/l. The readings returned gradually to normal without special treatment. The authors state that it is accepted that Korsakoff's disease may be due to Pb and As poisoning. This has been so rarely diagnosed that its possibility is often overlooked in a differential diagnosis.

- 1690** Montero Marchena, J. (Morón de la Frontera, Seville, Spain): Ambliopia tóxica en el saturnismo crónico. (TOXIC AMBLYOPIA IN CHRONIC LEAD POISONING.) *Hispalis Medica* 13:493-4 (Oct.), 1956.

The diagnosis of the probably Pb-induced amblyopia in a 54-yr-old typographer was based on the color of the skin, occupational history, liver disorder evidenced by the presence of urobilin (which occurs frequently in Pb poisoning), hypochromic anemia, discrete depigmentation of the temporal portion of the optic disc and absence of other causes. Treatment with "Cocarbil" brought recovery of vision within 3 mo.

- 1691** Mosci, L. (Univ. Genoa, Italy): Occlusione dell'arteria centrale della retina in un lavoratore del piombo. (Contributo clinico e considerazioni generali.) (OCCLUSION OF A CENTRAL RETINAL ARTERY IN A LEAD WORKER. (A CLINICAL CONTRIBUTION AND GENERAL CONSIDERATIONS.)) *Ann. ottalm. e clin. oculist.* 82, No. 8:397-402, 1956.

Reference is made to the observation of a case of occlusion of the central retinal artery with subsequent optic atrophy in a Pb worker. The possibility is discussed that 2 different pathogenic factors have coincided here: ischaemia, due to alterations of the vascular apparatus, and direct action of the metal on the nerve fibers. The fact that arterial pressure measured in the upper arm was lower than normal confirms the modern views on pressure values in cases of Pb poisoning. (From *Excerpta Medica*, Sect. 12, 11:Abstr. No. 1500, 1957)

- 1692** Mueller, J. (Dept. Ind. Hyg. Occup. Diseases, Prague, Czechoslovakia): FACTORS INFLUENCING THE MECHANISM OF LEAD POISONING. *Osaka City Medical Journal* 2:129-40, 1956.

This is an English translation of the author's article published in 1950; see Abstr. No. 1235.

- 1693** Njemirovskij, Z.: (DENTAL CALCULUS IN LEAD WORKERS.) *Arhiv Hig. Rada* 7:263-5, 1956.

In examining the oral cavities of workers in a storage battery plant, in a Pb mine and a smelting plant the author noticed a high incidence of dental calculus. Analysis of the dental calculus showed a higher percentage of Pb particles in the Pb workers than in nonexposed persons. The Pb in dental calculus may be deposited in the surrounding gum tissue. (From *Industrial Hygiene Digest* 21: 840, 1957)

- 1694** Nunziante Cesaro, A., Granata, A., and Saitta, G. (Univ. Messina, Italy): Le fosfatasi acide ed alcaline nel sangue periferico di soggetti normali e di sog-

getti affetti da alcune tecnopatie. Procedimento per la colorazione delle fosfatasi acide negli elementi figurati del sangue periferico. (ACID AND ALKALINE PHOSPHATASES IN THE PERIPHERAL BLOOD OF NORMAL PERSONS AND THOSE WITH OCCUPATIONAL AILMENTS. HISTOCHEMICAL DETERMINATION OF PHOSPHATASES IN THE FORMED BLOOD ELEMENTS.) *Folia Medica* (Naples) 39:132-9 (Feb.), 1956.

For acid phosphatase the smears were fixed with formaldehyde vapor, washed with water, incubated 24 hr at 37° in a substrate consisting of 10% Na  $\beta$ -glycerophosphate, 4 ml, 15% Pb nitrate 2 ml, acetate buffer pH 4.7 15 ml, washed with water, treated 20-25 min with 10% ammonium sulfide, and washed with water for 10 min. For alkaline phosphatase the method of Gomori-Takamatsu, modified by Kabat and Furth was used. Both phosphatases were found in the lymphocytes, monocytes, neutrophil and eosinophilic granulocytes, mast leukocytes and platelets. There was no difference between normal persons and patients with Pb poisoning, silicosis, acetonc and acetic acid poisoning, and men employed in P treatment of metals and Parke process.

- 1695 Odescalchi, C.P. (Univ. Padua, Italy): *Richerche sulla prevenzione medicamentosa del saturnismo. (RESEARCH ON THE MEDICAL PREVENTION OF LEAD POISONING.)* *Minerva Medica* 47:150-4 (July 11), 1956.

The author first reviews rather extensively the various agents used or studied in the prevention of Pb poisoning, such as EDTA (more useful in diagnosis than in cure), levulose, liver extracts, vitamin B<sub>12</sub>, folic acid, Ca, amino acids, and milk (which has been subject to great debate). His own work has been the study of the effectiveness of tablets composed of serum albumin (total N 13-15%), P and Ca ions. These were first tested in vitro, in a homogenized aqueous suspension to which 1% solution of Pb nitrate was added in increasing doses (0.5-20 ml). After centrifugation, the supernatant liquid was reacted with Na sulfide. In all samples the reaction was negative, while in the control without the suspension it was positive.

Next, 50 workers of several Pb industries were subjected to the urinary and fecal Pb excretion test to reveal the degree of exposure and absorption, using Kehoe's criteria. Determination of Pb was by the method of Kehoe et al (1939). The preparation was administered before meals at a dose of 2-4 keratinized tablets (400 mg each)/day. The concentrations found in urine before and after administration, in mg/l, and in feces, in mg/24 hr, were: in manual compositors, 0.054-0.175 and 0.040-0.150; 0.61-1.71; in accumulator factory workers 0.12-0.186 and 0.08-0.90; 0.67-2.70 and 0.90-3.80; in PbO manufacture workers, 0.17-0.33 and 0.13-0.22; 2.26-3.09 and 2.57-4.10, respectively.

The author concludes that the PbO workers were exposed to greatest risk and that the P-Ca-protein preparation (supplied under the trade name "Prevalba") was effective in binding the absorbed Pb, and forming insoluble compounds in the intestinal tract.

- 1696 Oltramare, M. (Policlinique Méd. Univ., Geneva, Switzerland): *Intoxication saturnine professionnelle avec manifestations cérébrales, rénales et sanguines chez une ouvrière de poterie. (OCCUPATIONAL LEAD POISONING WITH EFFECTS ON THE BRAIN, KIDNEY AND BLOOD IN A POTTERY WORKER.)* *Praxis* 43, No. 8: 173-8, 1956.

Severe Pb poisoning occurred in a 44-yr-old woman who had been working in a pottery for 3 yr. Her job consisted in hand-dipping plates into an enamel bath which contained >25% (vol) Pb. No precautionary measures were taken, the workers did not even wash their hands before eating. Complaints of vomiting after ingestion of fatty food started after 1 yr's work. Other symptoms, such as fatigue, anorexia and visual disturbances developed during the 2nd yr. A physician whom she consulted diagnosed an anemia which responded readily to transfusions and liver extract. After she went back to work, her symptoms soon returned in aggravated form; epileptic convulsions occurred and a blood test showed the presence of stippled cells and Pb content of 140 mg/100 ml. Since treatments with BAL (400 mg/day for 2 days, then 100 mg/day for 2 days) made her condition worse, iv administration of EDTA was started which resulted in disappearance of the nervous symptoms, coproporphyrinuria and stippled blood cells. The residual anemia was treated with vitamin B<sub>12</sub>, ACTH and cortisone, but a moderate anemia and some edema still persisted 2 yr after the intoxication.

- 1697 Paterni, L. (Univ. Rome, Italy): *ARTERIOSCLEROSIS IN OCCUPATIONAL MEDICINE. ARTERIOSCLEROSIS FROM WORK AND FROM TECHNICAL DISEASE.* *Folia Med. (Naples)* 39:573-603, 1956.

A typical type of arteriosclerosis is produced by muscular work and another by the effects of industrial poisons such as As, Pb, Mn, Hg, nitrates, CO, and CS<sub>2</sub>. (179 references) (From Chemical Abstracts 50:15992, 1956)

- 1698 Pecora, L., Fati, S., Vecchione, C., and Brancaccio, A. (Univ. Naples, Italy): *RELATION BETWEEN LEAD IN THE BLOOD AND IN VIVO SYNTHESIS OF FREE PROTOPORPHYRIN OF THE ERYTHROCYTES.* *Folia Med. (Naples)* 39:1133-46, 1956.

Pb in Pb poisoning circulates mainly in the plasma and the small part bound to the erythrocytes is adsorbed to the surface. Pb injected into the blood stream in vivo does not interfere with the protoporphyrin synthesis although this happens in vitro, because in the latter case the protective action of the serum is absent. (From Chemical Abstracts 51:8934, 1957)

- 1699 Pardini, A., and Odescalchi, C.P. (Univ. Padua, Italy): *Il midollo nel saturnismo. (THE BONE MARROW IN LEAD POISONING.)* *Folia Medica* (Naples) 39:335-48 (Apr.), 1956

Bone marrow studies were carried out on 12 patients with various degrees of Pb poisoning. A constant depression of the Karyokinetic global index with a definite prevalence in the erythrocyte series

was found. (From authors' summary; 20 references)

- 1700 Pendini, A., and Odaleschi, C.P.: (PLUMBISM AND THE COLOPATHIC SYNDROME.) Gior. Clin. med. 37:241-58 (Feb.), 1956.

The authors studied the colopathic syndrome in 25 patients with plumbism. Eleven patients had colic only once. Four had it 2 or 3 times. These 4 patients had had appendicostomies, 2 after 1 yr of work, 1 after 10 yr, and 1 after 22 yr of exposure to Pb. According to some authors, recurrent appendicitis is frequent among patients with plumbism. Hypochromia was present in all patients. The number of red blood cells with granular basophilic degeneration was high. Porphyrinuria had increased in almost all patients. The renal function was normal in only 16 patients. Three showed a slight decrease in the power of concentration or dilution. The blood pressure was normal. Some hyperchlorhydria was present in 8. Radiology showed acceleration in the passage of the motor test meal through the gastrointestinal tract. Signs of spastic or hypertonic colitis were present in all patients. Duodenal ulcer was present in 1, but the authors doubt that it had anything to do with the patient's plumbism. The age of the patient and the length of the exposure showed no relation to the frequency with which the colopathic syndrome occurred. Frequency of colic and the whole syndrome were independent of the spastic colitis caused by plumbism. Anemia and porphyrinuria were not correlated with the degree of intensity of the colopathy. Disturbances of the gastric juices had nothing in common with the syndrome. All the patients showed clinical or radiologic evidence of colitis. The authors think that use of alcohol, excessive smoking, poor hygienic habits, poor and unregulated diet, and other bad physical and psychic factors must be considered together with the toxic effect of Pb to which these patients were exposed during their work. (From Journal of the American Medical Association 161:1425 (Abstracts), 1956)

- 1701 Perrault, M., Clavel, B., and Chain, F. (Paris, France): Intérêt actuel de la chélation en thérapeutique. (PRESENT VALUE OF CHELATION IN THERAPEUTICS.) Thérapie 11, No. 4:735-44, 1956.

The results of  $\text{CaNa}_2\text{EDTA}$  treatment of occupational Pb poisoning in a 31-yr-old battery plant worker (N. African), who after having been employed for 1 yr suffered from a typical Pb colic and pain in the lower extremities, are described. At admission in hospital examination showed a great number of stippled cells, no coproporphyrins and a blood Pb concentration of 115  $\mu\text{g}/100\text{ ml}$  (normal 40  $\mu\text{g}$ ). The drug (prepared by the authors since it was not available in France) was infused iv in a dose of 0.50 g in a 250 ml saline solution over 2-3 hr twice/day for 4 days. After an interval of 3 days the course was repeated, but then 1 injection/day of parathormone was added in order to mobilize the Pb from the bones. At the end of the 1st course the clinical symptoms had completely disappeared, the number of stippled erythrocytes had dropped from 47,400 to 14,000/million. The blood Pb level had decreased to 85  $\mu\text{g}/100\text{ ml}$ . After a 3-day rest period the urinary Pb was 1.5 mg/day. During the

1st 2 days of the 2nd course, Pb excretion increased again to 3.3-5.7 mg/24 hr. At the end of the treatment the patient was much improved; the blood-picture normal without stippled cells, the blood Pb had dropped to 40  $\mu\text{g}/100\text{ ml}$ .

The authors recommend the  $\text{CaNa}_2\text{EDTA}$  in cases of Pb poisoning over the use of BAL and indicate the modes of application, stressing the originality of their method and review other diseases for which it has been recommended. (23 references).

- 1702 Perrault, M., Truhaut, R., Klotz, B., Boudène, C., Dreux, C., Clavel, B., and Chain, F. (Lab. Toxic. Ind. Hyg., Univ. Paris, France): Sur l'efficacité de l'E.D.T.A. calcique dans l'intoxication saturnine professionnelle. (THE EFFECTIVENESS OF  $\text{CaEDTA}$ , IN OCCUPATIONAL LEAD POISONING.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 17:423-9; discussion 470-2, 1956.

A case of acute occupational Pb poisoning is described. The man, who was employed in making storage batteries, had been handling for 1 yr a mixture containing Pb. He had paroxysms of abdominal pain and suffered from constipation, severe headaches and pains in the legs. There was an absence of coproporphyrinuria, but moderate anemia with very large number of stippled cells, and Pb content in blood of 115  $\mu\text{g}/100\text{ ml}$ .  $\text{CaEDTA}$  was given by intravenous (iv) perfusions, with rapid removal of all pains and feeling of malaise. The perfusion was given over a period of 2-3 hr twice a day for 4 days and this course was repeated after an interval of 3 days. The headaches and joint pains persisted until the 2nd course. Stippled red cells soon disappeared from the blood and large amounts of Pb were excreted in the urine.

The action of  $\text{CaEDTA}$  is considered at length. It is a chelating agent which means that it captures Pb or other metals from the tissues, converting them into soluble and non-toxic salts; these salts are promptly carried to the kidneys to be excreted. Pb in the soft tissues and blood is first chelated; the Pb stored in the bones passes into the blood where it is chelated in turn. Metals which may be chelated are Ca, Cu, Pb, Hg, Fe and Cr. In order to avoid chelation of normal Ca, leading to hypocalcemia and tetany, the Ca salt is used instead of the Na salt. The Pb excreted in the urine may reach 4 mg in a child and 10 mg in an adult/day. The authors prefer iv administration, since the contents of the stomach may neutralize some of the chelating power before the drug reaches the blood. In the discussion, a plea is entered for oral administration in less acute cases to hospitalized patients or treated as ambulatory cases. Possibly EDTA might be used prophylactically for workers unavoidably exposed to a Pb hazard. EDTA is far less toxic than BAL; in fact, no injurious side effects have been seen. Its possible value in other conditions besides Pb poisoning has yet to be assessed. A successful ambulatory case is described.

In the discussion, Albahary discusses his experience with the drug. He agrees with the above authors that oral administration in milder cases would be more convenient, and raises the question

of prophylactic treatment for heavily exposed workers. The optimum procedure still needs to be determined.

- 1703** Perrault, M., Truhaut, R., Klotz, B., Dreux, C., Clavel, B., and Chain, F.: Traitement par un chélateur (EDTA calcique) d'un cas d'intoxication saturnine professionnelle récente première observation française; intérêt général de la méthode. (TREATMENT OF A RECENT CASE OF OCCUPATIONAL LEAD POISONING WITH A CHELATING AGENT, CALCIUM SALT OR ETHYLENEDIAMINE TETRAACETIC ACID; FIRST FRENCH CASE; GENERAL VALUE OF THIS METHOD.) Bull. Mém. Soc. Méd. Hôp. Paris 72:262-9 (Mar.), 1956.

See preceding abstract.

- 1704** Picard, R. (Nantes, France): Saturnisme d'origine hydrique dans les régions granitique. (LEAD POISONING FROM WATER CONTAMINATION IN GRANITIC REGIONS.) Revue de Pathologie Générale et Comparée 56:1770-82, 1956.

The danger of Pb poisoning from the use of Pb pipes for conducting drinking water in granitic regions is explained on the basis that (1) water is low in mineral content; (2) is poor in Ca carbonates (where these are present, an insoluble Pb carbonate is formed and acts as a protective layer); (3) contains nitrates and chlorides which, with the aid of atmospheric CO<sub>2</sub> form soluble Pb compounds. Three epidemics of Pb poisoning of 27, 18 and 11 cases, respectively, due to contamination of water were observed since 1923 in the eastern part of France. Numerous cases had first been mistaken for intestinal obstruction, appendicitis, cholecystitis, renal lithiasis or even cancer. Arterial hypertension, stippled erythrocytes and coproporphyrinuria were considered as reliable signs of Pb poisoning. Analysis of the water which had caused the poisonings showed Pb contents of 1-3 mg/l. The author points out that Pb pipes for drinking water should not be permitted.

- 1705** Pollini, R.R.: Considerazioni sulla morte di una intera famiglia per il presunto avvelenamento da piombo tetraetile. (DEATH OF AN ENTIRE FAMILY BY THE PRESUMED POISONING BY TETRAETHYL LEAD.) Rassegna di Medicina Industriale 25:56-62 (Jan.-Feb.), 1956.

In 1946 Cavallazzi reported the poisoning of an entire family by the vapors of a liquid used as a disinfectant in a home. The same incident was reported again in 1947 by Luccarello and Provasoli. These authors attributed the poisoning to TEL. Pollini questions the validity of their conclusions on the basis that pure ethyl fluid could not have been used since it is not available commercially; also that leaded gasoline contains an insufficient quantity of ethyl fluid to have caused such dramatic and rapid poisoning. Also such gasoline is not sold as disinfectant. He believes that the liquid in question was a solution of methyl bromide. The signs of intoxication by methyl bromide and TEL are discussed. (21 references)

- 1706** Prato, V., and Fiorina, L. (Univ. Turin, Italy): Il midollo osseo nell'intossicazione professionale da piombo. (THE BONE MARROW IN OCCUPATIONAL LEAD POISONING.)

Minerva Medica 47:1937-45 (Dec. 8), 1956. The behavior of the bone marrow was studied in 17 cases of occupational Pb poisoning. It was found to be stimulated in an attempt to counteract the increased destruction of the erythrocytes; in a second stage, with diminution of the hemolysis, the erythroblastic proliferation returned to the initial value, and subsequently, the rapid maturation was also slowed down. Several hypotheses to explain the reaction of bone marrow are discussed. (38 references)

- 1707** Ramsak, M.: (A CASE OF MANIFOLD POISONING AFTER AUTOGENOUS WELDING IN A CLOSED SPACE.) Arhiv Hig. Rada 7:89-93, 1956.

A case is described of a manifold poisoning which occurred after autogenous welding. It consisted of metal fume fever, welders' jaundice, N oxides poisoning, and Pb poisoning. Pb poisoning is particularly emphasized as it occurred in a man exposed to Pb for the 1st time, and for 4 hr only. (From Industrial Hygiene Digest 21:598, 1957)

- 1708** Reich, J. (Fed. Railway Board, Mainz, Germany): Zur Kasuistik der Bleigefährdeten. (CASUISTICS OF PEOPLE EXPOSED TO LEAD.) Ärztl. Dienst DB 17:73, 1956.

In control examinations of Pb workers a 39-yr-old signal mechanic attracted attention by the repeated occurrence of punctate cells. No other signs of Pb poisoning were noted. Since the man had formerly suffered from stomach trouble, the physician in charge took X rays which revealed a large carcinoma of the stomach. Author points out that the presence of punctate cells should be interpreted by differential diagnosis and that the industrial physician should follow up all complaints. (From Zentralblatt für Arbeitsmedizin und Arbeitsschutz 8:301 (Abstracts), 1958)

- 1709** Reinl, W. (Düsseldorf, Germany): Prophylaxe bei Bleiarbeitern mit oralen Gaben von Dikalziumäthylendiamintetraessigsäure (Ca<sub>2</sub>EDTA). (PROPHYLAXIS OF LEAD WORKERS WITH ORALLY ADMINISTERED Ca<sub>2</sub>EDTA.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 6:5-8 (Jan.), 1956.

The oral administration 3 times/day for 6 wk of "Mosatil" tablets containing 1 g Ca<sub>2</sub>EDTA, to 17 workers in a Pb foundry, exhibiting established porphyrinuria, was effective in controlling it completely in all but 2 cases. In the latter, medication had been interrupted. The Pb content of the blood was also greatly diminished. The control group of 10 workers who received no EDTA also showed a certain improvement, indicating that strict supervision of precautionary measures had a favorable influence. On the basis of this investigation, the oral administration of 1 g Ca<sub>2</sub>EDTA 3 times/day to Pb workers who exhibit signs of Pb absorption, brings about improvement in the condition and prevents the establishment of Pb poisoning. The effect is seen as a certain elimination of Pb from the blood by way of the urinary system and in the binding of the Pb, in-



gested in the course of work, into a nonabsorbable compound.

- 1710** Rizzo, A., and Sbertoli, C. (Univ. Milan, Italy): La diagnosi della nefropatia saturnina alla luce della moderna fisiopatologia renale. (DIAGNOSIS OF NEPHROPATHY CAUSED BY LEAD POISONING IN LIGHT OF THE NEW PHYSIOPATHOLOGY OF THE KIDNEY.) *Medicina del Lavoro* 47:117-28 (Feb.), 1956.

Kidney function was studied in 6 cases of Pb poisoning by new selective methods (glomerular filtration by Newman et al method; renal plasma volume by Simes', and Smith et al; tubular secretion by Simes', etc). Each case is described and blood pressure findings, urinalyses and blood chemistry, as well as indices of clearances are tabulated in detail. The findings showed 2 of the men to have no signs of renal impairment; at the examination, 1 was confirmed to be normal, but the other presented the functional picture of hypertensive nephropathy. The other 4 showed: (1) a glomerulotubular pathologic process; (2) 1 case of incipient and 1 of advanced vascular nephrosclerosis; (3) a renal angiospastic state evidenced 1 mo after remission of colic during which signs of renal disturbance had been noted.

The authors conclude that the number of cases was too small to permit any general or definitive opinion. However, the point of attack of Pb on the kidney was found to be prevalently vascular and its action clearly sclerogenous. This work confirmed the authors' opinion, shared by other investigators, that renal function tests, commonly used in clinics, are insufficient to permit an early evaluation of the nature, localization and severity of a kidney lesion, while selective renal clearances do accomplish this, and that the problem of the pathogenesis of Pb-induced kidney lesion can be studied only by means of them. (28 references)

- 1711** Roche, L.: Les formes latentes de l'intoxication saturnine. (LATENT FORMS OF LEAD POISONING.) *Revue Lyonnaise de Médecine* 5:351-3, 1956.

Due to improvements in industrial hygiene the classic form of acute Pb poisoning is becoming rare today. Latent poisonings, however, still occur frequently. Author describes in detail the symptoms and subjective complaints which are characteristic for these latent cases, such as atony of the intestines, constipation, general physical and psychical asthenia, frequent headaches and dizziness. A slight increase of the blood pressure is frequently present; the Pb line is often missing. The presence of stippled erythrocytes and urinary excretion of coproporphyrin are important signs. Special equipment is required for Pb analyses in the blood. The etiology must be considered. Also, nonoccupational Pb poisonings are frequently observed. (From *Zentralblatt für Arbeitsmedizin und Arbeitsschutz* 8, No. 12:301 (Abstracts), 1958).

- 1712** Rossi, L. (Inst. Ind. Med. Univ. Naples, Italy): La funzionalità renale nel saturnismo professionale. (KIDNEY FUNCTION

IN CHRONIC LEAD POISONING.) *La Riforma Medica* 70:841-51, 1956.

Twenty-two subjects in whom the history, objective examination and laboratory tests demonstrated a chronic Pb intoxication were submitted to modern tests for renal function.

In the majority of the cases a decrease of renal plasma flow was found, with little or no alteration of glomerular function. In the cases in which tubular function was determined by maximal excretion capacity, a tubular lesion was noticed which was a result of the ischemic condition of the organ as shown by the behavior of the ratio of renal blood flow to maximal excretion capacity.

The author concludes that on the basis of these results and in agreement with the most recent investigations, renal impairment in chronic saturnism should be considered a vascular nephropathy. (From author's summary)

- 1713** Rubino, G.F., Prato, V., and Fiorina, L. (Univ. Turin, Italy): Meccanismi emolitici nell'anemia saturnina. (HEMOLYTIC MECHANISM IN ANEMIA CAUSED BY LEAD POISONING.) *Folia Medica (Naples)* 39:1117-32 (Dec.), 1956.

Erythrocytes of 14 patients with anemia caused by Pb poisoning had a higher resistance to hemolysis by hypotonic solutions than erythrocytes from healthy individuals. There was no difference in the resistance to lysocytins. Tests for the presence of auto- and heteroagglutinins and lysins to the blood of the same patients were negative. The resistance to osmotic influence is caused by modifications in the structure and permeability of the cell membrane. (18 references)

- 1714** Salinas, M.: Comentarios de orden clínico a tres afecciones dermatológicas profesionales. (CLINICAL COMMENTARIES ON THREE OCCUPATIONAL SKIN DISEASES.) *Med. y Seguridad del Trabajo (Madrid)* 4:61-71 (Apr.-June), 1956.

Two cases of dermatitis in patients with plumbism are described. One patient, a barman for 14 yr, had an exudative papulo-vesicular lesion on the backs of his hands; the palms were smooth and edematous; the creases of the fingers had disappeared and there were fissures with hyperkeratosis. Pb in the blood was 135  $\mu\text{g}/100\text{ ml}$  and in the urine 300  $\mu\text{g}/1000\text{ ml}$ . Patch tests with metals were negative. The skin lesions persisted after treatment for plumbism. Patch tests with soap containing Na and K and a bleaching solution were strongly positive, showing it was a clear case of soap dermatitis. The other patient was a printer aged 56. For 2 yr he had had a rash (erythrodermia, deep red, raised, exudative) on the trunk, limbs and scalp. There were patches in the mouth and there was itching and fever. The skin was thickened and fissured in the flexures. Pb in the blood was 160  $\mu\text{g}/100\text{ ml}$  and in the urine 150  $\mu\text{g}/1000\text{ ml}$ . The blood picture was that of hypochromic anemia. In patch tests against metals the only positive one was with Cr. A Zn oleate ointment was prescribed for the skin and the usual treatment for plumbism and anemia. After 25 days' treatment the skin improved concurrently with a reduction of the Pb in the blood and urine to 25

µg/100 ml and 120 µg/1000 ml, respectively. This was a true toxicodermy. Black and white photographs of the skin lesions of both patients are included. (From Bulletin of Hygiene 31:1241, 1956)

- 1715** Sassi, B., and Zéràh, A.: Le saturnisme en Tunisie. Enquête médico-sociale parmi les ouvriers d'une fonderie de plomb. (LEAD POISONING IN TUNISIA. MEDICO-SOCIAL INVESTIGATION OF WORKERS OF A LEAD FOUNDRY.) Tunisie Médicale 34:335-91, 1956.

Pb poisoning is the chief and oldest occupational disease in Tunisia. The first Pb mine, Djebel Ressas, began to be exploited in 1868. Pb exposed workers number 4000. The authors present a brief historical outline of Pb production in Tunisia, listing tonnage, foundries, number of workers, illustrated by photographs, and organizational and other tables.

The foundry used as a study site was that of Megine which employs 70% of the metallurgic labor force and produces 80% of the Tunisian Pb output. The investigation included 196 workers, ~52% of the total number of workers in the factory, who were screened by questioning, physical examinations (digestive, cardiovascular and nervous systems) and laboratory analyses (Hb level, number of basophilic stippled cells, urinary coproporphyrin (CP) levels). Some individuals were given more specialized examinations such as gastroscopy, rectoscopy, EKG, and radiologic and biologic studies for azotemia, blood Pb levels, and hepatic flocculation. The results of the routine questioning and examination of all workers are set forth in 6 tables.

Examination of the digestive tract revealed a large degree of oral and dental lesions. Only 15.2% had no such lesions with the exception of dental caries; 21.5% had defective dentures and 63.3% stomatitis (total number of workers examined, 177). Practically 93.9% of the workers ≥40 yr had severe oral defects. The gastrointestinal complaints, early and frequent, in appearance, were too unspecific to be ascribed to Pb poisoning in all cases; 62% of the workers had dyspeptic episodes of various types, from simple anorexia to white vomit (Pb chloride). Two typical cases are described.

In the cardiovascular studies, the 177 workers were grouped as follows: 85 workers (88%) with normal or low blood pressure (BP); 52 workers (29.3%) with slightly elevated BP; and 40 workers (22.7%) with hypertension. Of the 40, the majority (52%) were 40-50 yr of age. Blood urea was normal in 31 and elevated in 12. Hyperazotemics were numerous. Dyspnea, due to anemia, was frequently observed. The results indicated the slowness of the cardiovascular response to Pb intoxication since it was found chiefly in aged workers.

One case of brachial paralysis, severe stomatitis and cephalic impairment with visual disturbances and Pb induced nephritis is described. About 1/5 of workers examined neurologically had diminished reflexes.

In the Hb studies, 3 groups of workers emerged as follows: 40 (22.1%) had Hb values >80%; 96 (55.8%) had Hb from 60-80%; and 40 (22.1%) <60%. For the determination of stippled cells, the Manson-Schwarz method as modified by L. Muller, was used. Of the 177 workers, 82 (46.6%) had up to

1000 stippled cells/million red cells; 46 workers (25.5%) had 1000 stippled cells/million. Thus, 128 (72%) had stippled cells; 28% had none.

Urinary CP values (Harlay and Malangeau, 1939, modified by Sennelart) in 68 workers (39%) were <50 µg, 46 (26.4%) showed 1+ (50-100 µg), 30 (17.3%), 2+ (100-500 µg), and 30 3+ (>500 µg). It seemed that the frequency and severity of the moderate-to-severe urinary CP corresponded to the intensity of exposure the same as was observed in the case of the stippled cells.

The authors examined the relationship between biological criteria such as Hb levels in relation to stippled cells and the latter in relation to urinary CP, as well as the relationship between the various clinical and biological signs.

In recapitulating the findings, 63% of the workers had stomatitis, 62% dyspepsia, 63% Pb colics, 22.7% hypertension, 22.1% <60% Hb values (av 69%), 25.5% had >1000 stippled cells/million, and 35.6% had elevated urinary CP excretion. Thus, a high level of Pb intoxication with frequent exacerbations and a marked degree of oral and gastric defects was found among the workers in the Pb foundry of Megrine.

The authors conclude with a general survey of Pb intoxication, its causes, prevention, diagnosis and therapy, and discuss legislation concerning its prevention, personal hygiene, and governmental and social security measures for the protection, education and rehabilitation of the working population in Tunisia.

- 1716** Savićević, M., and Petrović, L.: (DETERMINATION OF PUNCTATE BASOPHILIC ERYTHROCYTES IN WORKERS ENGAGED IN THE LEAD INDUSTRY.) Glasn. Hyg. Inst. (Beograd) 5, No. 1-2:103-10, 1956.

Löffler's and Lehmann's methods were used together with the dark field method, the latter being simpler and more efficient in revealing a larger number of punctate basophilic erythrocytes. A maximum allowable upper limit of punctate basophilic erythrocytes in Pb workers is proposed. (From Excerpta Medica, Sect. 17, 3:Abstr. No. 2565, 1957)

- 1717** Schmitt, F., and Schlenzig, H. (City Hosp., Berlin-Charlottenburg, Germany): Untersuchung zur Bleiprophylaxe. (PREVENTION OF OCCUPATIONAL LEAD POISONING.) Medizinische Monatsschrift 10:508-14 (Aug.), 1956.

To illustrate the problems of prophylaxis and treatment of Pb intoxication, the authors briefly describe the action of Pb in the organism and include a survey of the literature on the subject.

The authors' own research concerns the effects of various salts of thiosulfate given orally to normal persons and Pb-exposed workers, after having obtained good results with Na thiosulfate given intravenously. The thiosulfates used in these experiments were the Na, K, Ca, Mg and Sr, and their effects upon blood Pb level, urinary Pb excretion and Na-K concentrations in plasma and erythrocytes were observed.

Any of the thiosulfates, given daily at a dose of 6 tablets of 0.35 g each, resulted in a lowering of the blood Pb level to normal values. Three tablets/day kept the level constant. A moderate

urinary Pb excretion was observed in normal persons, and in the case of K and Sr thiosulfate, also in the Pb-exposed individuals. The Pb level sank more rapidly in plasma than in the erythrocytes and it was assumed that more ionized Pb was eliminated. Based on this, only Sr and K thiosulfates were given to the factory workers. Both drugs were tolerated well. After several weeks' medication, the workers felt well and had no complaints. Na thiosulfate resulted in storage of Na in the tissues causing water retention, while K thiosulfate caused water elimination from the tissues. It is well tolerated and was therefore given to Pb-exposed workers during the working hours. The thiosulfate expected to have a double effect upon the Pb metabolism (ie, Ca thiosulfate) has to be given in solution, is difficult to dose, lowers the blood Pb level to normal but is not tolerated well. Mg thiosulfate is well tolerated, lowers the blood Pb level rapidly but causes fatigue and cannot be used during working hours. Noteworthy is the fact that all normal individuals not exposed to Pb showed increased blood Pb levels. Numerous tables illustrate the effects of the various thiosulfates tested. (26 references.)

- 1718 Shiels, D.O., Thomas, D.L.G., and Kearley, E. (Ind. Hyg. Div., Dept. Health, Melbourne, Victoria, Australia): TREATMENT OF LEAD POISONING BY EDATHAMIL CALCIUM-DISODIUM. A.M.A. Archives of Industrial Health 13:489-98 (May), 1956.

Five subjects with industrial Pb poisoning and an 8-yr-old boy with pica-caused Pb poisoning were given  $\text{CaNa}_2\text{EDTA}$  orally; the adult dose was 2 g twice a day for several days, followed by omission for 7 days and then by a 2nd course similar to the 1st. Five were in hospital and watched in detail; the urine was analyzed for Pb and coproporphyrin (CP); blood was examined for Pb content and stippled cell counts. Details of the case histories of these 6 patients are given. (The child's case, presented by McCoy at a meeting, is briefly noted in Medical Journal of Australia 1:662, 1955.) Treatment was also given to 14 ambulatory patients. The drug caused pronounced increase in the concentration of Pb in the urine and in the total daily excretion in the urine. In some cases the increase amounted to 5-35 times for the concentration and to 5-22 times for the total Pb excreted. In some cases this occurred on the 1st day of treatment. Fecal Pb excretion was also increased. As to blood Pb, there was an immediate drop then subsequent rise in some cases; in one case there was a steady fall. These increases continued for several days after cessation of treatment. During the 2nd course of treatment the increases were substantial, but not so excessive. In most instances the amounts excreted in the urine alone greatly exceeded the amount circulating in the blood prior to treatment. In connection with elimination of Pb from body tissues, the authors found it of interest to examine the latter in relation to the amounts present in the body at the start of treatment. On the basis of analyses performed by them and published data, they estimate that in cases of poisoning such as theirs, the amount of Pb in blood and soft tissues might be 70 mg and 800-1000 mg in bones. During the

course of treatment, 1 patient eliminated a total of 31.5 mg, or 5 times the amount of Pb in the blood, and 20 times the amount of Pb which would have been absorbed during the course from food.

The effect on excretion of CP in the urine varied; before treatment the weight of CP excreted exceeded 6-fold the weight of Pb excreted; shortly after treatment commenced the weight of CP excreted daily fell to 2/3 of the weight of Pb. The clinical results of treatment were favorable throughout, and a comparison of the effects of Na citrate and EDTA indicated a much greater increase in the excretion of Pb with EDTA than with Na citrate in an equal period of time. The treatment was capable of removing Pb from the bones. The possible metabolic changes which determine the changes observed are discussed.

- 1719 Sinkulová, L.: Otravy oloven v Čs. průmyslu v letech 1918-1920. (LEAD POISONING IN CZECHOSLOVAKIAN INDUSTRY IN THE YEARS 1918-1920.) Pracovní Lékarství 8: 56-62 (Jan.), 1956; Current List of Medical Literature 30:44096, 1956.

- 1720 Suntych, F. (Clinic Occup. Dis., Ind. Hyg., Prague, Czechoslovakia): EFFECT OF VITAMIN B<sub>12</sub> ON CHRONIC LEAD POISONING. Pracovní Lékarství 8:169-72, 1956.

Treatment of Pb poisoning in man with intramuscular injections of vitamin B<sub>12</sub> brought about a significant decrease of basophilic stippled cells, whereas the erythrocyte count, hemoglobin content, porphyrin value in the urine, plumbemia, and excretion of Pb in the urine were not affected. In view of the results this medication is not recommended. (From Chemical Abstracts 50:15961, 1956)

- 1721 Suntych, F. (Clinic Occup. Dis., Ind. Hyg., Prague, Czechoslovakia): Einfluss des Vitamin B<sub>12</sub> auf chronische Bleivergiftung. (EFFECT OF VITAMIN B<sub>12</sub> IN CHRONIC LEAD POISONING.) Zeitschrift für Ärztliche Fortbildung 50:803-6 (Oct.), 1956.

See preceding abstract. (From Current List of Medical Literature 31:39598, 1957)

- 1722 Sutherland, D.A., and Eisentraut, A.M., with assistance of Minster, M. (Veterans Hosp.; Univ. Texas, Dallas): THE DIRECT COOMBS TEST IN LEAD POISONING. Blood 11: 1024-31, 1956.

The changes in the erythrocyte membrane in chronic Pb poisoning in humans and in experimentally induced acute and chronic intoxication in dogs were studied on the following material: blood samples from 29 workers with chronic asymptomatic Pb poisoning who had been exposed to Pb at a local smelter over prolonged periods and selected because serial hematologic evaluations had revealed anemia or reticulocytosis; controls came from a group of 20 normal hospital employees. Dogs were injected iv with a solution of Pb acetate at 0.5 g/6 ml.

As summarized, the anemia produced by Pb intoxication in humans as well as experimentally induced Pb poisoning in dogs results in a positive direct

Coombs test. The direct antiglobulin test will become positive within 24 hr in cases of severe Pb poisoning in dogs. The blood will form a layer phenomenon when allowed to stand, with the formation of a supernatant fraction of cells above the packed erythrocytes. These cells remain suspended in the plasma for many hours. This superior fraction on a column of blood has a high per cent of reticulocytes, and cells with coarse basophilic stippling. The direct Coombs test is positive in the superior fraction of such a column. The positivity decreases as the sampling approaches the bottom. In many instances the direct Coombs test of the whole blood may be negative and the cells from the superior portion of the column be strongly positive. The latter phenomenon was also found in the above workers. The possible significance of the correlation of the direct antiglobulin reaction and cell immaturity of chemical trauma to the membrane is briefly discussed. (13 references)

- 1723 Teisinger, J., and Srbová, J. (Clinic Occup. Dis., Ind. Hyg., Prague, Czechoslovakia): Zur Frage der Therapie der chronischen Bleivergiftung mit dem Calciumdinatriumsalz der Äthylendiamintetraessigsäure. (TREATMENT OF CHRONIC LEAD POISONING WITH CALCIUM DISODIUM ETHYLENE DIAMINETETRAACETATE.) Archiv für Gewerbepathologie und Gewerbehygiene 14, No. 6: 579-93, 1956.

Since  $\text{CaNa}_2\text{EDTA}$  was not available commercially at the time in Czechoslovakia, the authors prepared the salt using Komplexon II of Swiss and local origin. The toxicity of the preparation was tested on mice; and found to be 4.5 g/kg which agrees with data reported in the literature.

In the course of 1-1/2 yr the authors treated 25 cases of Pb poisoning, and in 5 additional cases showing no signs of poisoning, they tested the value of the drug for the diagnostic mobilization of Pb while the persons continued work. The 25 patients were mild to moderately severe cases; in some colic and pronounced anemia were observed. In 11, sternal puncture showed signs of erythropoietic disorder in addition to some other minor deviations. Signs of nervous system damage were found in only 1 female patient. All patients were followed daily as to elimination of Pb and porphyrin in the urine; stippled erythrocytes, hemoglobin and Pb content in blood were frequently checked in the course of treatment.

In 9 patients, 250 ml EDTA (0.5-1% in physiologic solution) was administered 2 times daily by intravenous (iv) infusion (2.5-5 g within 2-3 hr) for 2-3 days followed by an interval of 1-4 days. The total number of infusions and dose differed, but usually was over 14-35 days. Another group of 12 were treated with iv injections (10 or 20% solution) at a daily dose of 3 g, the treatment day being followed by a 2 or 3-day pause. Four patients received the drug as an aerosol. All treatments were well tolerated. Having first determined the urinary elimination of Pb in nonexposed individuals to be 0.050-0.130 mg/l, and in those with chronic Pb to average  $\sim 0.300$ -1.2 mg/24 hr, they found in all cases following each treatment considerable elimination of Pb, up to 15.75 mg/24 hr.

In the evaluation of the different types of treatment, the authors concluded that iv injection is preferable to infusion. Although its effectiveness is somewhat smaller, it is more convenient and enables an ambulant therapy. They recommend a 20% aqueous solution in a dose of 3 g every 3rd-4th day until all symptoms have disappeared. They also suggest aerosol inhalation of EDTA for prevention of poisoning; however this needs further investigation. They also found iv administration to be most suitable for diagnostic mobilization of Pb. (26 references)

- 1724 Teisinger, J., and Srbová, J. (Clinic Occup. Dis., Ind. Hyg., Prague, Czechoslovakia): TREATMENT OF CHRONIC LEAD POISONING WITH CALCIUM VERSEDATE. Pracovní Lékařství 8:163-9, 1956.

See preceding abstract.

- 1725 Trelles, J.O., Polack, F., and Guerra, G.: (LEAD ENCEPHALOPATHY.) Rev. neuro-psiquiat. 19:293-321, 1956.

Familial Pb poisoning occurred in both parents and 3 infants from 1-3 yr of age. The father worked at home preparing Pb plates for batteries of automobiles. The course of the disease was relatively slow in all but 1 patient. One of the infants was treated with  $\text{CaEDTA}$ . The Pb impregnation of the tissues diminished, but the clinical course of the disease was unchanged. In 1 of the infants the disease followed a rapid course for 1 mo. The patient died with an acute Pb encephalopathy. Autopsy revealed that the predominant lesions were meningeal, neuronal, and vascular. The changes in the cerebral and cerebellar cortex and the inferior olive were similar to those of experimental Pb poisoning, but without glial reaction. The level of Pb content in the tissue was not correlated with intensity of the lesions. (From Journal of the American Medical Association 164:814, 1957)

- 1726 Van Bogaert, L. (Antwerp, Belgium): Über bleibedingten Parkinsonismus mit begleitender Augenmuskellähmung (anatomische Studie). (PARKINSON'S DISEASE CAUSED BY LEAD EXPOSURE WITH ACCOMPANYING OCULAR MUSCLE PARALYSIS.) Mschr. Psychiatr. (Basel) 131: 73-88, 1956.

This report deals with a printer, 42 yr old at the time of his death in 1933, who had handled Pb type since age 20. In 1918 he developed rheumatic complaints; in 1920 "typical Pb colic," then recovered; in 1926, visual disturbances, tremor and stiffness of left limbs; in 1927, headaches. Diagnosis at that time was myocarditis, chronic nephritis, and incipient Parkinson's disease. In 1933, he showed high blood pressure, 200/100, cardiac insufficiency, constant edema in legs, bilateral tremors at rest, then acute paralysis of the left side. A further rise in blood pressure, rise in temperature, and a urea content of 3.9 mg% was seen. A detailed description of histopathologic examination of the brain is given (5 micrographs) which led to the following conclusion: Pb poisoning can produce a true Parkinson's syndrome, which results from depigmentation of the substantia nigra with gliosis. However, the disease picture differentiates itself clinically and pathological-

ly from the hypertonic-akinetic form of Mn poisoning. The diagnosis of such a case can be essentially of forensic medical interest. Similar reports recorded in the literature are pointed out, and another case of Parkinson's disease by Pb is mentioned in a Pb solderer in whom an autopsy could not be done. (The existence of Parkinson's disease caused by Pb does not seem to the reviewer (Symanski) to be proved in any way by the description of the work history and clinical data). (From *Zentralblatt für Arbeitsmedizin und Arbeitsschutz* 7:69 (Abstracts), 1957)

- 1727** Vaughan, J.M. (Nuffield Dept. of Med., Oxford, England): THE EFFECTS OF RADIATION ON BONE. In G.H. Bourne, ed.: *The Biochemistry and Physiology of Bone*, Academic Press, New York, 1956, pp. 729-65.

In discussing pathological changes induced in bone by internal radiation, the author states (p 753) that the damage to the ends of long bones is especially pronounced in young people who have been exposed to Ra while their epiphyses are still active. Closure may always remain incomplete or increased calcification may result giving a so-called "Pb line" which is possibly similar in pathology to the growth lines produced by infection or the transverse dark lines following external radiation.

- 1728** Velling, E.I.: (HEMATOLOGIC CHANGES IN INDUSTRIAL POISONINGS.) *Materialy po Voprosam Gigieny Truda i Klin. Professional. Boleznei* (Gorki) Sbornik 1956, No. 5: 174-80.

In the first stages of acute poisoning with cyanides, TEL or Hg the following symptoms were observed in the peripheral blood: erythrocytosis, an increase of hemoglobin, a moderate reticulocytosis, the appearance of single normoblasts and considerable qualitative changes. Hypochromic anemia, basophilic granularity of erythrocytes, reticulocytosis, increase of the amount of immature cells of the erythroblastic series in bone marrow and a change of the physicochemical properties of the blood are recorded in acute Pb poisoning. (From *Chemical Abstracts* 53:13392, 1959)

- 1729** Villaumé, J., Méniel, M., Lambert, G., and Deleplanque, G.: Les signes biologiques du saturnisme. (BIOLOGICAL SIGNS OF LEAD POISONING.) *Médecin d'Usine* 18, No. 5:243-8, 1956.

See Abstract No. 1875.

- 1730** Viniegra, G., Morales, F.M., Lopez Martinez, A., Gerni, R.L., and Izaguirre, B.L.: TREATMENT OF LEAD POISONING WITH DISODIUM CALCIUM ETHYLENEDIAMINETETRAACETATE IN A FACTORY MANUFACTURING LEAD OBJECTS. *Bol. Epidemiol.* 20:172-83, 1956.

Ten patients suffering from saturnism were treated by administering EDTA at a daily dose of 1.5 g. This treatment was satisfactory, but some minor disagreeable symptoms were observed during treatment. EDTA cannot be used as a prophylactic agent. It is believed that interrupted injections may hold the danger of sensitization or action of EDTA as a toxic substance. Only industrial hygiene

is suitable for prevention of saturnism. (From *Chemical Abstracts* 52:17567, 1958)

- 1731** Wegelius, O., and Harjanne, A. (Maria Hosp., Helsingfors, Finland): TREATMENT OF LEAD POISONING WITH CALCIUM ETHYLENEDIAMINETETRAACETIC ACID. *Scandinavian Journal of Clinical and Laboratory Investigation* 8:335-7, 1956.

No untoward effects were noted when patients with chronic Pb poisoning were treated with 2.5 g CaEDTA in 1 l 5% glucose administered iv over 2-3 hr for 10 days. The results, based on daily Pb excretion and coproporphyrin determinations, showed a rapid and favorable effect on the excretion of circulating Pb. (16 references)

- 1732** Yamaga, S., Saruta, K., and Shimazu, Y. (Yokohama Med. Coll., Japan): (A SURVEY ON INDUSTRIAL LEAD POISONING.) (Report III). *Journal of Science of Labour* (Japan) 32:991-5 (Dec.), 1956.

Comparative studies of several common tests done on a group of 70 Pb workers and on 57 painters were made. It was found that a decrease of blood specific gravity and of hemoglobin was more frequent among painters than among Pb workers, with significant difference ( $\alpha=0.05$ ); positive reaction of urobilinogen in urine was more frequent among Pb workers than among painters, with significant difference ( $\alpha=0.05$ ); and abnormalities in other tests, ie, decline of blood cell counts and of A/G ratio, and positive reaction of coproporphyrin and of albumin in urine, were not different between the 2 groups. (From authors' English summary)

- 1733** Yanev, P., Panitsa, D., and Papazov, G. ("I.P. Pavlov" Hosp., Plovdiv, Bulgaria): Ostra khemolitichna anemiya pri olovno otravyane. (ACUTE HEMOLYTIC ANEMIA IN LEAD POISONING.) *Suvremenna Meditsina* (Sofia) 7, No. 1:106-9, 1956.

The case described is that of a 21-yr-old farmer, whose blood picture showed 1,900,000 erythrocytes, 40% Hb, 13,950 leukocytes, 120,000 basophilic stippled erythrocytes, among other findings which included icteric coloration. Pb in blood was 99.88  $\mu\text{g}\%$ , in spinal fluid, 7.35  $\mu\text{g}\%$ , in stomach juice, 1.19%. His history revealed that 4 yr earlier he had had malaria, then gripe, and the year before hospitalization, pleuritis. The source of Pb poisoning was traced to consumption of marmalade kept in Pb-glazed containers. Treatment was with Ca gluconate, vitamin C, glucose, iodine, etc. Recovery took 2 mo. The authors state in their summary that in cases of acute hemolytic anemia, it is necessary to consider Pb poisoning, and that it does not occur only in acute, but also in chronic poisoning.

- 1734** Yoshida, Y.: STATISTICAL STUDIES ON THE URINE COPROPORPHYRIN EXCRETION IN JAPANESE FEMALE ADULTS. *Journal of Osaka City Medical Center* 5:33-48 (Jan.), 1956. In *Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School*. Vol. 1, April 1949-March 1959, p. 41.

Daily coproporphyrin (CP) excretion was measured

in 392 healthy Japanese female adults and 160 normal Japanese pregnant women. Statistical studies were performed on the theoretical distribution type and the upper normal limit for the 2 groups. The theoretical distribution followed the log-normal type. The results showed that 95 and 99% excreted 75.9 and 105.4  $\mu\text{g/day}$ , respectively. No significant seasonal variation was observed except in the 50-yr group. No significant difference was observed among age groups. Among the pregnant group, 95 and 99% excreted 58.9 and 77.7  $\mu\text{g}$ , respectively. No significant differences were observed in the different stages of pregnancy. Significant differences between healthy males and females also were not seen.

- 1735** Zahorski, W., Myślak, Z., and Chmielowski, J. (Inst. Med. Pracy, Zabrze, Poland): (THERAPEUTIC AND PROPHYLACTIC ACTION OF CALCIUM VERSENATE IN LEAD POISONING. II. POLAROGRAPHIC STUDIES ON THE BEHAVIOR OF LEAD IN THE BLOOD AND URINE OF TREATED PATIENTS.) *Medycyna Pracy* 7:189-98, 1956.

Administration of CaEDTA to Pb-poisoned subjects quickly mobilized Pb deposited in tissues: blood Pb level increased from 112-189  $\mu\text{g}\%$  to 400-600  $\mu\text{g}\%$  (1st day of treatment), and urine Pb level was raised from 9-44  $\mu\text{g}\%$  to 800  $\mu\text{g}\%$  (2nd-3rd day of treatment). Serum Ca and P levels were not affected by the drug. The clinical importance of the observations is discussed. (From *Chemical Abstracts* 53:18294, 1959)

- 1736** Zannini, D., and Odaglia, G. (Univ. Genoa, Italy): Contributo all studio del circolo periferico nei saturnini. Sull'azione degli alcaloidi idrogenati della segale cornuta. (PERIPHERAL CIRCULATION IN LEAD POISONING PATIENTS. THE ACTION OF HYDROGENATED ALKALOIDS OF ERGOT.) *Gazzetta Medica Italiana* 115:223-30, 1956.

Five cases of chronic Pb poisoning suffering mainly from digestive disorders, having recovered from acute attacks, for whom laboratory findings as to elevated urinary and blood Pb and coproporphyrinuria have been recorded, are described. In addition they presented disturbances of acroparesthesia and acroasphyxia. Treatment, im, with hydrogenated ergot alkaloids brought about definite changes in the various areas of the peripheral vascular system, as evidenced particularly by photoplethysmographic and capillaroscopic examination of an increase in the digital pulse and of an improved capillary circulation. (24 references)

- 1737** Zosin, P., and Gavrilesco, S. (Med. Clinic I, Timisoara, Romania): Consideratii asupra leziunilor renale si hepatice in saturnism. (KIDNEY AND LIVER LESIONS IN LEAD POISONING.) *Medicina Interna* 8:257-63 (Apr.-May), 1956.

Examination of 150 workers (17-64 yr old, 81% of them male) with signs of Pb poisoning were subjected to liver and kidney function tests, and blood pressure measurements. Urinalysis on 100 of them showed albumin in 13, 9 of whom were hypertensive; slight hematuria was found in 4, and cylinders in 4. Twenty, with moderate poisoning, selected for further study, were separated into

the normotensive and hypertensive. It was found that the functional changes were more frequent and marked in the hypertensive, leading to the conclusion that these changes in kidney function were secondary to this state. Liver function tests were positive in 11% of the cases followed. The changes were discrete and could be attributed in part to Pb poisoning. (16 references)

1957

- 1738** Albahary, C., and Boudène, C.: (St. Denis Hosp., Paris, France): Saturnisme alimentaire par bouchon-verseur de vinaigrier. Remarquable effect d'un détoxifiant: le versenate de calcium disodique (Ca EDTA). (ALIMENTARY LEAD POISONING FROM THE POURING SPOUT OF A VINEGAR CRUET. REMARKABLE EFFECT OF A DETOXICANT: CALCIUM DISODIUM VERSENATE (CaEDTA).) *Semaine Hôpitaux de Paris* 33, No. 14:1-5, 1957.

A 42-yr-old woman who worked as a book-binder in a library, over a period of 2 yr developed an anemia which did not respond to the usual treatment. Within the following 2 yr she suffered repeated attacks of violent epigastric pain and vomiting. Clinical tests revealed an intensely gray gingival line (Burton's), slight hypertension and enlargement of the liver. The blood contained 0.1 mg Pb/100 ml. A diagnosis of Pb poisoning was made; upon treatment with CaEDTA her symptoms disappeared but a slight anemia remained. Analysis of her drinking water showed a Pb content of 150  $\mu\text{g/l}$  which was considered too small to cause the poisoning. However, it was found that she had been using a vinegar cruet with a pouring spout made of an alloy containing 59% (weight) Pb. The vinegar poured through this spout contained 1.6 mg Pb/ml or 16 mg/tbs (1 tbs = 10 ml).

The action of CaEDTA as a detoxicant in Pb poisoning is discussed: While the urinary coproporphyrins drop rapidly and the Pb concentration in the urine increases greatly, the decrease of stippled erythrocytes is delayed for a few days and there is little change in the Pb level of the blood. The optimum dose of CaEDTA by injection should not exceed 3 g/day for an adult of 50 kg weight, a daily oral dose of 4 g is tolerated but not as effective. It is pointed out that subacute Pb poisoning is best diagnosed by the presence of stippled erythrocytes and urinary coproporphyrins. (22 references)

- 1739** Albahary, C., Truhaut, R., and Boudène, C. (Inst. Ind. Hyg., Coll. Pharm., Paris, France): Saturnisme et detoxication par le versenate de calcium: nouvelles observations. (LEAD POISONING AND DETOXICATION BY CALCIUM VERSENATE: NEW OBSERVATIONS.) *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 18, No. 1:40-6, 1957.

The results of treatment of 3 cases of Pb poisoning, 2 of them occupational, the 3rd of alimentary origin, are described. CaEDTA was used iv, or orally, or both. In discussing the results, the authors raise the question of the safety of iv administration; in any event, dosage should not exceed 3-4 g/day in adults. Orally, this dose is

well tolerated. They also suggest that it may be administered orally before any sign of poisoning has appeared to workers exposed to high concentrations of Pb.

- 1740 Ambrosino, C., Liberatori, J., Lovisetto, P., Sibour, F., and Turco, G.L. (Univ. Turin, Italy): Studi sul comportamento elettroforetico delle emoglobine di soggetti normali e di soggetti con anemia da piombo. (ELECTROPHORETIC BEHAVIOR OF HEMOGLOBIN IN NORMAL INDIVIDUALS AND IN PATIENTS WITH LEAD ANEMIA.) *Rassegna di Fisiopatologica Clinica e Terapeutica* 29: 1241-61 (Nov.), 1957.

Six normal individuals and 14 Pb poisoning patients were examined. The free phase electrophoresis (phosphate or cacodyl buffers) showed for all subjects only 1 component (phosphate buffer) or several (cacodyl) in both the ascending and descending branches of the pherogram. For a 20-hr electrophoresis 7 such components were found; they showed no analogy with those obtained for normal adult CO-hemoglobin by Derrien and Reynaud (1953). By paper electrophoresis (barbital buffer, 8-9 hr) also no marked difference between normal individuals and Pb patients was observed. (From authors' summary; 71 references)

- 1741 Ambrosio, L., Serra, C., and Mazza, V. (Italy): ELECTROMYOGRAPHIC STUDY IN OCCUPATIONAL POISONING. In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. II, Summaries, p. 74.

Workers subject to occupational poisoning often show subjective troubles (paresthesia, pain in limbs) or actual insufficient motorial function. A study of the action potentials of the brachial biceps, body-flexor, abductor, gastrocnemius, anterior tibial muscles was made to this end by means of an electromyograph furnished with 3 cathodic tubes with coaxial electrodes. The following cases of poisoning were examined: acute CO poisoning, 15 cases; C disulfide, 22; Pb poisoning, 23. Electromyograms in CO poisoning showed in all the muscles examined, a slight innervatory deficit, with very wide voltage potentials, often polyphasic, of increased duration, rarefied; the findings were reversible as time went by; in most serious cases lasting many days, minute fibrillatory potentials occurred. In laboratory studies on rabbits, similar potentials appeared as early as 8-10 days after the acute event. In C di-sulfide poisoning, is-chemic factors prelinated especially in the abductor, gastrocnemius, anterior tibial muscles, while pathologic potentials of a "neurogen" type were present especially after long exposure. In Pb poisoning, the biceps brachial, body-flexor muscles were mostly affected; often troubles of a neurogenic type were present due to trophic disturbances; "myogen" blended signs were rarely found.

On the basis of their studies, the authors believe that the electromyographic test should be considered as a modern supplement of considerable value in the diagnosis and prognosis of the action by occupational poisons on the neuromuscular system.

- 1742 Antoniotti, F., and Murino, P. (Univ. Rome,

Italy): Osservazioni casistiche ed indagini sperimentali sull'intossicazione da arseniato di piombo. (CASE REPORTS AND EXPERIMENTAL FINDINGS ON LEAD ARSENATE POISONING.) *Acta Medicinæ Legalis et Socialis (Liège)* 10:249-63 (June-Sept.), 1957.

Following a literature review 2 cases of criminal poisoning by Pb arsenate are described. (1) A 40-yr-old man had been given small doses of Pb arsenate for 3 mo. The first signs of intoxication consisted of continued nausea, anorexia, gastric pyrosis, sleepiness, vomiting, headache and intermittent fever; the urine contained traces of albumin, some hemoglobin and hyaline cylinders. After 3 mo a neurologic syndrome, characteristic of As poisoning, was obvious. A slight Pb line indicated Pb poisoning. Urine analyses about 6 mo after the first nervous signs had appeared showed the presence of Pb and As in an amount corresponding to 69 mg Pb arsenate/l. (2) A farmer's wife, 37 yr old, showed general malaise, intermittent fever and vomiting, diarrhea and epigastric pain. She seemed to recover, but 1 mo after the appearance of the first symptoms she developed asthenia and paresthesia. Urine and blood tests showed no pathologic changes. She improved, later was operated on for hysterectomy and again was given a single dose of Pb arsenate. About 17 mo after the first signs of poisoning and 3 mo after the last administration her urine was found to contain 0.032% Pb but no As. After 20 mo no Pb nor As was found in the urine while the hair contained 0.43 g% Pb and 0.30 g% As (10 times normal). The authors state that both cases took a similar course, starting with gastrointestinal disturbances and resulting in a paretic polyneuritis.

Experiments were made with 13 rabbits, 1-2.1 kg weight, which were given by gastric tube, for 2-60 days a daily dose of 0.04-0.2 g of a commercial Pb arsenate containing 19.1% As and 58.9% Pb. Gastrointestinal disturbances were followed by paresis, muscular tremor and death within 2-60 days. The authors conclude that the resulting syndrome was solely that of As poisoning and not Pb intoxication. (37 references)

- 1743 Ardaillou, R. (Paris, France): L'utilisation des chélateurs dans l'intoxication par les métaux lourds. (THE USE OF CHELATING AGENTS IN INTOXICATION BY HEAVY METALS.) *Vie Médicale (Paris)* 38, No. 8: 1045-6, 1049-51, 1957.

The use of CaEDTA in Pb, Cr, Co, Be and Pu poisoning is discussed. (13 references)

- 1744 Ashbel, S.I., Gulina, O.M., and Kornakova, A.A.: (METHOD FOR DETERMINATION OF VITAMIN K AND OF ITS CONTENT IN BLOOD, IN NORMAL CASES AND IN CERTAIN CASES OF POISONING.) *Materialy po Voprosam Prom. Toksikol. i Kliniki Professional. Bolenzneĭ, Sbornik* 8:97-108, 1957.

A new method for the quantitative determination of vitamin K in blood serum, using a reaction with  $C_6H_5NH_2$ , is described. Data obtained for normal people (24 medical students) ranged from 1.74-3.29 mg% with a prothrombin time of 17-25 sec. Low

levels in blood, 0.58-1.62 mg%, were observed in 11 out of 28 cases of chronic benzene poisoning and 13 cases of chronic Pb and TEL poisoning. Prothrombin time remained normal. (From Chemical Abstracts 55:21230, 1961)

- 1745** Baldi, G., and Sbertoli, C. (Univ. Milan, Italy): Evoluzione delle alterazioni renali che possono condurre al rene grinzoso saturnino: un caso dimostrativo. (THE DEVELOPMENT OF RENAL LESIONS LEADING TO A SATURNINE CONTRACTED KIDNEY: DEMONSTRATIVE CASE.) *Medicina del Lavoro* 48, No. 10: 533-8, 1957.

A workman employed for 11 yr as Pb scrap smelter, suffering from chronic poisoning with repeated colics, still showed decreased blood N and hyposthenuria 1 mo after he had recovered from the last colic. Selective functional tests showed a decrease of renal blood flow (-23%) and a corresponding decrease of glomerular filtration rate (-25%), with unimpaired tubular function. These data suggested a spasm of glomerular afferent arterioles. The spasm could be considered as transient and the renal insufficiency as reversible; but a stage of the development of Pb damage evolving into arteriosclerotic organic changes could also be surmised by the authors. A second renal function test, 1-1/2 mo later, showed a marked decrease of renal blood flow and of glomerular filtration rate as well as an evident impairment of the tubular secretion.

The authors consider that since the tubular secretion is not much impaired by the transient ischemia due to a spasm, but is always altered by the ischemia due to arteriosclerosis, the decrease of secretion capacity suggested the onset of arteriosclerotic lesions. This, they state, is the first case described so far where a saturnine kidney condition has been studied in its evolution passing from the stage of functional lesion to that of organic change. This confirms the modern theory on the pathogenesis of chronic saturnine kidney, which considers the contracted kidney as the result of an arteriosclerotic process due to repeated angiospasm and not a consequence of inflammatory glomerular lesions. (From authors' summary; 14 references)

- 1746** Baltimore Department of Health: LEAD POISON EXPOSURE IN A GLASS MANUFACTURING PLANT. *Baltimore Health News* 34, No. 8: 164-6, 1957.

In a glass container manufacturing plant the Pb content of the blood of 6 workers ranged from 0.057-0.12 mg/100 g. Determinations carried out on 47 samples from 28 employees showed that in 21 cases the Pb content of the blood was >0.06 mg/100 g but only 1 employee of this group had any symptoms of Pb poisoning. Air samples at 2 points of the factory contained 0.237 and 1.973 mg Pb/m<sup>3</sup>, respectively. Improvements in the factory resulted in lower Pb values in the air and in the blood of the workers.

- 1747** Barry, P.S.I. (Assoc. Ethyl Co. Ltd., England): A RECENT CASE OF MILD TETRAETHYL LEAD INTOXICATION. *Transactions of the Association of Industrial Medical Of-*

*ficers* 7, No. 2:71-3; discussion, 73-4, 1957.

A man, 40 yr old, had been engaged in maintenance work in a TEL plant for 10 mo when he complained of anxiety, sleeplessness, headache and metallic taste. On examination, he was found to be in a state of extreme agitation, with a marked tremor of his outstretched hands but otherwise normal reflexes and no other signs of the central nervous system. He had a previous history of neurasthenia and amnesia while serving in the army. He admitted to exposure to TEL: while working in a pump house (almost saturated atmosphere) his airline became accidentally disconnected for 2 min; it is assumed, however, that repeated exposure must have occurred. He was sent home with the diagnosis of mild TEL poisoning and his symptoms diminished within 2 mo when he resumed work. Although he was restricted from work in the TEL plant, he had spells of headache for the following 3 mo. Urinary Pb, measured at weekly intervals, ranged from 583 µg at the onset of his illness to 60 µg/l at his recovery. Pb in the blood during the same period ranged from 112-53 µg/100 g, stippled cells from 6000+3000+11,500+400/million, hemoglobin from 90-106%. The feces contained 280 µg Pb/g ash at the onset of the illness and 110 µg/g ash 2 mo later. The author concludes that the case described is typical for mild TEL intoxication and occurred as a result of a failure fully to appreciate the necessity for maintenance of the highest levels of safety measures.

One of the discussants was concerned with the risk in the storage of Pb gasoline in enclosed spaces in ships. Barry pointed out that the small amount of TEL contained in gasoline would be hazardous only when the gasoline became evaporated to 1/3 of its volume, in which case gasoline fumes would be the risk. Other answers were that in England there had been 1 case of TEL poisoning in manufacture, and a number of incidents among tank cleaners (10 cases since the war). As to a question of the significance of the time lag between the highest point of urinary output of Pb and the highest stipple cell count, Barry could not explain it, and said that it was not usual in TEL poisoning to find any rise in stipple cell count.

- 1748** Barsi, C. (Inst. Ind. Med., Florence, Italy): Su alcuni casi di saturnismo nella produzione del minio. (SOME CASES OF LEAD POISONING IN THE PRODUCTION OF MINIMUM.) *Rassegna di Medicina Industriale* 26:315-9 (July-Aug.), 1957.

Nine cases of Pb poisoning in 2 factories producing minium are reported. Clinical signs, such as colic, anemia or gastritis, appeared after an exposure of 1-5-1/2 mo. Erythrocyte counts ranged from 3.0-5.6 million, Hb from 57-80%, basophilic cells (in 7 subjects) 1500-16,000/million; urinary porphyrin was increased; the Pb level in the blood was 22-57 µg%. It is pointed out that technical deficiencies in the factories were responsible for the poisonings.

- 1749** Bastenier, H., Deslypere, P., and De Graefmillet (Mme) (Belgium): Un test utile pour le diagnostic du saturnisme. (A USEFUL



# TEST FOR DIAGNOSIS OF LEAD POISONING.)

In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 243-5.

Intravenous injections of CaEDTA were administered in order to produce a rapid urinary excretion of Pb. Comparisons were made between Pb elimination in the urine by normal subjects and by subjects with Pb poisoning. A standard test is presented which may be useful for medico-legal diagnosis of Pb poisoning.

- 1750 Beritic, T., Grgic, Z., and Sirec, A. (Yugoslavia): IRON CONTAINING BLOOD CELLS IN HUMAN LEAD POISONING. In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 184-5.

The Fe-containing inclusions in erythrocytes and in their precursor were studied in 10 cases of Pb poisoning in the aim of detecting morphologically the presence of nonutilized Fe deposits.

It was found that the number of erythroblasts with Fe-positive granules was invariably high in the bone marrow of the patients, ranging from 74-96%. Fe-containing erythrocytes in the peripheral blood of the same group, however, were present in much smaller numbers. A relatively high number of the marrow reticuloendothelial cells with stainable Fe content was also found.

Basophilic stippling (BS) was frequently seen in the siderocytes and sideroblasts. As explained by the authors, in addition to Fe-positive granules which stain blue (Prussian blue reaction), the above forms in Pb poisoning contain Fe-negative granules which stain red (with counterstain), thus giving distinct color contrast; but they differ distinctly in number, shape and position within the cell. BS granules are the more numerous, almost invariably round, regular and well defined, while the Fe granules vary in shape and size and are often ill-defined. BS granules are diffusely scattered within the cell; the Fe granules are usually situated close together or in the center or periphery of the siderocyte or in the perinuclear zone of the sideroblast.

- 1751 Berrod, F. (Dijon, France): Les méthodes biologiques de diagnostic du saturnisme. (BIOLOGICAL METHODS FOR DIAGNOSIS OF LEAD POISONING.) Vie Médicale (Paris) 38, No. 8:1021-7, 1957.

A review with 18 references, including chelate mobilization tests in questionable cases.

- 1752 Besançon, M. (Metallurgy Soc., Normandy, France): Plomb et hyperazotémie chez les jeunes. (LEAD AND HYPERAZOTEMIA IN YOUTHS.) Médecin d'Usine 19, No. 9:641-4, 1957.

Samples of air and dust taken in a galvanizing workshop were examined for Pb content by polarography. Results were (in  $\mu\text{(sic)}/\text{l air}$ ) 4.6 (vapor) and 0.81 (dust) above the preheating bath and 0.91 (vapor) and 3.6 (dust) above the retort, much higher than the MAC of 0.15. The dust was 10% Pb and could be inhaled or swallowed. Case histories were presented of 2 20-yr-old workers who showed basophilic stippling (BS) (36 and 22/100 leukocytes) and high blood urea values (0.82 and 0.59), but no

albuminuria or previous nephropathy. One also showed blood Pb content of 170  $\mu\text{g}/100\text{ ml}$ . When they were removed from the Pb source, the values decreased without treatment. They are described as cases of "isolated hyperazotemia, coinciding with exposure to the poison and disappearing more or less quickly with it." A 30-yr-old worker showed blood urea of 0.61, no albuminuria or previous nephropathy, and BS of 25/100 leukocytes. After being removed from the Pb source, the blood urea remained high for 4 mo. Hospital examination showed blood urea 0.45, Ambard constant 0.116, PSP 58%, normal EKG and blood cholesterol. It was described as a case of "slight, isolated N retention yielding only slowly to removal of the toxic deposit."

The author concluded that (1) the N retentions were caused by Pb; (2) it was not necessary to consider these N retentions of Pb origin as incipient nephritis; and (3) to prevent Pb nephritis, the factory doctor should determine blood urea at pre-employment, determine blood urea yearly in exposed subjects, and follow-up the azotemia after removal from work because of disease. If a young worker shows a normal blood urea at preemployment, slight N retention not yielding to removal of the Pb, no nephropathy foreign to the work, and clear signs of Pb absorption, he should consider a declaration of occupational disease.

- 1753 Bidstrup, P.L. (London Hosp., England): CALCIUM DISODIUM VERSENATE. (SODIUM CALCIUM-EDETATE.) Practitioner 179, No. 1071:314-21, 1957.

The literature on the therapeutic uses of  $\text{CaNa}_2\text{EDTA}$  is reviewed. It is of value in the treatment of Pb poisoning, and in the case of Pb encephalopathy in children is the only therapeutic agent known which dramatically alters the course of the disease and results in rapid relief of symptoms, with no sequelae due either to Pb or to the drug. A case is described in which  $\text{CaNa}_2\text{EDTA}$  was used in the treatment of Pb palsy. (15 references)

- 1754 Boccia, D.: Prevencion medicamentosa y tratamiento actual del saturnismo. (CURRENT MEDICAL PREVENTION AND TREATMENT OF LEAD POISONING.) Semana Medica (Buenos Aires) 111:985-8 (Nov. 14), 1957; Current List of Medical Literature 34:11553, 1958.

- 1755 Boglevskaya, N.M.: Bioelektricheskaya aktivnost kory i bazal'nykh otdelov mozga pri svintsovoi intoksikatsii. (BIOELECTRIC ACTIVITY OF THE CORTEX AND BASAL SEGMENTS OF THE BRAIN IN LEAD POISONING.) In Trudy Yubileinoi Nauchnoi Sessii Posvyashchennoi 30-Letnei Deyatel'nosti Instituta 1924-1954. Leningrad, Ministerstvo Zdravookhraneniya RSFSR, Institut Gigeny Truda i Profzabolevaniy, 1957, pp. 426-34.

EEG's were performed on 15 patients with various degrees of Pb poisoning and 6 controls. Characteristic changes in central nervous system function of varying degree of severity were seen in the Pb cases. These changes were attributable to the appearance of changes in the frontal portions of the cerebral cortex and subcortical regions. In the other portions of the brain, depending on

the severity of poisoning, functional changes of varying degree were observed.

- 1756** Bonzel, J., and Bonzel, H. (France): Un curieux cas de saturnisme. (A CURIOUS CASE OF LEAD POISONING.) *Annales de Biologie Clinique* (Paris) 15:731 (Oct.-Dec.), 1957.

The case described is that of an X-ray technician who, with her mother lived in an apartment above an X-ray laboratory in which both worked. She was referred to the authors by her family physician for a complete examination because of repeated complaints of intestinal disorders and pain in the liver region. History revealed her father to have had liver cancer. Thorough examination showed only a slight anemia. In the meantime, her mother also required an examination; she also exhibited a slight anemia accompanied by an unexplained pronounced neutropenia. Radiation injury, first suspected, was excluded because of the normal blood formula. Having observed the Pb line on the gums of the patients, Pb poisoning was then confirmed by the presence of basophilic stippling of erythrocytes (120/100 leukocytes in the mother), Pb in blood (130 µg/100 ml in the daughter, 90 in the mother), coproporphyrinuria (90/1000 and 100 respectively). Analysis of tap water for Pb showed 0.3 mg/l. The entire plumbing of both the laboratory and apartment was of iron and copper. However, several meters of Pb pipe extended below and above the meter, and were probably the site of electrolysis by way of ground wire; in fact, the X-ray apparatus was grounded to the water pipe.

The authors state in conclusion that numerous cases of Pb poisoning due to water have been reported. However, in a similar case which was reported to them, the manipulation of Pb letters used for revising the name plates by X-ray technicians, was incriminated as the only cause.

- 1757** Borello, E., Lovisetto, P., Turco, G.L., and Sibour, F. (Univ. Turin, Italy): Studi sulla emoglobina nell'anemia da piombo. IV. Spettroscopia nell'infrarosso. (HEMOGLOBIN IN LEAD ANEMIA. IV. INFRARED SPECTROSCOPY.) *Bollettino della Società Italiana di Biologia Sperimentale* 33:303-4, 1957.

The infrared spectrum of hemoglobin from 8 cases of Pb poisoning did not differ from that of normal hemoglobin.

- 1758** Boudouresques, J., and Guillot, P. (France): Oedème papillaire, manifestation solitaire d'une intoxication par le plomb. (PAPILLEDEMA, SOLITARY MANIFESTATION OF LEAD POISONING.) *Marseilles Médical* 94, No. 10:693-5, 1957.

The case described is that of a 23-yr-old woman who presented bilateral papillary stasis with edema. History revealed that for 1-1/2 mo she had had headaches with vomiting. Hematologic findings revealing the presence of 130 stippled cells/10,000 led to consideration of Pb poisoning, which appeared to be justified since the woman worked in an unventilated workroom for enameling operations in a tile manufacturing shop. Finding Pb in blood confirmed the diagnosis (80 µg/100 ml;

Pb in urine, 90 µg/l). Treatment was first with Mg sulfate iv and BAL im every 4 hr for 2 days, followed by injections every 6 hr for 3 days, and 2 injections/day for 10 days. The authors found the effectiveness of BAL astounding; all signs disappeared.

- 1759** Boulding, J.E., and Baker, R.A. (Crease Clinic Psychological Med., Essondale, British Columbia, Canada): THE TREATMENT OF METAL POISONING WITH PENICILLAMINE. *Lancet* 2:985 (Nov. 16), 1957.

A worker in a Pb smelter with an increased number of stippled red blood cells and a urinary Pb excretion of 510 µg/l was removed from exposure. After 2 days' treatment with 0.3 g penicillamine 3 times/day, 1/2 hr before meals, urinary Pb excretion was >2000 µg/l and he became free of symptoms. (The case was not considered as definitely confirmative for the effect of penicillamine due to the mildness of the symptoms.) A woman worker, intermittently exposed to Pb vapors for several years and suffering from abdominal colic, anemia and symptoms suggesting peripheral neuritis, did not improve after 1 mo of conventional treatment for Pb poisoning. When given 0.3 g penicillamine 3 times/day 1/2 hr before meals for 14 days, urinary Pb excretion rose from an initial 530 µg/l-1530 µg/l after 4 days and 2000 µg/l after 13 days and symptoms disappeared soon. A man with liver disease and other signs of Fe poisoning and a urinary Fe excretion of 2.8 mg/24 hr, was given 0.3 g penicillamine 3 times/day 1/2 hr before meals for 3 days. Urinary Fe was 2.5 mg/24 hr on the 2nd and 5.5 mg/24 hr on the 3rd day of treatment. A woman with hemochromatosis and bronze diabetes did not respond to the penicillamine treatment. The author points out that further investigations are needed in order to determine the value of treatment with penicillamine in metal poisoning.

- 1760** Boyd, P. (Assoc. Ethyl Co., Ltd., London, England): TETRAETHYL LEAD POISONING. (Letter to the Editor.) *Lancet* 1:430 (Feb. 23), 1957.

In reply to a letter (Abstract No. 1850), Boyd states: The case described by Dr. G.L. Robinson in his letter last week is not really typical of TEL poisoning because neither a marked anemia nor punctate basophilia are characteristic of this form of Pb poisoning, and the central nervous system is always affected. Scaling of tanks which have contained Pb gasoline usually results in exposure to inorganic Pb salts combined with other Pb compounds which are the result of the breakdown of TEL. It would seem that the brief description of this particular case is substantially that of ordinary Pb poisoning. It should also be mentioned that Pb can always be found in the urine of normal people who have had no specific exposure, since this metal is invariably present in very small amounts in the atmosphere and food of an industrial community. Accurate methods of analysis have proved these facts. Finally, Boyd doubts much if any case of ordinary Pb poisoning with normal kidney function would have typical symptoms and signs unaccompanied by an excretion of Pb in the urine in excess of normal.

1761 Boyd, P.R., Walker, G., and Henderson, I. N. (Assoc. Ethyl Co., Ltd.; Middlessex Hosp., London, England): THE TREATMENT OF TETRA-ETHYL LEAD POISONING. *Lancet* 1:181-5 (Jan. 26), 1957.

Five men had worked for 6 wk cleaning underground gasoline tanks. They had been provided with protective clothing and face masks, but had disregarded the safety instructions. One, who remained on the surface showed no signs of poisoning. The others, 3 with moderately severe and 1 with severe central nervous system signs of TEL poisoning (anorexia, anxiety, fatigue, depression, insomnia with nightmares, etc, confusion, paranoia, hallucinations and violence) as well as gastrointestinal and other complaints were hospitalized and treated with  $\text{CaNa}_2\text{EDTA}$ , orally and intravenously (iv) as well as with oral penicillamine.

During hospitalization, urine was collected daily for estimation of Pb, coproporphyrin (CP) and creatinine; Pb analyses were also made on feces daily; and on blood frequently. Cases 1-3 were treated for 3-day periods with 1 g  $\text{EDTA}/30$  lb body weight/day by iv infusion over 4-6 hr; with 300 mg 3 times daily and with 1 g  $\text{EDTA}$  4 times daily orally. In each case treatment was preceded by 2 days (under sedation) control period. The mean urinary and fecal levels of Pb before treatment were, respectively, in  $\mu\text{g}$  daily: Case 1, (with the longest exposure, 10 yr) 688 and 1000; Case 2, 270 and 540; Case 3, 222 and 710. The details and means of daily output during specific treatments of these 3 cases are shown in a table and summarized in terms of percentage of pretreatment figures (mean, 100%) as follows for urine, feces, and total: Iv  $\text{EDTA}$ , 705, 93, 279; during interval, 222, 103, 136; penicillamine, 231, 69, 118; interval, 163, 62, 91; oral  $\text{EDTA}$ , 240, 69, 118; interval, 254, 75, 123; iv  $\text{EDTA}$  for urine of Case 1 only, 452. Therefore, iv  $\text{EDTA}$  increased urinary Pb 7-fold and total excretion 3-fold, while oral  $\text{EDTA}$  and penicillamine had much less effect. No drug affected the fecal excretion which fell progressively.

There was no change in the blood-Pb content as a result of treatment in cases 1-3, whose mean blood-Pb figures on admission were 51, 63 and 56  $\mu\text{g}/100$  g, respectively. The urinary CP excretion varied considerably from patient to patient and from day to day. The mean pretreatment levels in cases 1, 2 and 3 were 12, 46 and 13  $\mu\text{g}/\text{day}$  and there was no significant change during or as a result of treatment.

After discharge,  $\text{EDTA}$  was given orally, 1 g 4 times/day, every other week until the clinical condition was satisfactory and Pb excretion normal. The total duration of illness was: Cases 1 and 2, 11 wk; case 3, 7 wk.

Case 4 was not treated with this regimen and data were scanty because of the severity of his illness. He was transferred to a mental hospital where drug treatment did not calm him. Electroconvulsion treatment (ECT) was given which enabled the patient to start on  $\text{EDTA}$  iv for 2 days, followed by another ECT on the 3rd day because of recurring restlessness, and  $\text{EDTA}$  infusions on the next 3 days with further improvement. His blood Pb content was as follows: On admission, 86  $\mu\text{g}/100$  g and 89  $\mu\text{g}/100$  g on consecutive days; within 1 mo, the level fell

to 50-60  $\mu\text{g}/100$  g. Urinary CP excretion before treatment averaged 142  $\mu\text{g}/\text{day}$  which fell to 30-60  $\mu\text{g}/\text{day}$  within 1 mo. The average daily Pb excretion before treatment was 5123  $\mu\text{g}$  (urine 789  $\mu\text{g}$ , feces 4334  $\mu\text{g}$ ). After 2 mo treatment, his urinary Pb dropped to 133, and the fecal, to 190  $\mu\text{g}/\text{day}$ . After discharge, the patient received oral  $\text{EDTA}$  as above. Six additional ECT's were given to prevent his recurring depression and paranoia from becoming an ingrained part of his personality. The total duration of his illness was 6 mo.

After discharge all but one patient said that they felt better when taking  $\text{EDTA}$  by mouth, but there was no other correlation between treatment and the relief of symptoms. The exception (Case 2) complained that the abdominal discomfort and diarrhea were aggravated by oral edathamil  $\text{CaNa}_2$ . No other symptoms referable to treatment were noted. No patient showed any desire to commit suicide. (22 references)

1762 Brandt, H.H. (Municipal Hosp. Friedrichshain, Berlin, Germany): Zur klinischen Problematik der Bleivergiftung. (CLINICAL PROBLEMS OF LEAD POISONING.) *Zeitschrift für die Gesamte Innere Medizin und Ihre Grenzgebiete* 12, No. 1:7-12, 1957.

The salient points of this discussion, based upon the literature, are as follows: Adults ingest daily 40-250  $\mu\text{g}$  Pb with their food and in some cases even more since, eg, a hard salami was found to contain 700  $\mu\text{g}$  Pb/kg. A person drinking daily 2.5 l. water containing 2.9 mg Pb/l, showed the 1st signs of poisoning after 2 yr. Inhalation of Pb fumes has resulted in damage of the reproductive organs and women living in the neighborhood of Pb industries were found to suffer from recurrent abortion. A mother who acquired Pb poisoning after parturition, by her milk transferred Pb to a healthy infant who subsequently developed blood changes characteristic of Pb intoxication. Pb entering the lungs passes directly into the bloodstream and is thus distributed in all tissues. Ingested Pb, by way of the portal vein is deposited in the liver and from there excreted in the bile. Circulating Pb occurs as easily soluble colloidal di-Pb-phosphate, stored Pb as difficultly soluble tri-Pb-phosphate; the latter forms an easily mobilizable fraction adhering to the trabeculae of the spongiosa and a more difficulty mobilizable subperiosteal fraction. Possibly, a rearrangement from the 1st to the latter causes the Pb level in the blood to rise without a concomitant increase of fecal or urinary Pb excretion. It may be assumed that Pb, by reacting with some enzymes, inhibits the synthesis of hemoglobin and thus leads to coproporphyrinuria. The ratio of the Pb content of whole blood to plasma is 3:1. Pb is excreted primarily by bile into the gut and secondarily by the kidneys. In chronic plumbism the feces contain 0.3-3.0 mg Pb/100 g; a content of >4 mg/100 g indicates "plumbophagia." The tolerance for Pb varies individually. A Pb level of 100  $\mu\text{g}\%$  has been found in the blood of Pb workers without manifest toxic signs. An alkaline vegetable diet seems to act protectively while food rich in fat promotes susceptibility. The threshold dose by ingestion which is about 2-3 mg/day, is higher than that by inhalation. Daily

doses of 2-3 mg Pb in the drinking water led to poisoning within several months, daily doses of 10 mg within some weeks. Reexposure to Pb after a previous Pb poisoning causes more serious signs within a shorter period. Symptoms may recur even without a 2nd exposure due to some drugs or febrile diseases. Excessive intake of alcoholic beverages increases the storage of Pb in organs rich in lipoids such as brain, adrenals and testes. An increase of stippled red cells to 10-20% is a serious warning though it is not specific for Pb poisoning. Coproporphyrinuria, however, is a definite early sign. Anemia, icterus, increased reticulocytes develop later. The Pb gum line is also not specific. Severe and chronic plumbism may lead to encephalopathy. Treatment consists in removal from exposure, administration of laxatives. Na citrate or CaEDTA, supported by vitamin B<sub>12</sub>, folic acid and cystine. BAL is not recommended. Protective measures in industry and frequent examinations of the workers in all Pb plants are the best means to prevent poisoning. The syndrome caused by TEL differs from that of other compounds. TEL is easily absorbed by the skin and causes cerebral poisoning. The ganglia cells are affected directly and acutely without previous vascular damage. Clinical signs are headache, irritability and bradycardia.

- 1763 Breton, J., and Mars, F.: Une anorexie qui n'était pas "mentale." (ANOREXIA THAT WAS NOT MENTAL.) Presse Médicale 65:1888 (Nov. 20), 1957.

On September 3, a frightfully emaciated (33 kg) 24-yr-old woman with "nervous anorexia" was admitted. The condition had begun to appear in June, with intense abdominal pains and greenish vomiting. Treatment by her physician for bacteriuria improved her condition until July 14 when the pain reappeared accompanied by constipation, anorexia and insomnia. Her character changed drastically from "good-natured girl" to raving maniac. Largactil, prescribed on the basis of "nervous history," had no effect. The physician had her committed for "mental anorexia" in the terminal stage.

After treatment of collapse and several hours' rest, hospital examination revealed subnormal temperature; accelerated pulse due to the rigors of the examination; a slightly muffled cardiac rhythm; a distinct murmur; azotemia 0.66 g; dry, transparent skin; scaly nails; sparse, brittle hair, no alopecia. Trichosis was slight but there was some fine growth in places normally hairless, a sign noted in descriptions of classical mental anorexia. Auscultation and lung X ray were normal. Neurologic examination was negative. The abdominal pains were ascribed by the patient to an 8-yr-old appendectomy scar. Pains improved with heat application. Vagina and uterus were normal, history of painful menstruation. Amenorrhea, the main classical sign of mental anorexia, was lacking. Psychiatric examination revealed no symptoms of manic-depressive state, dissociation, confusion, hallucination or delirium. Intelligence was normal. The reason for her total refusal of food, patient stated in these words: "Why should I eat if I vomit it out afterwards?"

The patient's history, revealing a difficult personal and family situation, is briefly described.

Patient, despite her situation, exhibited satisfactory maturity in behavior and a great extent of cooperation with the plan of treatment. Her condition improved. Laboratory tests on blood, urine, and liver, kidney and endocrine functions were normal. Blood test showed 1,900,000 red cells and 10,600 white, slight neutropenia and marked monocytosis, but, most important: 35 stippled erythrocytes/100 leukocytes, proof of Pb intoxication because elevated above the upper normal limit of 10/100 accepted by the Labor Department. Urinary coproporphyrin excretion was 3500 µg/24 hr (normal: 50-120 µg). Blood Pb level could not be determined because the first specimen was lost. A second specimen showed the level to be within normal limits: 70 µg Pb/l blood.

The patient left hospital on October 26. The Pb intoxication was believed to be due to contaminated drinking water in the patient's locality which showed 25 mg Pb/l, an unusually high level in view of the maximum acceptable level of 0.1-0.3 mg/l.

- 1764 Brugsch, J. (Municipal Hosp. Friedrichshain, Berlin, Germany): Toxische Leukoporphyrurie durch Bleivergiftung als Präporphyrurieform. (TOXIC LEUKOPORPHYRIA BY LEAD POISONING AS A FORM OF PREPORPHYRIA.) Zeitschrift für die Gesamte Innere Medizin und Ihre Grenzgebiete 12, No. 15:704-6, 1957.

While cutaneous porphyria in adults is characterized mainly by formation of uroporphyrin, acute porphyria is an earlier stage in the disturbance of heme synthesis, ie, a preporphyria or porphobilinogen porphyria. The case of a pregnant woman is described who had taken 20 g yellow Pb oxide as an abortive. She exhibited anemia, icterus, swelling of liver and spleen, gastric colic and abdominal pains. Urinary coproporphyrins were greatly increased, basophil stippled erythrocytes were found. Only traces of uroporphyrin were detected in the urine but large amounts of leukoporphyrins were present for about 3 mo. Crystallization and separation of the leukoporphyrins yielded mainly the uroporphyrin-III- and some type I. No porphobilinogen was found. Liver biopsy revealed no free uroporphyrin.

The author points out that the metabolic state in pregnancy may have been a predispositional factor for the cell damage leading to increased formation of leukoporphyrin. In contrast to real porphyria this leukoporphyrin was reversible. In conclusion, he states that the present form of preporphyria was characterized by the absence of uroporphyrins and porphobilinogen in the fresh urine; only coproporphyrins were present. A prestage of uroporphyrins could be transformed into uroporphyrin-III and crystallized as such. This prestage of uroporphyrin which is called leukoporphyrin disappeared upon recovery of the patient.

- 1765 Caccuri, S. (Italy): Hémopathies dans la toxicologie industrielle. (BLOOD DISORDERS IN INDUSTRIAL TOXICOLOGY.) In XII International Congress of Occupational Health, Helsinki, Finland, 1957, Vol. I, Reports, pp. 192-206.

Changes observed in the blood as a result of occupational exposure to Pb, benzene, N and Cl com-

pounds, aniline and CO are reviewed, particularly in respect to Pb.

- 1766** Cataldi, R., and Odaglia, G. (Italy): THE BLOOD COAGULATION IN ACUTE LEAD POISONING. In XII International Congress of Occupational Health, Helsinki, Finland, 1957, Vol. II, Summaries, p. 56.  
See Abstract No. 1896.

- 1767** Cataldi, R., Odaglia, G., and Zannini, D. (Univ. Genoa, Italy): Aspetti fisiopatologici del circolo periferico nei saturnini. (PHYSIOPATHOLOGY OF PERIPHERAL CIRCULATION IN LEAD POISONING.) *Folia Medica* (Naples) 40:710-9 (Sept.), 1957.

A group of 38 patients (18-69 yr old), hospitalized with Pb poisoning in various stages of the disease were studied by capillaroscopy and photoplethysmography, as well as by physical (immersion of hands in hot and cold water) and pharmacodynamic tests (administration of papaverine, etc). Data for each case are tabulated as to clinical findings, duration of illness, blood pressure, red cell number, condition of arterioles and capillaries. The results showed that in chronic Pb poisoning the capillary bed was frequently reduced, which the authors attribute to a precapillary sphincter, probably due to hypertonia of the muscular cells. (22 references)

- 1768** Corbin, J.L. (Internal Hosp., Paris, France): Les agents chélateurs dans le traitement du saturnisme. (CHELATING AGENTS IN THE TREATMENT OF LEAD POISONING.) *Progrès Médical* 85, No. 7-8:159-60, 1957.

Following a brief mention of the classical therapeutic agents, Ca, Mg sulfate, etc, followed by BAL, the discussion is limited to EDTA, specifically  $\text{CaNa}_2\text{EDTA}$ , as to chemical and physical properties, dosage, results, and tolerance.

- 1769** Crepet, M., and Corsi, G.C. (Italy): IRON-STAINING NORMOBLASTIC INCLUSIONS IN THE STUDY OF LEAD POISONING ANEMIA. In XII International Congress of Occupational Health, Helsinki, Finland, 1957, Vol. II, Summaries, p. 51.

Among biochemical data and morphological characteristics relating to Pb poisoning anemia, investigation was made on bone marrow sideroblastosis. Fourteen subjects suffering from Pb poisoning anemia of varying severity were studied. The findings are summarized as follows: Intense sideroblastosis (higher percentage of sideroblasts, coarse granules in greater number) were observed in those subjects who had suffered from anemia for a long period of time, with no relation to the severity of the anemia itself. In such cases, Fe-containing granules were obviously present even in normoblasts with no evidence of hemoglobin formation. A significant relation was found between the entity of bone marrow normoblastosis and the percentage of normoblasts with Fe-positive granules. A different distribution between basophilic stippling (BS) and Fe-containing granules was observed in the normoblasts. While the latter seemed to form a ring around the nucleus, the former were scattered

all over the cytoplasm. Sideroblasts with abundant and coarse Fe-containing granules were more numerous than normoblasts with BS. In strongly sideroblastic bone marrow, a higher number of BS and siderocytes could be found; in such cases these often appear in circulating blood. Any relation with reticulocyte counts, though quite clear, was not so significant. The relationship between Fe-containing granules in normoblasts and sternal marrow storage of hemosiderin was not quite clear. The erythrocyte coproporphyrin concentration closely paralleled the Fe contents of normoblasts with occasional deviation from this relationship. The same could not be said for the erythrocyte PP which showed no consistent linear correlation with the sideroblastic values. Finally, there was no correlation between sideroblastosis and bilirubinemia.

- 1770** Danilovic, V., Djuriscic, M., Mokranjac, M., Stojimirovic, B., Zivojinovic, J., and Stojakovic, P.: Néphrites chroniques provoquées par l'intoxication au plomb par voie digestive (farine). (CHRONIC NEPHRITIS DUE TO LEAD POISONING BY DIGESTIVE ROUTE (FLOUR).) *Presse Médicale* 65:2039-40 (Dec. 11), 1957.

See Abstract No. 1897.

- 1771** Danilović, V., Djurišić, M., Mokranjac, M., Stojimirović, B., Živojinović, J., and Stojaković, P.: Porodična obolenja bubrega u selu Šopić izazvana, hroničnom intoksikacijom olovom. (FAMILIAL KIDNEY DISEASES IN THE VILLAGE ŠOPIC CAUSED BY CHRONIC LEAD POISONING.) *Srpski Arhiv Za Celokupno Lekarstvo* 85:1115-25 (Oct.), 1957.

See Abstract No. 1897.

- 1772** De Leon, D.E.M.: Loodintoxicatie en haar behandeling met calcium-dinatrium-versenaat ( $\text{CaEDTA}$ ). Ervaringen bij zes patiënten. (TREATMENT OF LEAD POISONING WITH  $\text{CaEDTA}$ ). *Nederlands Tijdschrift voor Geneeskunde* 101, No. 12:532-8, 1957.

A description is given of the pathophysiology, clinical picture and treatment of Pb poisoning. In 6 of the author's cases,  $\text{CaEDTA}$  treatment resulted in a marked increase of the excretion of Pb, a significant decrease of coproporphyrin excretion, and subjective improvement, the latter being of short duration. The only side effect was a temperature peak in several patients. The serum level of inorganic phosphorus in one patient rose from 5.0-7.68 mEq/l, without any other disturbances of the electrolyte spectrum. Shortly after discontinuation of therapy the subjective symptoms of Pb poisoning returned in both patients. The further course was uneventful; recovery was complete in all cases 2 mo later (From author's English summary)

- 1773** Desoille, H., Albahary, C., Truhaut, R., and Boudène, C. (Paris, France): Le test de la plomburie provoquée par l'édathamilcalcium-disodium. (THE LEAD MOBILIZATION TEST USING  $\text{CaNa}_2\text{EDTA}$ .) In XII International Congress of Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 287-90.

The EDTA mobilization test was applied in iv infusion (1 g/250 ml 5% glucose) or orally (4 g/24 hr), in Pb poisoning cases and in controls. Fourteen cases are described and the results of urinary, fecal, and blood Pb, as well as the course of azotemia are shown in tables. On the basis of the results, the authors conclude that usually a dose of 0.50-1 g suffices for iv infusion. The following 8-hr urine must be examined. The 0.50 g dose can be injected directly without infusion, in 30 ml of the solvent. In this case the subject should empty his bladder before injection, and examination can be limited to the following 6-hr voidings. Except in acute, severe poisoning, there is no advantage in administering higher doses nor in performing >2 injections/wk. Such doses are not contraindicated for patients with nephritis, in fact may be of benefit if the ailment is due to Pb. Oral EDTA (4 g in 2 doses) is without danger, but does not produce Pb elimination of a magnitude obtained iv. So administered only 10-15% of the chelate penetrates the intestinal wall. The PbEDTA there formed is more capable of passing into the circulation to be finally eliminated in the urine; this results in a slight decrease in fecal Pb, which could lead to error in interpretation. Persons never exposed to Pb eliminate 10 times the normal amount of Pb when EDTA is administered. A positive test of Pb mobilization is represented by urinary Pb of 500 µg/l when given orally, and 800-1000 µg/l when given iv. Since the principal route of industrial exposure to Pb is the respiratory, causing rapid absorption, the iv mobilization test will best reveal the degree of risk, especially for those excessively exposed for the 1st time.

Aside from this, the test is easily performed within the industry, and could perhaps be utilized prophylactically in workers who are insufficiently protected. However, these tests should in no way compete with technical control of occupations at risk of exposure. (13 references)

- 1774** Dinischiotu, G.T., Nestorescu, B., Radulescu, I., Ionescu, C., Preda, N., and Roventa, A. (Inst. Ind. Hyg. Occup. Dis. Bucharest, Romania): Recherches sur les valeurs de la plomburie déterminées par les méthodes de minéralization et de coprecipitation et leur signification clinique. (STUDIES ON URINARY LEAD VALUES OBTAINED BY MINERALIZATION AND COPRECIPI-TATION METHODS AND THEIR CLINICAL SIGNIFI-CANCE.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 18, No. 2:138-44, 1957.

Groups of workers exposed to Pb in varying degrees were studied: (1) 6 cases presented an increased but not pathological Pb absorption; (2) 20 cases had chronic Pb poisoning; (3) 10 cases exhibited an acute period of colic. There were 44 controls. A total of more than 600 determinations of Pb in urine were made. Results obtained by the coprecipitation and by the mineralization method were compared. The following mean results were obtained by coprecipitation and mineralization, Pb in µg/l, respectively: controls, 42.6, 43.0; group 1, 98.53, 122.50; group 2, 112.53, 183.41; group 3, 183.60, 296.58. The authors conclude that the

values obtained by the mineralization method reflect indisputably the total Pb eliminated in the urine, while those of the coprecipitation method do not do so. It is pointed out that the methods do not appreciably differ in the urinary analyses of the controls. (13 references)

- 1775** Dinischiotu, G.T., Radulescu, I.C. and Miuca, N.: Cercetari asupra modificarilor hemodinamice in saturnism. (STUDIES OF HEMODYNAMIC CHANGES IN LEAD POISONING.) Med. interna (Bucuresti) 9, No. 9:1326-42, 1957.

See article published in Archiv für Gewerbepathologie und Gewerbehygiene 17, No. 2:148-67, 1959.

- 1776** Djuric, D. (Inst. Med. Res., Zagreb, Yugoslavia): Analize urina kod porfirinurija i porfirija. (ANALYSIS OF URINE IN POR-PHYRINURIA AND PORPHYRIA.) Arhiv za Higijenu Rada i Toksikologiju 8:61-71, 1957.

The definitions of porphyrinuria and porphyria are given, also the classification of porphyria according to Watson. The causes of porphyria and porphyrinuria are presented on the basis of Rimington's hypothesis of enzymatic block. The most pronounced symptoms and laboratory findings are described, and the findings in urine, ie, the characteristic color of urine, porphobilinogen, and other porphyrins are discussed more fully. Detailed instructions are given for the determination, both spectrophotometric and fluorimetric, of coproporphyrin, total uroporphyrin (UP) and UP III, and for the indirect determination of UP I. The results of comparative determinations of these porphyrins are also given. The determinations of UP have been carried out in 2 cases of porphyria cutanea tarda, while the experience concerning porphyrinuria has been gained on the basis of the observation of numerous cases of Pb poisoning. (From author's English summary)

- 1777** Djuric, D. (Inst. Med. Res., Zagreb, Yugoslavia): O potencijalnoj opasnosti otrovanja olovom prilikom upotrebe grnčarije sa olovnom glazurom. (POTENTIAL DANGERS OF LEAD POISONING AFTER USE OF POTTERY WITH LEAD GLAZING.) Medicinski Pregled 10, No. 4:210-3, 1957.

In Yugoslavia, poisoning following the use of glazed pottery has been detected among the rural population. Such pottery is widely used in villages and also in towns. In 6 cases of Pb poisoning in villagers the incriminated vessels and food specimens were tested. It is concluded that the solubility of Pb is dependent on: (1) mechanical properties of the glaze, (2) chemical properties of the glaze, (3) acidity (pH) of the material in the vessel, (4) chemical structure of the material in the vessel, and (5) temperature in the vessel. (From author's English summary)

- 1778** Dulong de Rosnay, C., Labadie, P., and Debot, P.: Recherches sur l'hémoglobine alcalinorésistante. Sa présence au cours de l'intoxication saturnine. (STUDIES ON THE ALKALI RESISTANT HEMOGLOBIN. ITS PRESENCE IN LEAD POISONING.) Proceedings of the Society of Industrial Medicine and

Hygiene, Paris. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 18, No. 4:474, 1957.

Studies on alkali-resistant hemoglobin in manifestations of Pb poisoning and in the experimental Pb poisoning of a dog were carried out. In mild exposure the increase is variable and cannot be used as a test. In severe exposure, however, the increase is constant and becomes more noticeable as the intoxication becomes more intense. Increased alkali-resistance seems to be a part of the biochemical syndrome of Pb poisoning.

- 1779 Egli, R., Grandjean, E., Marmet, J., and Kapp, H. (Tech. Coll., Zürich, Switzerland): Die Verbreitung der chronischen Bleivergiftung in Akkumulatoren- und Bleifarbenfabriken. (THE INCIDENCE OF CHRONIC LEAD POISONING IN ACCUMULATOR AND LEAD PAINT FACTORIES.) Schweizerische Medizinische Wochenschrift 87, No. 37: 1171-4, 1957.

This is the full report of the investigation covered by the following abstract.

- 1780 Egli, R., Kapp, H., Marmet, J., and Grandjean, E. (Switzerland): RELATIONSHIP BETWEEN LEAD EXPOSURE AND LEAD EXCRETION IN MAN AND CLINICAL SYMPTOMS. In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 281-2.

Ninety-four workers from 2 storage battery plants, 3 Pb-paint producing factories and 1 machine factory were examined clinically, according to a form designed for prophylactic examination of Pb workers, issued by the Swiss National Insurance Company. Only 40 out of the 94 subjects had exposures  $<0.15 \text{ mg Pb/m}^3$ , the others had been exposed to higher Pb concentrations. The Pb level in blood was  $>0.05 \text{ mg/100 g}$  in 59 men and  $>0.10 \text{ mg/100 g}$  in 9 of these 59. Urinary Pb excretion was  $<0.15 \text{ mg/l}$  in 41 subjects while the remaining 53 excreted higher amounts. Figures are given for hemoglobin (Hb), erythrocytes and basophil stippled cells. It was concluded that a definite Pb hazard exists in storage battery and Pb-paint producing plants in Switzerland.

In an analysis of clinical findings with laboratory results, the best correlation was found between Hb and coproporphyrin (CP) in urine. From the correlations, the authors arrived at the following threshold limits: Pb in blood  $0.058 \text{ mg/100 g}$ ; Pb in urine  $0.145 \text{ mg/l}$ ; CP in urine  $0.767 \text{ mg/l}$ ; average exposure  $0.235 \text{ mg/m}^3$ . Although the latter figure is higher than the generally admitted MAC of 0.15, since various factors have to be taken into account, ie, individual sensitivity, they do not suggest that the established limit of 0.15 mg be raised. A tolerance limit of 0.7-0.08 mg/l for CP excretion was proposed.

- 1781 Fabre, R., Truhaut, R., Boudène, C., and Albahary, C. (France): Le rapport érythro-plasmatisque du plomb au cours des intoxications chroniques chez l'homme et chez l'animal - influence de l'E.D.T.A.-Ca-. (ERYTHROCYTE-PLASMA PARTITION OF LEAD IN

THE COURSE OF CHRONIC POISONING IN MAN AND IN ANIMALS AS INFLUENCED BY CaEDTA.) In XII International Congress of Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 173-6.

The experiments described were undertaken for the reason that although in 1942 Kehoe et al had confirmed the findings of some authors in their classic experiments that almost all of the Pb absorbed into the circulation is localized in the erythrocytes, there have been many who have advocated that Pb be determined in the serum of Pb exposed subjects, rather than in whole blood. For the measurement of Pb distribution in blood, the authors chose the dithizone method of Cornish and Shields (1954), modified for the analysis of 10 ml plasma.

The results obtained on 20 normal subjects and Pb-exposed subjects, they found that 95% of the Pb is deposited in the erythrocytes. The same results were obtained in the blood of rabbits subjected to various degrees of chronic poisoning; this was slightly higher than Kehoe's findings (90%), but close to Mortensen and Kellogg's (97-99%), utilizing radio-Pb. In tests to determine in human subjects the percentage of Pb fixed in the plasma, after CaEDTA treatment, only partially successful results were obtained, since it was never possible to make analyses in samples collected in the 1st hr of the iv infusion. Samples collected in a minimum of 6 hr after the end of infusion never revealed any significant rise in plasma Pb  $>5 \text{ } \mu\text{g/100 ml}$ . In rabbits with chronic Pb poisoning, ip injection of 300 mg EDTA gave a rise in plasma Pb up to  $18 \text{ } \mu\text{g/100 ml}$  at the end of 1-1/2 hr; after 6 hr the level dropped to 3  $\mu\text{g}$ . Experiments were also performed with PbEDTA injected ip to rabbits in a dose of 3 mg Pb/kg and for comparison, with ionic Pb by injecting the same dose as Pb nitrate. The plasma/cellular Pb ratio in the 1st case was 1.53 1-1/2 hr after injection and 0.05 6 hr after injection; in the 2nd, Pb was not detectable in plasma 1 and 3-1/2 hr after injection, but  $30 \text{ } \mu\text{g/100 ml}$  was found at the same times in the cells. In in-vitro experiments on rabbit blood, the plasma/cell ratio was for chelated Pb, 1.90 and for ionic Pb, 0.01.

In conclusion, the authors state that their studies confirm an almost total fixation of Pb in the cells, with almost total absence in plasma and serum, even under pathologic conditions. It is only under chelation with CaEDTA that a transient but tangible rise in plasma Pb takes place which is in direct relation to the degree of urinary elimination.

- 1782 Filippova, N.G.: Analiz materialov periodicheskikh meditsinskikh osmotrov rabochikh Leningradskoi promyshlennosti za period 1948-1953 gg. (ANALYSIS OF THE RESULTS OF PERIODIC MEDICAL EXAMINATION OF WORKERS OF LENINGRAD INDUSTRIES IN THE PERIOD 1948-1953.) In Trudy Yubileinoi Nauchnoi Sessii Posvyashchennoi 30-Letnei Deyatel'nosti Instituta 1924-1954. Leningrad, Ministerstvo Zdravookhraneniya RSFSR, Institut Gigieny Truda i Profzabolevaniy, 1957, pp. 464-9.

The results of periodic medical examinations here

reported pertain to workers exposed to silica, TEL-containing gasoline, Hg, Pb, benzene and Mn.

- 1783** Francheteau, M.: Sur la prophylaxie du saturnisme des peintres dans un chantier de construction navale. (THE CONTROL OF LEAD POISONING IN A NAVY YARD.) Proceedings of the Society of Industrial Medicine and Hygiene, Paris. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 18, No. 4:439-40, 1957.

Among 125 painters, occupied in a navy yard where 75 tons minimum/yr were used, only 4 men had contracted Pb poisoning within 9 yr. Two of them developed anemia with 3,500,000 RBC and 2 had Pb colic. They recovered rapidly when removed from exposure. This is attributed to careful selection of workers, to safety measures, and to strict medical control. In the discussion following the paper, it is pointed out that minium presents a rather stable, little soluble form of Pb which may explain the infrequency of poisoning caused by it.

- 1784** Gaffuri, E., and Gobbato, F. (Univ. Padua, Italy): La risposta al "cold pressor test" nella intossicazione cronica da Pb. (COLD PRESSOR TEST IN CHRONIC LEAD POISONING.) Folia Medica (Naples) 40:583-7 (July), 1957.

The cold pressor test was carried out on 3 normal subjects, 2 cases of essential hypertension, and in 9 workers who had been exposed for a long time to Pb and who presented signs of poisoning. The results (as shown in a table) suggested to the authors that the hypertension in chronic Pb poisoning is of renal origin.

- 1785** Gajdos, A.: (PORPHYRIN METABOLISM IN LEAD POISONING.) Folia Med. (Naples) 40:1-14, 1957.

On the basis of data gathered from the literature the importance of porphyrin determination in the diagnosis of latent Pb poisoning is stressed; it is also of value in the evaluation of developing poisoning and the completeness of recovery. A new point is the frequency and early appearance of increased protoporphyrin in the blood cells which is the longest-lasting evidence of Pb poisoning. (From Chemical Abstracts 51:9926, 1957)

- 1786** Ghislandi, E. (Univ. Milan, Italy): L'aminoaciduria negli intossicati da piombo. (AMINOACIDURIA DURING LEAD POISONING.) Medicina del Lavoro 48:566-71 (Oct.), 1957.

Urinary excretion of amino acids was studied in 20 patients in different stages of Pb poisoning by means of a qualitative (chromatographic) and quantitative analysis, both during fasting and after oral administration of amino acids. The average elimination was found to be 9.3 mg/hr during fasting and 13.6 mg/hr after oral administration. These results are within normal limits. The finding of an increased urinary elimination of amino acids in Pb poisoning, recently reported by Granati, Scavo and Andreani, is therefore not confirmed. Keeping in mind the pathogenic mechanisms of an increased aminoaciduria it is not clear what

theoretical reasons could justify this finding in saturnine patients. In fact it is not possible to claim a renal mechanism as its origin, since no prevalent tubular hypofunction is observed. Neither can the "overflow" mechanism which derives from hyperaminoacidemia be accepted because the amino acids in the blood are at a normal level in saturnine patients and they have no severe liver lesions such as those found in aminoaciduric liver diseases. (From author's summary) (13 references)

- 1787** Grailly, de, Leger, H., Biessy, and Seilhan: Un cas de saturnisme fruste. (A BAFFLING CASE OF LEAD POISONING.) Proceedings of the Society of Industrial Medicine and Hygiene, Paris. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 18, No. 4:473-4, 1957.

A 33-yr-old painter, working with minium, lost weight, developed a hypochromic anemia, 14-20% basophils, marked increase in chronaxy of extensors, and traces of albumin in the urine. Urinary coproporphyrin was 350/l, Pb in blood 85/ $\mu$ g/100 ml, Pb in urine 130  $\mu$ g/l. A diagnosis of Pb poisoning was made although the signs, taken singly, were not decisive.

- 1788** Granati, A., and Scavo, D.: Il comportamento dell'aminoaciduria nella intossicazione professionale da piombo. (AMINOACIDURIA IN OCCUPATIONAL LEAD POISONING.) Folia Medica (Naples) 40:832-44 (Oct.), 1957.

In 14 patients with chronic Pb poisoning the urinary excretion of free N was determined by the method of Frame and Runel and that of the various amino acids by chromatography. The excretion of these substances was increased ~140%. The occurrence of aminoaciduria and its qualitative characteristics permitted its differentiation from that which is observed in Pb poisoning and nephropathy. It expressed, however, the incapability of the tissues to utilize the amino acids in a normal manner. (From Medicina del Lavoro 49:313 (Abstracts), 1958)

- 1789** Grandis, C., Lovisetto, P., Sibour, F., and Turco, G.L. (Univ. Turin, Italy): Studi sulla emoglobina nell'anemia da piombo. III. Ricerche mediante spettrofotometria nell'ultravioletto. (HEMOGLOBIN IN LEAD ANEMIA. III. STUDIES BY USE OF ULTRA-VIOLET SPECTROPHOTOMETRY.) Bollettino della Società Italiana di Biologia Sperimentale 33:301-3, 1957.

The ultraviolet spectrum of hemoglobin from 10 cases of Pb poisoning did not differ from that of normal hemoglobin.

- 1790** Graziani, G., and Calabro, F. (Italy): THE BIOCHEMICAL SETTING OF THE ANEMIA BY LEAD. In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. II, Summaries, p. 52.

The behavior of serum Fe and of the unsaturated Fe binding capacity in experimental poisoning and in several cases of occupational Pb poisoning was



studied; also, after oral and iv load of Fe. A considerable increase of the amount of Fe in blood was observed, followed, when the poisoning was very advanced, by a decrease beyond the starting values. The iv load curve revealed more considerable increases in comparison with those obtained before the poisoning and with those of normal subjects. The oral load curves were more flattened in the human cases and in the experimental, from which the authors infer a disturbance of Fe absorption. The behavior of the unsaturated Fe binding capacity in basal conditions and after oral and iv load, reflects that of serum Fe, so that the mechanism of Fe transport from deposits to tissues appears affected. The free erythrocytic porphyrin showed very high values, proportional to the degree of anemia.

The authors consider that this research completes the biochemical setting of Pb anemia. Apparently it is a question of a hypersideremic hyperprotoporphyrinemic anemia, of the type of aplastic anemias. It is primary because of the direct action of Pb on the blood-forming system; it is complicated by some other pathogenetic moments, such as the disturbance of Fe absorption, but surely depression of some enzymic systems.

- 1791** Great Britain, Ministry of Labour and National Service: ANNUAL REPORT OF THE CHIEF INSPECTOR OF FACTORIES ON INDUSTRIAL HEALTH FOR THE YEAR 1957. London, Her Majesty's Stationery Office, 50 pp.

Fifty-five cases of Pb poisoning, none of them fatal, were reported in Great Britain during 1957. Seven of these cases occurred in Pb smelting factories, 13 in shipbreaking, 6 in foundries, 6 in white and red Pb works, 12 in accumulator works, 2 in paint and color works, 2 in painting of buildings and 7 in other industries.

- 1792** Gréaud, H. (Lab. Biol. Anal. Ethyl-Kuhlmann-Painboeuf, France): Prophylaxie du saturnisme dans l'usine française de fabrication du plomb tétra-éthyle: Enseignements concernant les prélèvements pour dosages de plomb dans les matières biologiques. (PREVENTION OF LEAD POISONING IN A FRENCH TETRAETHYL LEAD PLANT. (COLLECTION OF SAMPLES FOR THE DETERMINATION OF LEAD IN BIOLOGIC MATERIALS).) Médecin d'usine 19, No. 9:647-51; 653-5, 1957.

The manufacture of TEL, the risks of workers from TEL vapor, and the measures of protection (ventilation and other equipment, gas masks, protective clothing and gloves) are briefly described. Physical examinations, follow-up and supervision by the industrial health officer are outlined. In the author's laboratory, since 1949 when the operations began, 20,500 analyses had been performed. In 1956, 1726 samples of urine, 578 of blood, and 381 of feces were analyzed for Pb. In 1956, out of 250 employees, 100 were directly exposed to TEL risks. The examinations performed showed the following: No cases of intoxication, none showed Pb gum lines, <4,000,000 red cells, >10 stippled erythrocytes/100 leukocytes, >0.2 mg/l urinary Pb. Only 10 had >0.1 mg/l urinary Pb, 4 had >0.12 mg/l, none had >0.15 mg/l. The results of

Pb blood levels in the same group were: 27 had >0.050 mg/100 g, 9 had >0.060 mg, 2 had >0.07 mg, none had >0.080 mg. The results on the urinary Pb of 1171 workers part-time exposed were: 0.17%, >0.200 mg/l; 1.7%, 0.15-0.2 mg; 4%, 0.12-0.15 mg; <27.2%, 0.08-0.12 mg; 66.8%, <0.08 mg. Thus there were no bioclinical signs of excessive absorption or poisoning, and this shows the effectiveness of the preventive measures taken in this industry. A form used by the firm shows instructions for the collection of samples for the determination of Pb in urine, feces and blood. This states that blood and feces samples be taken twice/yr, and in times of accidents or particular risks; for urine, every month for those regularly exposed and 4 times/yr for the others.

- 1793** Gréaud, H.: Effets biologiques d'un agent chélateur. Traitement d'un cas grave de saturnisme. Elimination du plomb urinaire dans l'imprégnation plombique. (BIOLOGICAL EFFECTS OF A CHELATING AGENT. TREATMENT OF A SERIOUS CASE OF LEAD POISONING. URINARY ELIMINATION OF LEAD IN CASES OF LEAD ACCUMULATION.) Médecin d'usine 19:657-64 (Nov.), 1957.

Apart from their remarkable effectiveness in the treatment of Pb poisoning, it seems that in certain cases chelating agents can be an important factor in enabling the industrial medical officer to assess the degree of Pb accumulation in exposed persons. The author gives an account of his experience in this field. (From Occupational Safety and Health Abstracts 8, No. 3:3133, 1958)

- 1794** Greenfield, I. (Woodmere, N.Y.): LEAD POISONING. X. EFFECTS OF LEAD ABSORPTION ON THE PRODUCTS OF CONCEPTION. New York State Journal of Medicine 57:4032-4 (Dec. 15), 1957.

A brief review is given about the controversy in the literature about the consequences of exposure to and intoxication by Pb on the frequency of stillbirths and state of health of the fetus. A case is reported of a 21-yr-old woman who had worked for 7 yr at the soldering bench on an assembly line where radio and phonograph wires were soldered to contact spots. She wore no mask and thus inhaled fumes of the molten solder. Although she began to complain of abdominal cramps, constipation and a run-down feeling, she remained on the job another 9 mo when she stopped work because of progressively increasing symptoms. A diagnosis of Pb poisoning was made; polychromasia, basophilic stippling and anisocytosis were present on occasion; no Pb deposits were found in the epiphyses of the long bones. After therapy the Pb level in the urine diminished and practically disappeared in the blood. Analyses made at the beginning of pregnancy, 2 mo later, showed 0.005 mg Pb/100 g of blood and 0.11 mg/984 ml of urine; during the 1st 3 mo the Pb concentration in the urine became normal. Gestation and delivery were normal. A trace of Pb, too small to be estimated, was found by spectroscopy in the maternal blood; neither the cord blood nor the placenta contained detectable amounts of Pb; 0.02 mg Pb were found in 886 ml urine 6 mo postpartum.

The author states that although no conclusions

may be drawn from a single case, Pb did not affect adversely gestation or fetus, thus did not traverse the placental barrier. (10 references)

- 1795** Guarino, A., and Giordano, C. (Univ. Naples, Italy): STUDY OF THE BLOOD HEMOGLOBIN IN LEAD POISONING BY TESTING ALKALI-DENATURATION. *Folia Med. (Naples)* 40:815-9, 1957.

The alkaline denaturation test supposedly reveals changes in the bond between hem and globin and was carried out according to the method of Singer, et al (1951). There was no evidence of an increase in the alkali-stable fraction. (From Chemical Abstracts 52:5653, 1958)

- 1796** Guarino, A., and Giordano, C. (Italy): Étude des fractions alcali-stable et alcali-labile de l'hémoglobine dans les anémies saturnines. (STUDIES ON THE ALKALI-STABLE AND ALKALI-LABILE FRACTIONS OF HEMOGLOBIN IN Pb-ANEMIAS.) In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, p. 184.

See preceding abstract.

- 1797** Haeger, B. (Malmö Gen. Hosp., Sweden): INCREASED CONTENT OF A  $\delta$ -AMINOLAEVULINIC ACID-LIKE SUBSTANCE IN URINE FROM WORKERS IN LEAD INDUSTRY. *Scandinavian Journal of Clinical and Laboratory Investigation* 9: 211-2, 1957.

Among Pb workers, 20 men (23-60 yr old), the increased urinary excretion of ALA, the precursor of porphobilinogen was more frequent than the increased excretion of PBG (range 19-267  $\mu$ M/ml  $\times 10^3$ ). This may be a more sensitive index of exposure to Pb than the determination of CP or hematologic changes. Urinary ALA in 60 control subjects was a mean of 0.0165 vs 0.0028  $\mu$ M PBG/ml.

- 1798** Harashima, S. (School Med., Keio Univ., Japan): DISTRIBUTION AND STATE OF LEAD IN DIFFERENT COMPONENTS OF BLOOD. In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 180-3.

Studies were carried out by using blood of Pb workers, and of Pb poisoned dogs, as well as of normal dogs. Ionic or inorganic Pb was separated from the nonionic or organic, by means of the coprecipitation method with Ca oxalate as reported by Ross and Lucas.

From the results the author concludes that when Pb is absorbed into the body, it is accumulated more abundantly in blood cells than in plasma. The mode of its accumulation in blood cells is that of adsorption on the surface of blood cells following Freundlich's adsorption isotherm. As the weak, physical adsorption continues, Pb tends gradually to be dissolved in the internal fluid of blood cells to form strong and stable organic compounds. Ionic or inorganic Pb in the blood can be easily chelated by CaEDTA to form soluble PbEDTA which is finally excreted in the urine; it is difficult to chelate the organic Pb compounds dissolved mostly in the blood cells.

- 1799** Harashima, S. (Keio Univ. School Med., Shinjuku, Tokyo, Japan): HEMATOLOGICAL STUDIES IN JAPAN OF INDUSTRIAL TOXIC SUBSTANCES. A REPORT OF A SPECIAL COMMITTEE OF THE JAPAN ASSOCIATION OF INDUSTRIAL HEALTH. In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 220-2.

This report was prepared for the purpose of summarizing the results of scientific papers on hematologic studies published in Japan in the past 10 yr. In the summary of the report here presented, attention was focused on morphological changes in erythrocytes and leukocytes; however, chemical or other changes where these are concerned with formed elements of the blood were also considered. For the sake of brevity, description was restricted to findings in chronic poisoning or exposure of man in industry, excluding acute or accidental cases. Aside from metals, including Pb, the following exposures were involved: CO, SO<sub>2</sub>, Se, Ni carbonyl, Hg, Mn, As, Sb, Cr, benzene, xylene, chloronitrobenzene, nitrobenzene, trinitrotoluene, chlorinated diphenyl, benzidine, pentachlorophenol, nitroglycerine, trichloroethylene, carbon disulfide, chlorinated naphthalene, monochloromethane, hexa-, di- and monochlorobenzene, and pyrite. Pb is stated together with metals to cause definite anemia and a slight change in differential leukocyte counts. Workers exposed are those in storage batteries, Pb refineries, printing works, pipe or tube soldering and porcelain coloring processes. As to special studies, in a paragraph on Pb, the work of Sano (1955, 1956) on basophilic granules is cited.

- 1800** Henderson, D.A., and Inglis, J.A.: THE LEAD CONTENT OF BONE IN CHRONIC BRIGHT'S DISEASE. *Australasian Annals of Medicine* 6, No. 2:145-54, 1957.

In an attempt to discover evidence of excessive Pb absorption in persons who had died from chronic nephritis, the incidence of which is high in Queensland, bone samples from subjects without and with chronic Bright's disease were analyzed for Pb. In all, material was obtained from 669 autopsies in Brisbane, Queensland, and from 197 in Sydney. Bones contain very little Pb in the 1st year of life; but the Pb content increases rapidly in the first 2 decades and more slowly thereafter. The mean Pb content of people born in Queensland was only slightly higher than of those born elsewhere. Female bones contained on the average less Pb than male bones (question of occupational factor). Throughout all age groups, rib bones in both sexes contained on the average less Pb than the skull. The mean Pb content of both skull and rib in males and females with Bright's disease was about twice that of subjects without chronic Bright's disease up to the 50-59 yr age group; then it fell to the level of subjects without the disease. The mean Pb content of 67 subjects from Queensland with chronic Bright's disease was (males and females, respectively): skull 7.31, 7.97 mg/100 g, rib 3.48, 4.14 mg/100 g. Bones from cases of Bright's disease (in 50+ age group) in Sydney contained 5.65, 3.32 and 3.26, 2.85 mg/100 g, respectively. The means for subjects in the same age group without chronic Bright's disease were: skull 3.91,

3.34; rib 1.48, 1.26; these corresponded rather closely to values found in the Sydney autopsies. Authors concluded that the high Pb content of bone in the Queensland cases of chronic Bright's disease was not due to retention of normally ingested Pb by failing kidney function but to excessive absorption caused by excessive exposure during childhood.

**1801** Hesse, F. (Norderney, E. Frisian Islands, Germany): Behandlung von Gesundheits-schäden durch Industriegifte, insbesondere Blei, mit Klimakuren auf der Nordseeinsel Norderney. (CLIMATOTHERAPY IN THE NORTH SEA ISLAND, NORDERNEY, IN INJURIES TO HEALTH CAUSED BY INDUSTRIAL POISONS, ESPECIALLY LEAD.) Archiv für Physikalische Therapie 9, No. 4:362-8, 1957.

Because toxic phenomena never occurred in infectious diseases on Norderney (no deaths due to scarlet fever over a period of 40 yr), patients suffering from Pb diseases were sent there in 1954 to see what effect the climate and change in environment had. The patients were tested as follows: coproporphyrin (CP) content of urine (de Langen) 3 times a day, amount and specific gravity of urine, basophilic stippling (BS) (Manson stain) every other day, protein lability (Mancke and Sommer, Weltmann), Ca, blood serum electrophoresis, pH, blood and urine Pb contents (dithizone) 3-5 times/patient. Patients usually remained for 3-4 wk, during which they received food enriched with lactalbumin and ascorbic acid. Symptoms were temporal headaches, vertigo, weakness, loss of appetite, constipation, stomach pains, nausea, loss of weight, anemia, and sometimes an extensor weakness or paralysis of the upper limbs. In 1954, 50 patients were treated. After a few days, all subjective complaints due to Pb intoxication were eliminated. During therapy, the patients showed a weight increase of 2-3 kg, 13% average increase of hemoglobin content, almost complete disappearance of BS and CP, normalization of erythropoiesis, blood pigment metabolism, and blood electrophoresis, and an increase of blood Pb content in those patients with initial Pb values up to 80 µg/100 g blood, mainly due to mobilization of Pb deposits. Forty out of 45 patients showed an improved earning ability. The author mentioned the purity of the air, the low pH of the dust and the shifting between a good climate and an irritating climate on Norderney as possible influences. He theorized about the possibility that the deposited Pb (quadrivalent) was converted to the water-soluble divalent Pb by the low pH and increased oxygen supply and then eliminated.

**1802** Holeček, V. with the technical assistance of Penickova, M. (Inst. Ind. Hyg. Occup. Dis., Prague, Czechoslovakia): EXCRETION OF URINARY COPROPORPHYRIN IN LEAD POISONING. PART I: LEVEL OF THE PRECURSOR OF COPROPORPHYRIN AND PREFORMED COPROPORPHYRIN IN FRESH URINE. PART II: DISTRIBUTION OF URINARY COPROPORPHYRIN ISOMERS I AND III. British Journal of Industrial Medicine 14:198-201; 201-8 (July), 1957.

Part I. Although Sallet had found as early as 1896 that coproporphyrin (CP) is partly eliminated

in the form of a nonfluorescent precursor, this problem has been studied in more detail only since 1951; however, it has not yet been isolated, but appears to be a 4-pyrrole compound which is readily oxidized to CP. The authors are of the opinion that the urinary CP had passed through the kidneys in the form of the precursor, and for this reason they investigated experimentally the theory that in Pb poisoning only the precursor of CP and not the CP is present in fresh urine.

CP was determined on Beckman's spectrophotometer by Rimington and Sveinsson's method (1950). For the determination of preformed CP, adsorption on Ca phosphate in an alkaline medium (Askevold, 1951) was used to minimize spontaneous conversion of the precursor to CP; for the same reason, an acid medium was avoided. Ca phosphate was precipitated within 5 min of micturition. All determinations were performed in subdued light, and before chemical treatment, urine samples were kept in complete darkness. In some samples, determination of the precursor in the alkaline supernatant was carried out in a room from which all daylight had been excluded, illuminated by a 25-watt lamp at a distance of 3 m.

The analytical procedure and calculations are described in detail. All determinations of preformed and total CP were carried out twice in parallel. The values obtained on 28 samples of freshly voided urine (15 Pb-poisoned, 4 after treatment, and 9 normal subjects) for total CP, preformed, precursor calculated and found, and preformed CP + precursor found, are tabulated, as is the breakdown and conversion of the precursor to CP under conditions of aging urine samples and whether kept in a dark refrigerator or at room temperature in dark or light. As summarized, the total CP in completely fresh urine in Pb poisoning was found to be formed of 1-12% preformed CP, and 88-99% precursor of CP. Preformed CP was not excreted in increased amounts in Pb poisoning. The increased level of total urinary CP in Pb poisoning is due to excessive excretion of the CP precursor. After micturition, the precursor is rapidly transformed to CP in the dark in the presence of oxygen in the air. In the light it disintegrates rapidly to nonporphyrin substances. Urines were examined in which this disintegration took place almost completely when they were exposed to the effect of diffuse daylight for 2 hr. In these cases the content of total CP fell to only a small percentage of the original value. It is imperative that urine samples for CP estimations are not exposed to light even for a short period.

In Part II, the conversion of the CP precursor was examined in the urine of both Pb-poisoned and healthy subjects immediately after micturition in order to decide whether the relative representation of the 2 CP isomers is produced by the nature of the precursor itself or whether it depends on the treatment of the urine when isolating the CP. Fresh urine was divided into 5 parts and each part treated immediately after micturition so that all the routine methods of extraction of urinary CP were used. The conversion was brought about under 5 conditions: spontaneously in untreated urine, in urine made alkaline by adding Na carbonate, in untreated urine by heating to 100° C., oxida-

tion with I in the ethyl acetate, by the action of HCl on ethyl acetate extract. In this way, large volumes of urine of 3 cases of Pb poisoning were treated and the amounts of porphyrin obtained were purified by column chromatography and in the obtained CP fraction. The specific methods used are stated and the procedure described in detail.

The results, as summarized, showed that the CP precursor in the urine in Pb poisoning was for the most part the precursor of CP III and to a very small extent precursor of CP I. The type of chemical treatment of the urine had no effect on the relative values of the resulting isomers I and III. In an alkaline medium, partial decarboxylation and the production of other porphyrins took place with the conversion of the precursor, but the relative values of the CP isomers were not changed. The CP precursor in the urine of healthy subjects was, on the other hand, formed by both isomers in equal amounts. The type of chemical treatment of the urine was here also of no effect on the ration of the resulting isomers.

- 1803** Holeček, V. (Inst. Ind. Hyg. Occup. Dis., Prague, Czechoslovakia): Vylučování koproporfyriu moči. III. Srovnání celkového obrazu vylučování koproporfyriu moči při otravě olovem s jinými pathologickými stavy. (URINARY EXCRETION OF COPROPORPHYRINS. III. COMPARISON OF TOTAL URINARY COPROPORPHYRIN EXCRETION IN LEAD POISONING WITH OTHER PATHOLOGICAL CONDITIONS.) Pracovní Lékařství 9, No. 6:513-5, 1957.

The mode of excretion of coproporphyrins (CP) in the urine was studied in 8 patients with liver cirrhosis, 3 cases with acute porphyria, 1 case of chronic Pb poisoning, 5 patients with normal CP levels and 4 healthy individuals. It was found that in all cases both CP isomers were excreted in the form of their precursors. The author advances that the pathophysiologic mechanism responsible for the increased level of total CP III in the urine is identical in the above diseases, or very similar. By following the influence of the collecting period of urine on the level of preformed CP it was found that a transformation of precursor to CP can occur in the bladder. By determining CP precursors in an alkaline medium, the author demonstrated that under these conditions part of the precursors could not be determined. In chronic Pb poisoning a great predominance of the isomer CP III over isomer I was found; in cirrhosis of the liver, a slight predominance of I over III, and in normal urine there was a slight predominance of III over I. The results were irregular in acute porphyria. (From author's summary)

- 1804** Horiguchi, S., Iwataki, N., Nagao, Y., Hashimoto, K., Watanabe, S., and Oda, K.: A CASE OF LEAD POISONING COMPLICATED WITH INTESTINAL ADHESION, WITH SPECIAL REFERENCE TO Ca-EDTA THERAPY. Nippon Geka Hokan 26:579-85 (July), 1957. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School. Vol. 1, April 1949-March 1959, p. 36.

Following surgical intervention for intestinal adhesion, the diagnosis of Pb poisoning was confirmed by laboratory tests. The results of treatment with Ca-EDTA are charted, which showed a rapid increase in urinary and fecal Pb excretion. Clinical signs and symptoms were greatly improved; Pb colic was cleared. Intravenous drip infusion was found to be more effective than oral administration. No significant side effects were observed.

- 1805** Horiuchi, K., Tamori, E., and Sugiyama, H.: A METHOD OF SYNTHETIC DIAGNOSIS OF MILD OR LATENT LEAD POISONING. AN APPLICATION OF THE STATISTICAL DISCRIMINANT FUNCTION. Osaka City Medical Journal 3: 195-200 (Jan.), 1957. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School. Vol. 1, April 1949-March 1959, pp. 153-8.

A synthetic method has been devised for the diagnosis of latent or mild Pb poisoning, using the statistical method of discriminant function with the findings of several examinations. In order to construct a useful discriminant function in cases of mild or latent Pb poisoning for Pb workers, the following had been tested: (1) erythrocyte count, (2) Hb content, (3) Pb in blood, (4) Pb in urine and (5) coproporphyrin in urine. A number of Pb workers were examined with regard to the above and other clinical signs and were classified by experts in occupational medicine, into the following 2 groups: (A) those free from signs of Pb poisoning and (B) those recognized to be affected by Pb poisoning. The values of these 5 criteria were statistically worked out into numbers indicating normality or a certain degree of deviation, possibly depending on the intoxication. A nomogram was made for quickly finding a limit above which intoxication had to be diagnosed. By this method 5% and 1%, respectively, of each group A and B were considered to have been classified into the wrong group.

- 1806** Humperdinck, K. (Ruhr Miners' Org., Bochum, Germany): Sammelreferate: Arbeitsmedizin. (LITERATURE REVIEWS: INDUSTRIAL MEDICINE.) Medizinische Klinik (Berlin) 52, No. 44: 1930-1, 1957.

A brief discussion of treatment of Pb poisoning with CaNa<sub>2</sub>EDTA is included.

- 1807** Jecklin, L. (Basel, Switzerland): Blei in den Knochen von chronisch Rheumakranken. (LEAD IN THE BONES OF PATIENTS WITH CHRONIC RHEUMATISM.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 7:213-5 (Sept.), 1957.

The Pb content in the vertebral column of 3 normal subjects and 4 patients was determined by the dithizone method. In the 3 subjects with healthy vertebral column (2 men, 1 woman, age 56-71 yr) a Pb content of 735, 660 and 500 µg Pb/100 g bone substance, respectively, was found. The high content in the 1st is explained by his occupation, sanitary mechanic, which involved exposure to Pb. The 4 patients with arthropatia deformans (2 men, 2 women, age 49-80 yr) showed 418, 638, 178 and

143 µg Pb/100 g bone, respectively. The first case (418 µg) had worked in a printing plant where he had been exposed to Pb and Pb fumes. Author concludes that Pb cannot be the cause of chronic rheumatism of the joints.

- 1808** Johnstone, R.T. (Los Angeles, Calif.): A RE-EXAMINATION OF THE PICTURE OF PLUMBISM. *Industrial Medicine and Surgery* 26: 323-6 (July), 1957.

After 20 yr of intimate experience with Pb intoxication the author believes that the picture of this disease has undergone great changes. Because of greater attention to industrial hygiene the disease has recently become rare and mild, and it is now Pb absorption rather than Pb poisoning which is observed. However, instances will occur where ordinary illness is ascribed to Pb, owing to the mistaken impression that the patient has been exposed to Pb, eg, when he has used paint for inside purposes, though paint now no longer contains Pb in the US. Modern textbooks often rely on old-fashioned authors rather than on modern experience, and postulate a relationship between hypertension, arteriosclerosis, gastric ulcer, hepatitis and other general diseases without sufficient foundation. Industrial Pb poisoning today shows itself by constipation with fatigue and dull headaches; mild or severe intestinal colic may follow and nausea, vomiting and anorexia may be present. A Pb line on the gums should not be relied upon as evidence of intoxication. Abdominal tenderness about the umbilicus is usual. Encephalopathy and peripheral neuritis are unusual and so are tremor, wrist drop, and weakness of the extensor muscles. Laboratory reports on specimens of urine or blood, by mentioning the presence of Pb, although within normal limits, may suggest plumbism. The author cautions against interpretation of a laboratory's findings without knowledge of its qualifications for Pb analyses, complete occupational and personal history of the patient, and containers used for collection of urine samples. He illustrates this by briefly describing 2 cases. Pb in the urine must be in excess of 0.07 mg/100 g of blood before being regarded as abnormal in amount. Ordinary mild Pb absorption, if the patient is removed from exposure, calls for no treatment. Colic may be removed by intravenous Ca gluconate at intervals of 3 or 4 hr, and 0.5 oz MgSO<sub>4</sub> daily will relieve constipation. EDTA is seldom needed and it is indefensible as a preventive measure. Prevention should be a matter of good industrial hygiene, and in these conditions if Pb intoxication does occur it is a mild gastro-intestinal condition only.

- 1809** Kadlec, K., and Vyskočil, J.: Diagnostický význam komplexonu (CaNa<sub>2</sub> EDTA) u saturnismu. (DIAGNOSTIC IMPORTANCE OF COMPLEXON (CaNa<sub>2</sub>, EDTA) IN LEAD POISONING.) *Pracovní Lékařství* 9, No. 2:134-7, 1957.

- 1810** Kahnemann, F.: Miosi monolaterale transitoria da intossicazione piombo-arsenicale. (TRANSITORY MONOLATERAL MIOSIS CAUSED BY LEAD ARSENATE POISONING.) *Annali di Ottalmologia e Clinica Oculistica* 83:653-62 (Nov.), 1957.

- 1811** Kaliteevskaya, T.N. (Inst. Ind. Hyg. Occup. Dis., Acad. Med. Sci. USSR): Rentgenologicheskie nablyudeniya nad izmeneniyami zheludochno-kishechnogo trakta pri svints-ovoi intoksikatsii. (ROENTGENOLOGIC EXAMINATION OF THE GASTROINTESTINAL CHANGES IN LEAD POISONING.) *Sovetskaya Meditsina* 21, No. 4:96-8, 1957.

The author examined 105 patients hospitalized in the clinic of the Institute with varying degrees of Pb poisoning. As summarized, in colic, X rays point to the presence of distinct and characteristic changes in the gastrointestinal tract which confirm the findings of other authors. It was also found that even in mild poisoning some disorders of gastric or intestinal function take place although they are not always present and are not characteristic. In addition to X rays, gastric acidity was determined.

- 1812** Karlsen, E.O., and Aanonsen, A.: Blyeksposisjon; noen vurderinger av verdien ved telling av basofilt punkterte røde blodlegemer og bestemmelse av blyutskillelse i urinen. (LEAD POISONING; ESTIMATION OF THE VALUES FOUND BY COUNTING BASOPHIL PUNCTATED ERYTHROCYTES COMBINED WITH A DETERMINATION OF THE EXCRETION OF LEAD IN THE URINE.) *Nordisk Hygienisk Tidsskrift* 38, No. 11/12:259-62, 1957.

- 1813** Kastarlak, N., Önen, K., and Gülcüler, A.C. (Univ. Istanbul, Turkey): Bir kronik kurşun intokalkasyonu vak'ası. (CASE OF CHRONIC LEAD POISONING.) *Türk Tıp Cemiyeti Mecmuası* 23, No. 4:252-6, 1957.

The case described is that of a 25-yr-old storage battery worker who was admitted to the hospital with epigastric pains. The clinical and laboratory findings which included EKG, basal metabolism rate, <sup>131</sup>I uptake, are presented. The signs and symptoms of Pb poisoning and treatment are discussed at some length.

- 1814** Koch, H.J., Jr., Smith, E.R., and McNeely, J. (Sloan-Kettering Inst. Cancer Res., New York City): ANALYSIS OF TRACE ELEMENTS IN HUMAN TISSUES. II. THE LYMPHOMATOUS DISEASES. *Cancer* 10, No. 1:151-60, 1957.

The following ranges of Pb concentrations (µg/g dry tissue) were found for normal subjects and patients with lymphomatous diseases, respectively: kidneys 1.3-48.7, 3.2-110.0; liver 4.2-26.0, 4.1-7.4; lung 4.7-21.9, 1.2-85.0; spleen 3.4-9.6, 3.7-8.0. (29 references)

- 1815** Lancis, F., and Penalver, R. (Cuba): Valor de la coproporfinuria III en la determinación de la exposición al plomo. (IMPORTANCE OF COPROPORPHYRINURIA III IN THE DETERMINATION OF LEAD HAZARD.) In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 280-1.

The determination of the percentage of workers with high coproporphyrin III (CP) urine, is more practicable than the determination of Pb in air, not

requiring specific and expensive equipment.

A survey was done at 1 of the storage battery companies in Havana. Workers were classified in 2 groups. Those with high exposure to Pb were found with high values of CP in urine (24 out of 26), and in the group with limited exposure only 1 out of 14 show this high value.

- 1816** Larens, W. (Univ. Heidelberg, Germany): Ein Fall von Bleiencephalopathie. (A CASE OF LEAD ENCEPHALOPATHY.) Archiv für Toxikologie Fühner-Wieland's Sammlung von Vergiftungsfällen 16:220-3, 1957.

A case of acute Pb poisoning with encephalopathy in a 43-yr-old man who had been engaged for almost 10 yr in the removal of old paint (by sandblasting) from boilers and iron structures is described. No previous manifestations of exposure to Pb had been evident, although the patient had been examined every 2 yr. Gastric disturbances occurred only in the course of the last job when, together with 2 other workers, he was removing paint by means of a cutting torch from a metal conveyor in a cellar. In spite of the fact that the workers wore masks and adequate fresh air was provided, all 3 developed gastric disturbances during the first week. The other 2 workers took sick leave at the end of the 2nd wk, while the patient continued working on another job in the open. On this job he came in contact with red Pb. His condition worsened until he was admitted to the hospital. At the time of admission, his blood Pb was 119 µg/100 ml; urinary Pb, 333 µg/100 ml. Lumbar puncture on the 10th day showed among certain deviations from normal, Pb content of 77 µg/100 ml. The course of treatment is not described. The patient recovered almost completely 6 mo later. (13 references)

- 1817** Leger, H.: Données actuelles sur l'hématologie du saturnisme. (PRESENT STATUS OF THE HEMATOLOGY OF LEAD POISONING.) Proceedings of the Society of Industrial Medicine and Hygiene, Paris. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 18, No. 4:472, 1957.

The hematological picture in Pb poisoning is discussed. The most distinct syndrome develops in severe Pb poisoning as is the case of foundry workers, welders and in the manufacture of batteries. An isochromic anemia with marked polychromatophilia, but without poikilocytosis often occurs. Basophilic stippling (BS), although they are not specific for plumbism, are of diagnostic aid. A gradually increasing or a constantly elevated percentage of BS are an almost certain sign of Pb poisoning. A slow drop in the number of red blood cells with BS and their final disappearance is an additional proof. Other hematologic changes caused by plumbism are a moderate thrombopenia, leucocytosis, polynucleosis and rarely mononucleosis. The bone marrow usually shows an erythroblastic reaction, BS are seen in the myelogram. In cases of mild but chronic Pb absorption as it occurs in printers and plumbers, a slight isochromic anemia with a few BS is noted. However, renal damage with hypertension and hyperazotemia is more important in these cases. In acute poi-

soning anemia with polychromatophilia and occasional poikilocytosis is very pronounced; but no BS is present. Determination of Pb and free protoporphyrins in the blood are a valuable aid in diagnosis.

- 1818** Lob, M. (Lausanne, Switzerland): Les intoxications professionnelles par les métaux. (OCCUPATIONAL POISONING BY METALS.) Praxis 46, No. 6:121-5 (Feb.), 1957.

In this discussion of hazards, the most frequent industrial metal poisoning is stated to be Pb poisoning. The order of toxicity of Pb and Pb salts is as follows: basic carbonate, oxides, metallic Pb, monosilicates. A concentration of 0.15 mg/m<sup>3</sup> is considered as threshold value for Pb in the atmosphere. Symptoms and signs of Pb poisoning and its therapy are discussed. The syndrome of TEL poisoning is briefly described. The effects of exposure to Mn, Hg, Cd, Cr, Be and V, are also briefly discussed.

- 1819** Lombardi, A.R., and Lurie, A.S. (Smoky Hill Air Force Base, Salina, Kan.): HEALTH HAZARDS ENCOUNTERED IN REPAIR OF JET AIRCRAFT FUEL CELLS. Journal of the American Medical Association 164, No. 5: 531-3, 1957.

Twelve airmen, average age 23 yr, assigned to the repair of fuel cells were subjected to physical examinations and laboratory tests. All findings were within normal limits. A number of men not wearing masks occasionally exhibited reactions of the central nervous system, such as dizziness, ataxia, headache; these did not occur among men wearing masks. No definite evidence of chronic toxic effect was found in the 12 airman examined. The composition of the jet fuels listed did not include TEL, although it is stated that "most jet engines can and do burn aviation gasoline occasionally, producing a potential Pb hazard." A brief summary is given of the safety measures. Because of the fact that the type of safety mask used at the station (positive pressure hose mask) has a very limited efficiency (effective only at concentrations <1000 ppm) additional precautions should be taken before entering the fuel cells.

- 1820** Lovisetto, P., Sibour, F., and Turco, G.L. (Univ. Turin, Italy): Studi sulla emoglobina nell'anemia da piombo. I. Ricerca mediante cromatografia su carta. (HEMOGLOBIN IN LEAD ANEMIA. I. STUDIES WITH PAPER CHROMATOGRAPHY.) Bollettino della Società Italiana di Biologia Sperimentale 33:149-51, 1957.

Hemoglobin from 14 cases of chronic Pb poisoning was studied by monodimensional ascending and bi-dimensional chromatography. All 14 subjects were affected by Pb colic; 12 showed anemia from 3-3.5 million red cells, coproporphyrins (CP) in urine of 300-500 µg; 2 who were observed during an attack of colic had CP up to 900 µg and severe anemia (2 million red cells). A denaturation process of the alkali-sensitive fraction could be detected which was superimposed over the other changes in the pigment produced by the chromatographic manipulations. (30 references)

- 1821 Lovisetto, P., Turco, G.L., and Sibour, F. (Univ. Turin, Italy): Studi sull'emoglobina nell'anemia da piombo. II. Ricerche mediante denaturazione alcalina. (HEMOGLOBIN IN LEAD ANEMIA. II. STUDIES BY MEANS OF ALKALINE DENATURATION.) Bollettino della Società Italiana di Biologia Sperimentale 33:151-2, 1957.
- Using Singer's method (1951, 1953), in 14 cases of Pb anemia, denaturation of hemoglobin by alkali treatment was found to be very rapid; the amount of alkali-resistant hemoglobin was <1%. Thus the possibility of a superficial modification of the hemoglobin molecule is excluded. (25 references)
- 1822 Ludwig, G.D. (Univ. Penn., Philadelphia): SATURNINE GOUT. A SECONDARY TYPE OF GOUT. A.M.A. Archives of Internal Medicine 100: 802-11 (Nov.), 1957.
- A 57-yr-old house painter who for 38 yr had worked with paints containing Pb, developed weakness, heart and joint trouble. In addition he had dyspnea, trepopnea, occasional chest pain and episodes of vertigo. He felt weakness in his hands, swollen wrists and ankles and had lost weight. Hemoglobin (Hb) values varied between 13.7 and 14.3 g/100 ml, RBC 4,200,000-4,700,000/mm<sup>3</sup> with slight anisocytosis, poikilocytosis, but no excessive basophilic stippling. The only abnormal finding was blood uric acid, 8.8-9.0 mg/100 ml. X-rays showed degenerative changes of the right sacroiliac joint and both hip joints. Surgery for a toxic nodular goiter was performed. Laboratory tests made 9 yr after this acute illness showed Hb 13.7 g/100 ml, erythrocytes 4,310,000/mm<sup>3</sup>, urinary coproporphyrin 1100 µg/24 hr, Pb in blood 69 µg/100 ml, blood uric acid 4.1 mg/100 ml. It was assumed that the patient had stored Pb in his bones over a period of years where it had remained dormant until mobilized by the development of thyrotoxicosis. After the stimulus to mobilization of Pb was removed by thyroidectomy, elimination of circulating Pb by excretion may have taken place.
- A 60-yr-old machinist, exposed for many years to molten Pb and Pb dust from a grinding operation, complained of weakness and swelling of his hands, episodes of pain in his feet and toes, pains in his shoulders, neck and low back, and slight deafness. Blood values were generally normal; the blood uric acid level was elevated. Roentgenographically, slight hypertrophic changes in spine, pelvis, distal phalanges and mild degenerative joint changes were noted. Pb in blood was 0.06-0.161 mg/100 ml., urinary coproporphyrin 357 and 406 µg/24 hr on 2 occasions. Urinary Pb excretion after intravenous administration of CaNa<sub>2</sub>EDTA was 0.550 mg/24 hr; 2 control determinations 0.250 and 0.370 mg/24 hr.
- The authors emphasize that they do not want to imply that saturnine gout is common or that Pb is an important etiologic agent in gout but that saturnine gout may be a secondary type of gout. (50 references)
- 1823 Magan, C., and Grinstein, M. (Med. Dept. Directorate Milit. Mat. Prod., Buenos Aires, Argentina): La coproporfirinuria como elemento de diagnóstico precoz de la intoxicación por plomo. (COPROPORPHYRINURIA AS A FACTOR IN EARLY DIAGNOSIS OF LEAD POISONING.) Semana Medica (Buenos Aires) 110, No. 4:125-32, 1957.
- Coproporphyrinuria (CP) and hematological data were studied in normal males and in employees of the Fabrica Militar de Derivadas del Plomo (Ramos Mejia). CP content in 24-hr urine samples and in 1 single voided morning sample was determined according to the method of Schwartz et al (1951). CP levels in 33 normal males (18 24-hr samples and 15 morning samples) ranged from 82-303 µg/24 hr urine (10.1-27.5 µg/100 ml) and from 9.6-33.5 µg/100 ml in the single morning specimens. These levels were comparable to the normal limits stated by Zieve et al (1953) for the North American population.
- Of the employees of the Fabrica Militar, who were exposed to Pb or Pb oxides, the great majority had markedly elevated levels of CP, while the hematological data (erythrocytes, Hb and basophilic stippled cells) showed no correlation to the CP levels. There was a correlation between the CP levels and the length and intensity of exposure to Pb or Pb oxides. CP levels (in 1954) in these persons (42) ranged from 153-2863 µg/24 hr (16-675 µg/100 ml). The majority had levels >300 µg, the upper normal limit and, with one exception, no stippled cells were present. Erythrocytes averaged 5 million/mm<sup>3</sup>, Hb values averaged 100%.
- The data show CP to be a sensitive indicator for the early detection of Pb intoxication at a time when the hematological data give no indication of its presence. (23 references)
- 1824 Marlet, J.J.C. (Univ. Hosp. Utrecht, The Netherlands): Een gecompliceerd geval van chronische chroom-en loodvergiftiging. (A COMPLICATED CASE OF CHRONIC CHROMIUM AND LEAD POISONING.) Nederlandsch Tijdschrift voor Geneeskunde 101, No. 19:863-9, 1957.
- The case of a 39-yr-old man who had worked in a metal factory for a few years, is described. First signs of abdominal cramps, headache and bronchitis appeared after 3 yr. One year later, his hand became swollen, he developed abdominal and back pains, fatigue and listlessness. Neurological tests revealed impairment of his reflexes; X-ray tests, changes of the lumbar vertebrae. His urine was found to contain 600-750 µg Pb and 10-14 mg Cr/l. He was treated with CaEDTA. The author points out that the particular signs of intoxication in this case might be associated with general neurologic degeneration in the subject since his coworkers were not likewise affected.
- 1825 Merli, A. (Milan, Italy): Considérations concernant l'emploi de sero-albumine dans la prophylaxie de l'intoxication dérivant du plomb. THE USE OF SERUM ALBUMIN IN THE PROPHYLAXIS OF LEAD POISONING. In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 294-5.
- In a Pb-acid accumulator factory in Northern Italy, workmen of various departments were given only serum albumin or together with vitamins PP and C. It was given by means of capsules in variable doses and for a certain period of time. By comparing clinical data and laboratory examination



before and after treatment, it was found that on the basis of complete clinical examinations with pressure readings and weight control, laboratory tests as to stippled red cell counts, determination of hemoglobin, urinary coproporphyrins and complete urinalyses, the results obtained might be considered as favorable.

- 1826** Meyers, J., and van Dommelen, C.K.V.: (CALCIUM VERSENATE IN LEAD POISONING.) *Nederlandsch Tijdschrift voor Geneeskunde* 101:1252-4 (July 6), 1957.

Calcium versenate (EDTA) has been widely accepted as the most effective drug for the treatment of Pb poisoning, but opinions are still divided about the dosage. Some recommended intravenous (iv) injection of 0.6 g of EDTA in 10 ml of water on 3 successive days, and others give 3 g of the drug in 500 ml of water by iv infusion daily for 3 days. The authors used these doses alternately in a 49-yr-old man in whom Pb poisoning developed while working in a factory producing storage batteries. They found that iv infusion of 3 g of EDTA repeatedly induced more copious urinary excretion of Pb than did the iv injection of 0.6 g. Therefore, they recommend that the larger dose be used in the treatment of Pb poisoning. (From *Journal of the American Medical Association* 165, No. 13:1752, 1957)

- 1827** Mikhailov, M.N.: CHEMICAL COMPOSITION OF SALIVARY CALCULI. *Stomatologiya* 1957, No. 3:43-6.

Calculi consisted of Ca 32-36, P 12-16, and Mg 3-3.5%; Na was found in considerable quantity. Cr, Mn, Fe, Cu, K, and Pb were found as trace elements. (Referat. *Zhur. Khim., Biol. Khim.* 1957, Abstr. No. 24894.) (From *Chemical Abstracts* 52: 6574, 1958)

- 1828** Minden, H., and Opitz, H. (Acad. Social Hyg., Ind. Hyg., Med. Educ., Berlin-Lichtenberg, Germany): Bleiexposition und Bleiintoxikation. (EXPOSURE TO LEAD AND LEAD POISONING.) *Archiv für Gewerbepathologie und Gewerbehygiene* 15, No. 3:230-3, 1957.

The results of serial laboratory examinations (hemoglobin levels, erythrocyte counts, basophilic erythrocytes, urinary porphyrins) of 219 workers exposed to Pb fumes and dusts are summarized in graphs and compared with corresponding findings on 56 patients with established Pb poisoning. The overlapping of the curves facilitated the recognition of the early stages of the disease, thus timely prevention, and the diagnosis of existing intoxication. The limit values of intoxication were found to be: 77.5% hemoglobin, 4.38 million erythrocytes, 4.5/1000 basophilic cells, 74 µg% Pb in blood, >100 µg% urinary porphyrins. The findings are interpreted as follows: It is not essential that in a case of Pb poisoning all laboratory values should lie on the side of greater probability. However, in no established case did all values lie to the left of the point of intersection of the curves. Where this does occur, a different etiology must be sought. The findings indicated that there was no single case of Pb poisoning without increase in the number of basophil-

ic cells, while recurrent poisoning cases with normal porphyrin elimination in the urine did exist. For this reason basophilic stippling is more important diagnostically than porphyrinuria. Although blood Pb values showed a wide scatter, in certain cases Pb levels are decisive and indispensable for expert testimony. Determination of Pb in urine and feces may be necessary in suspected cases of massive poisoning, but otherwise is of little value.

- 1829** Mörrer, A.: Das tägliche Blutbild. IV. Blutbild bei akuter Bleivergiftung. (THE DAILY BLOOD PICTURE. IV. BLOOD PICTURE IN ACUTE LEAD POISONING.) *Medizinische*, 1957:225.

Using a case of Pb poisoning in a dock worker as an example, the author recommends the testing of blood for stippled cells in a thick droplet in the belief that this is the simplest procedure. Besides stippled erythrocytes, anemia, anisocytosis and poikilocytosis, colics and Pb line were observed. Because of subfebrile increases of the temperature, the diagnosis of uncertain febrile infection had been made first. (From *Zentralblatt für Arbeitsmedizin und Arbeitsschutz* 7:258 (Abstracts), 1957)

- 1830** Moeschlin, S. (Med. Clinic, Mun. Hosp. Solothurn, Switzerland): Zur Klinik und Therapie der Bleivergiftung mit Bericht über eine tödliche toxische Nephrose durch Ca-EDTA (Calciumversenat). (CLINICAL MANIFESTATIONS AND THERAPY OF LEAD POISONING WITH REPORT OF A FATAL TOXIC NEPHROSIS CAUSED BY Ca-EDTA (CALCIUM VERSENATE.) *Schweizerische Medizinische Wochenschrift* 87, No. 34:1091-6, 1957.

The author reports that automobile fuel presently used in Switzerland contains 425 mg Pb/l as TEL and aviation gasoline 530 mg/l. Since 52-76% of the Pb compounds are dispersed into the air with the exhaust gases, he calculates that 200,000-300,000 kg Pb are spread annually into the atmosphere of a country as small as Switzerland. Assuming that the threshold limit for inhaled Pb is 100 µg/m<sup>3</sup>, he points out that the motorcycle driver on roads heavily traveled by motor vehicles may be exposed to the risk of Pb poisoning. Poisoning in 2 auto mechanics due to inhalation of TEL is reported. Both men exhibited the usual symptoms and clinical findings of TEL poisoning. The presence of coproporphyrin III in urine and feces and of punctate erythrocytes in the blood was considered as indicative of Pb poisoning. In addition, 2 fatalities, precipitated by EDTA treatment of workers exposed to white Pb are described. Disturbances of the central nervous system occurred after each infusion of 2 g CaEDTA and the men died with signs of toxic nephrosis. Another lethal case of a 52-yr-old man with previous Pb poisoning, due to treatment with EDTA, is mentioned. The author points out that intravenous treatment with CaNa<sub>2</sub>EDTA even in the presently recommended doses of 50-60 mg/kg/day may produce lethal damage to the kidneys. (Many references)

- 1831** Monaenkova, A.M. (Inst. Labor Hyg. Occup. Dis., Acad. Med. Sci., USSR): FUNCTIONAL



STATE OF THE THYROID GLAND IN CHRONIC INTOXICATION WITH SOME INDUSTRIAL POISONS. *Gigiena Truda i Professional'nye Zabol-evaiya* 1, No. 2:44-8, 1957. Translation in U.S. Department of Commerce, Office of Technical Services: Soviet Research in Toxicology. Document OTS 63-31382, 1963, pp. 9-17.

Thyroid gland function, using  $^{131}\text{I}$ , and the basal metabolic rate were determined in 40 patients with chronic Hg poisoning and 41 with Pb poisoning, in addition to an extensive general examination. Of those with Hg poisoning, 18 showed a high, 16 a normal, and 6 a low uptake of  $^{131}\text{I}$ . Of the 41 with Pb poisoning, there were 7 women and 34 men, 21-60 yr old, most of them 31-50, exposed to Pb for 3-10 yr. Twenty had a mild form of poisoning, 19 a moderate, and 2 a severe form. The  $^{131}\text{I}$  test showed 29 to have normal I uptake, 2 an increase and 10 a reduction. The increase in I uptake was seen in patients  $\leq 30$  yr, and the decrease in those  $\geq 40$  who had longer contact with Pb. The author admits that clear signs of hypothyroidism or complaints pointing to it were not found in these patients. Comparison with the basal metabolic rate in 33 showed in most (21) an absolute coincidence of both indexes. The author concludes that thyroid gland function is changed by both poisons and that a significant role is played by the thyroid in the mechanism of the appearance and development of these poisonings. More significant changes occur in Pb poisoning.

**1832** National Safety Council: LEAD. Data Sheet, D-443, 1957.

A discussion of properties of Pb and TEL manifestations of poisoning, determination of Pb concentration in air, prevention, selection and placement of employees and training of employees.

**1833** Niemöller, H.K.: Zur Prophylaxe der Bleivergiftung. Inhalationsversuche mit verschiedenen Chemikalien. (THE PROPHYLAXIS OF LEAD POISONING: TRIALS WITH VARIOUS INHALANTS.) *Deut. med. Woch.* 82, No. 18: 738-40, 1957.

This is an account of an investigation of the prophylactic effect, as judged by a rise in hemoglobin level, a fall in basophilic stippling (BS), the level of Pb in the blood and porphyrinuria, of various chemical compounds given by inhalation in the form of aerosols to persons exposed to Pb.

The compounds chosen for a preliminary examination were Ca, Na citrate, Zr citrate and methionine. Only methionine was found to give definitely favorable results; these, following its inhalation, as a 10% aqueous solution, for 10 consecutive days, by means of a normal (Drage) aerosol apparatus, were compared with those in which an electroaerosol apparatus was used.

The most definite variation was shown in the hemoglobin (Hb) level, where the normal aerosol inhalation was followed by a slight decrease in 6 out of 10 cases, the electroaerosol by a slight rise in all; BS showed a decrease in 7 of the normal aerosol patients as compared with 5 of the electroaerosol, the porphyrinuria a decrease in 5 compared with 7, and the Pb blood content no difference.

On the basis of the more favorable effect on the Hb level, which the author attributes to stimulation of the bone marrow by the electric current, and to the fact that with the electroaerosol method there were no complaints of an unpleasant taste of methionine, it is claimed that the electroaerosol apparatus is the better prophylactic agent.

(As noted by the abstractor, E. Browning, this article is not convincing; the assumption that bone-marrow stimulation by the electric current is responsible for the slight and variable alterations of Hb is unwarrantable, and the number of cases investigated is too small on which to base accurate conclusions.) (From *Bulletin of Hygiene* 32:870, 1957)

**1834** Nishino, S. (Gifu Med. School, Japan): EFFECT OF ORAL ADMINISTRATION OF CALCIUM ETHYLENEDIAMINETETRAACETATE IN LEAD POISONING. *Kokumin Eisei* 26:90-5, 1957.

EDTA was administered continuously to Pb-poisoned subjects for 60 days to 1 group and intermittently every 10 days to another group. The toxic symptoms and signs of Pb poisoning were more or less improved by the administration of EDTA without any harmful effect. EDTA showed favorable effect on anemia in chronic Pb poisoning especially in the group of continuous administration. Stipple cells disappeared or decreased more extensively in that group than in the group of intermittent administration. (From *Chemical Abstracts* 51:18309, 1957).

**1835** Nishiyama, K. (Tokushima Univ., Japan): SIGNIFICANCE OF LEAD CONTENT OF HAIR IN LEAD POISONING. PART III. LEAD CONTENT OF THE HAIR OF LEAD WORKERS. PART IV. LEAD ANALYSIS OF HAIR AS AN INDICATOR OF EXPOSURE TO LEAD. *Shikoku Acta Medica* 11: 64-9; 164-70, 1957.

Part III. The Pb content in the hair of 112 workers of various industries was found to be as follows ( $\mu\text{g/g}$ ): storage battery plants 37.5-550 (av 217.3); rayon manufacture 46.7-616.8 (av 168.1); measuring instruments manufacture av 11.3; automobile painting av 6.1; bobbin painting av 22.5; printing, newspaper office av 30.9 (male), 93.3 (female); small printing offices 106.4 (male), 116.3 (female). Pb content in hair was proportional to the degree of Pb exposure. Thus Pb analysis of hair in Pb workers indicates the degree of exposure to or absorption of Pb. (13 references)

Part IV. The relation between the Pb content in hair, blood and urinary Pb, coproporphyrin and stippled blood cell count was studied in 57 Pb workers. The following data were found for Pb content in hair,  $\mu\text{g/g}$ , and blood Pb,  $\mu\text{g}/100\text{ ml}$ , and urinary Pb,  $\mu\text{g}/1$ , respectively: male printers 3.9-196.1 (av 75.9), 48.3, 60.0; female printers 13.4-215.3 (av 115.4), 32.7, 61.4; rayon manufacture 13.9-616.8 (av 163.3), 51.9, 72.6; storage battery plants 37.5-550 (av 217.2), 135.5, 115. A statistical correlation was observed between Pb in hair and blood and urinary Pb. Pb contents in hair  $< 30\text{ }\mu\text{g/g}$  indicate nonoccupational, normal Pb exposure; 30-110  $\mu\text{g/g}$  occupational Pb exposure, and  $> 110\text{ }\mu\text{g/g}$  dangerous exposure. There was no correlation between general symptoms of Pb poisoning, stippled blood cell count and specific gravi-

ty of blood. (From author's English summaries) (30 references)

- 1836** Nishiyama, K., Ishizawa, M., and Oshima, M.: THE SIGNIFICANCE OF LEAD CONTENT OF HAIR IN LEAD POISONING. Proceedings of the 30th General Meeting of Japan Association of Industrial Hygiene. Journal of Science of Labour (Japan) 33:549 (July), 1957.

The Pb content of the hair can be used as an indication of the degree of exposure to Pb. The following three grades are mentioned: Pb content of hair ( $\mu\text{g/g}$ ) at negligible, moderate and serious or dangerous exposure, respectively: <30, 30-110, >110. (From Occupational Safety and Health Abstracts 8, No. 3:Abstr. No. 3132, 1958.

- 1837** Nogaki, K. (Kyushu Univ. Med. School, Japan): (ON THE ACTION OF LEAD ON THE BODY OF LEAD REFINERY WORKERS: PARTICULARLY ON THE CONCEPTION, PREGNANCY AND PARTURITION, IN THE CASE OF FEMALES AND ON THE VITALITY OF THEIR NEWBORN.) Igaku Kenkyu 27, No. 6:1314-38, 1957.

The Pb content of the blood was examined in 157 workers at a refinery. Pb levels ranged from 0.317 mg/100 ml to 0.110 mg/100 ml which is considerably higher than in normal subjects. General health was less favorable than in normal subjects, but was not significantly related to the Pb content of the blood. Fertility was reduced, the frequency of abortion increased, not significantly related to the Pb level. There was a significant prevalence in the number of boys over girls among the newborn, higher in workers with higher Pb content of the blood. (From Excerpta Medica, Sect. 17, 4:Abstr. No. 2176, 1958)

- 1838** Nunziante Cesàro, A., and Granata, A. (Inst. Ind. Med., Messina Univ., Italy): Recherches d'hémocytochimie quantitative dans la silicose, le saturnisme, le benzolisme, le sulfocarbonisme et l'oxycarbonisme professionnels. (QUANTITATIVE HEMOCYTOCHEMISTRY IN SILICOSIS AND IN OCCUPATIONAL POISONING BY LEAD, BENZENE, CARBON DISULFIDE AND CARBON MONOXIDE.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 18:412-27 (July-Aug.), 1957.

The studies were limited to a quantitative analysis of the polysaccharides, ribonucleins and desoxyribonucleins. In silicosis the polysaccharides were slightly increased in the neutrophils and monocytes. The desoxyribonucleins were normal in the neutrophils but slightly decreased in the lymphocytes and monocytes. The ribonucleins were decreased in the nucleus and cytoplasm of the neutrophils and in the monocytes and lymphocytes. In Pb poisoning the polysaccharides were decreased in the neutrophils and monocytes. The desoxyribonucleins were clearly increased in the neutrophils and lymphocytes and the ribonucleins were decreased in the nucleus and cytoplasm of the neutrophils and in the monocytes and lymphocytes. In benzene poisoning, the polysaccharides were decreased strongly in the neutrophil granulocytes and less in the monocytes. The desoxyribonucleins were increased in the neutrophils, eosinophils,

monocytes and lymphocytes while the ribonucleins were decreased in the nucleus and cytoplasm of the neutrophils and lymphocytes and increased in the monocytes. In  $\text{CS}_2$  poisoning the polysaccharides were increased in the neutrophil granulocytes, less in the monocytes. The desoxyribonucleins were increased in the neutrophils, monocytes and lymphocytes. The ribonucleins were decreased in the nucleus and cytoplasm of the neutrophils, in the monocytes and lymphocytes. In CO poisoning the polysaccharides were increased in neutrophils and monocytes. The desoxyribonucleins were increased in the neutrophils, slightly decreased in the lymphocytes. The ribonucleins were decreased in the nucleus and cytoplasm of the neutrophils, in the nucleus of the eosinophils and in the monocytes and lymphocytes, but slightly increased in the cytoplasm of the eosinophils.

- 1839** Nunziante Cesàro, A., Saitta, G., and d'Urso (Inst. Ind. Med., Univ. Messina, Italy): Analyse hémocytochimique de l'acide ascorbique des éléments cellulaires du sang périphérique dans certaines maladies professionnelles (saturnisme, silicose, intoxication par cyanures et par anhydride sulfureux). (HEMOCYTOCHEMICAL ANALYSIS OF ASCORBIC ACID IN THE CELLULAR ELEMENTS OF PERIPHERAL BLOOD IN SOME OCCUPATIONAL DISEASES (PLUMBISM, SILICOSIS, CYANIDE AND SULFUR DIOXIDE POISONING).) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 18:643-54 (Nov.-Dec.), 1957.

A method for the detection of ascorbic acid in the cellular elements of peripheral blood, based on the reaction of Szent-Gyorgi is described. The peripheral blood of 10 patients affected by diseases listed in the title was examined. A definite decrease in ascorbic acid was observed in silicosis and lead poisoning. A smaller decrease was found in cyanide poisoning whereas in  $\text{SO}_2$  poisoning a distinct increase of ascorbic acid was noted.

- 1840** Nunziante Cesaro, A., Saitta, G., and d'Urso, S. (Italy): Etude cytochimique de l'acide ascorbique dans les éléments cellulaires du sang périphérique chez les malades professionnels. (CYTOCHEMICAL STUDY OF THE CONTENT OF ASCORBIC ACID IN PERIPHERAL BLOOD CELLS IN OCCUPATIONAL DISEASE.) In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings p. 185.

See preceding abstract.

- 1841** Ohta, N. (Metropolitan Univ. Tokyo, Setagaya-Ku, Japan): STUDIES ON INORGANIC CONSTITUENTS IN BIOLOGICAL MATERIALS. THE INORGANIC CONSTITUENTS IN HUMAN STONES. Bulletin of the Chemical Society of Japan 30:833-41, 1957.

Average analyses of mineral stones, cholesterol-pigment-Ca stones and cholesterol stones were given in ppm: Fe 728, 124, 40; Cu 3274, 387, 43; Zn 333, 142, 56; Pb 105, 67, 36; Mn 482, 90, 13. Values

in human gall bladder bile, blood, urine, in ppm were: Fe 25.6, 494, 1.88; Cu 10.9, 1.20, 0.18; Zn 9.4, 7.57, 1.52; Pb 0.35, 0.29, 0.068; Mn 1.35, 0.37, <0.01, respectively.

The author points to the correlation between Pb and the calcification phenomenon in biological material; Pb showed the highest concentration ratio in every case of gallstones (203 times that of bile) and urinary calculi (500 times that of urine). Zn and Pb were contained in relatively high quantities in pancreatic calculi. The internal portion of gallstones seemed to contain a greater quantity of heavy metals than the external portion. (60 references)

- 1842** Okada, A.: A STUDY ON THE CONTENTS OF LEAD IN THE BLOOD, URINE, AND FECES OF THE HEALTHY JAPANESE RURAL POPULATION. *Journal of the Osaka City Medical Center* 6:50-79 (Nov.), 1957. In *Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School*, Vol. 1, April 1949-March 1959, pp. 36-7.

No significant differences were observed between rural and urban dwellers in the Pb content of blood, urine and feces per day, although some difference was observed in respective amounts in urine. The theoretical distribution of blood Pb concentrations for 120 healthy rural dwellers showed a log-normal type. On the basis of this curve, 95 and 99% of the population showed <0.01 and 0.038 mg/100 g, respectively. In the daily urine, such distribution was also a log-normal type, while that in the feces was a normal type. A total of 0.020-0.23 mg Pb was found in the meconium of the newborn. After birth, Pb amounts in urine and feces were found to increase with age. Significant correlations were observed between age and Pb concentrations in urine and feces. However, no such relationships existed after 2-1/2 yr in the feces, because of growing individual differences. The total Pb intake per day of bottle-fed babies and weaning infants was fairly higher than that excreted. It was assumed that a daily Pb storage is ~0.060 mg in the former and ~0.043 mg in the latter, and that storage is less in the other age groups. (From author's English summary)

- 1843** Pecora, L., Fati, S., and Vecchione, C. (Univ. Naples, Italy): BEHAVIOR OF PORPHYRINS IN VARIOUS OCCUPATIONAL INTOXICATIONS AND OTHER MORBID CONDITIONS. *Folia Med. (Naples)* 40:24-43, 1957.

Disturbances of porphyrin metabolism, attributed only to porphyria, Pb poisoning, and some anemias, were found to occur in a large number of occupational and other types of illness. (From *Chemical Abstracts* 51:9884, 1957)

- 1844** Peters, H.A., Woods, S., Eichman, P.L., and Reese, H.H. (Univ. Wisconsin Med. School, Madison): THE TREATMENT OF ACUTE PORPHYRIA WITH CHELATING AGENTS: A REPORT OF 21 CASES. *Annals of Internal Medicine* 47:889-99, 1957.

The authors' studies include 26 acute intermittent cases, 1 mixed hepatic porphyria and 3 latent types, 21 of whom were subjected to treatment with

BAL and EDTA. In their laboratory, the following are accepted as upper normal values in urine: porphobilinogen, 1 mg/l; ALA, 2.5 mg/l; Zn, 0.5 mg, and Pb 0.05 mg/l. Uro- and coproporphyrins were graded 0-5+. The clinical symptomatology is described, and 2 cases are presented in detail. In discussing the results, the authors noted increased Zn and Pb (0.08 mg/l) before chelation, indicating accumulation of heavy metals which could form an enzymatic block in the transformation and thus resulting in excretion of important metabolites. They caution all porphyria cases to avoid exposure to barbiturates, sulfonamide, heavy metals, oil paints and solvents.

- 1845** Piazza, G. (Univ. Padua, Italy): L'esame radiologico del tubo digerente negli intossicati cronici da piombo. (RADIOLOGICAL EXAMINATION OF THE DIGESTIVE TRACT IN PATIENTS WITH CHRONIC LEAD POISONING.) *Rivista degli Infortuni e delle Malattie Professionali* 44, No. 5:700-7, 1957.

X-ray observations made on 65 subjects with chronic Pb poisoning are discussed. Functional and organic alterations are reviewed on the basis of prior literature. (12 references)

- 1846** Prato, V., Conterno, G., Fiorina, L., and Rasetti, L. (Univ. Turin, Italy): EARLY SIGNS OF ABSORPTION OF, AND POISONING WITH LEAD. *Folia Med. (Naples)* 40:570-82, 1957.

The earliest signs of Pb absorption are increase of the free protoporphyrin in the erythrocytes, followed by a marked level of Pb in the blood, then appearance of free coproporphyrin in the erythrocytes and in the urine. Anemia appears later and only occasionally basophil granulation of the erythrocytes is evident. In addition to the increase of protoporphyrin in the blood, the reticulocyte count is an early diagnostic sign. (From *Chemical Abstracts* 52:573, 1958)

- 1847** Preda, N., Dinisiotu, G.T., Pilat, L., and Ionescu, C. (Inst. Ind. Hyg. Occup. Dis., Bucharest, Romania): Etudes sur la décharge plombique par le B.A.L. et son utilisation pour le diagnostic du saturnisme. (STUDIES ON THE MOBILIZATION OF LEAD BY BAL AND ITS UTILIZATION FOR THE DIAGNOSIS OF LEAD POISONING.) *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 18, No. 2:145-51, 1957.

The influence of BAL injections on the urinary excretion of Pb was studied in 89 patients treated with either a single injection of 2.0 mg BAL (10% oil solution) or repeated after a 48-hr interval. The chelating effectiveness was followed by determination of urinary Pb 3 hr before and 21 hr after injection. The patients were placed into 4 groups: (A) 29 cases of obvious plumbism; (B) 29 men working daily in Pb-polluted atmospheres, having a urinary Pb excretion of 80-300 µg/l, Pb level in the blood 70 µg/100 ml, and occasional increase in basophils and urinary porphyrins; (C) 19 workers exposed daily to minimal amounts of Pb without clinical symptoms; (D) 12 subjects without occupational Pb exposure. In group A the urinary

Pb concentrations were scattered over a wide range reaching a maximum of 5100 µg/l; 64% were between 2000-3000 µg/l; only 2 samples were <1500 µg/l. In group B, the majority of samples contained up to 500 µg Pb/l. In groups C and D the Pb level in most cases was <200 µg/l. The authors point out that the effect of BAL on the urinary Pb excretions in Pb poisonings may be used as a diagnostic aid.

- 1848** Radulescu, C., Dinischiotu, G.T., Maugsch, C., Ionescu, C., and Teodorescu-Exarcu, I. (Inst. Ind. Hyg. Occup. Dis., Bucharest, Romania): Recherches sur l'atteinte du rein dans le saturnisme industriel par l'étude du clearance de la créatinine et de l'urée. (STUDIES ON THE INVOLVEMENT OF THE KIDNEY IN OCCUPATIONAL LEAD POISONING BY THE DETERMINATION OF CREATININE AND UREA CLEARANCE.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 18, No. 2:125-37, 1957.

After a review of the literature, the functional renal disturbances which precede the anatomic changes of the kidney in the advanced stage of Pb poisoning were studied. The rate of glomerular filtration was determined by measuring the clearance of endogenous creatinine and the Van Slyke urea coefficient was determined by the method of Moller, McIntosh and Van Slyke. Eighty-two cases (80 men, 2 women; 2/3 of them aged 20-40 yr, 8 above 50 yr) with chronic plumbism with and without acute complications, were studied. Seventeen of them were in the stage of colic, 18 had had colics in the past. None of them had typical urinary signs of nephritis or nephrosis. Frequently, a microscopic hematuria and in exceptional cases a proteinuria was noted. No edemas were observed. The hematologic syndrome was characterized by a moderate N retention (50-70 mg% urea) in about 1/3 of the cases tested, with return to normal values within a short time. Only 2 patients exhibited a chronic glomerular nephritis and in 3 subjects the N retention receded very slowly. The rate of glomerular filtration and the Van Slyke coefficient were below normal (<80 ml/l and <50%, respectively) in ~25% of the subjects; the rate of glomerular filtration was <120 ml/l in 47% and the Van Slyke coefficient <70% in 70% of the subjects. The reductions occurred more frequently and more intensely in the stage of colic. The milder the poisoning, the more rapid was the return to normal values.

It is assumed that Pb has a vasospastic effect on the kidney thereby limiting the clearance of creatinine and by its action on the capillaries decreases the rate of filtration. The urinary excretion of Pb is small at the height of the renal vasoconstriction but increases as the rate of glomerular filtration returns to normal, as illustrated in the case of a 32-yr-old man working with PbO. (30 references)

- 1849** Radulescu, I.C., Dinischiotu, G.T., Maugsch, C., Ionescu, C., and Teodorescu-Exarcu, I.: Recherches sur l'atteinte du rein dans le saturnisme industriel par l'étude du clearance de la créatinine et de l'urée. (STUDIES ON RENAL INVOLVEMENT

IN OCCUPATIONAL LEAD POISONING BY MEANS OF CREATININE AND UREA CLEARANCE TESTS.)

Medicina Interna 9, No. 5:724-36, 1957.

See preceding abstract.

- 1850** Robinson, G.L. (Devanport Lab., Greenwich, London, England): TETRAETHYL LEAD POISONING. Letter to the Editor. Lancet 1:378 (Feb. 16), 1957.

The author states that TEL due to cleaning tanks may occur in seamen. He reports the case of a Polish sailor who was an inpatient in the Seamen's Hospital (under the care of Dr. Alec Winfield) from Oct.-Dec., 1956, suffering from abdominal colicky pain, tightness in the chest, and vomiting. His sclerae were slightly icteric; he had a hemolytic anemia (hemoglobin 8.2 g/100 ml, mean corpuscular fragility slightly decreased, reticulocytes 6%, active normoblastic marrow, serum-bilirubin 2 mg/100 ml), and 0.8% of his red cells, showed the coarse basophilia of Pb poisoning. Urinary Pb excretion was 0.3 mg/24 hr. He said that the haze of rust in the atmosphere during scaling of the tank gave rise to cough with rusty sputum. The author compared this seaman with a case of Pb poisoning in an accumulator worker who happened to be in the hospital at the same time: this patient's complaint was also colicky abdominal pain (he had been thought to have a perforated peptic ulcer), but he had no anemia and excreted no Pb in the urine, though he showed characteristic stippling of his red cells. Both patients responded very definitely to therapy with intravenous  $\text{CaNa}_2\text{EDTA}$ .

- 1851** Sagara, Y. (Kyushu Univ., Japan): (STUDIES OF LEAD POISONING. I. CLINICAL STUDY OF ORAL CHANGES IN WORKERS EXPOSED TO LEAD.) Igaku Kenkyu 27, No. 6:1360-8, 1957.

Oral changes in 108 workers handling material containing Pb in a newspaper plant were examined clinically. A Pb line was detected in 51%. It was more frequent in the incisors than in the molars, and more frequent in the lower jaw than in the upper. This finding indicates that Pb which is dissolved in the saliva from the air is apparently absorbed by the gingiva. No definite correlation was observed between the Pb line and gingival affections. The Pb line was more frequent in the longer exposed than in the recently employed. There was no distinct difference among those who had different kinds of work. The condition of the teeth was neither worse nor better than that of workers in other occupations. (Excerpta Medica, Sect. 17, 5:Abstr. No. 3121, 1959)

- 1852** Saita, G. (Univ. Milan, Italy): La terapia del saturnismo. (TREATMENT OF LEAD POISONING.) Medicina del Lavoro 48:307-28 (May), 1957.

The causal therapy of Pb poisoning was mainly based, until some 10 yr ago, on the use of Ca and alkalizing substances favoring the storage of Pb in the bones and of Mg, ammonium chloride, parathormone, iodides as favoring the mobilization and elimination of the poison. Na citrate was also used, because it is capable of chelating Pb into a compound which can be easily dissolved and elimi-

ated. Towards the end of the last decade BAL was also widely experimented, but its use was not quite safe, particularly in acute stages. Pb elimination with these treatments was always rather limited and therefore there was little detoxifying action. The recent introduction of CaEDTA in the treatment of Pb poisoning opened new perspectives, because this drug has a low toxicity and effects Pb elimination quickly and intensely, particularly by renal route.

The mechanism of action of EDTA is reviewed: it consists in chelating the Pb into a non-ionized soluble compound which can be readily eliminated. The author reports the results obtained at the Clinic for Occupational Diseases in Milan in 46 cases of Pb poisoning treated with EDTA in doses of 2 g daily. Pb elimination in the urine was found to be as high as 20 mg daily and up to 70 mg in 9 days of treatment. Pb elimination was greater when the drug was administered by intravenous (iv) injection rather than by oral route. If the drug is administered by slow iv infusion, its action is more effective than when it is rapidly injected as a 10% solution.

The Pb content in the blood shows a tendency to decrease in the cases where it is initially high, while it remains unchanged in the cases with initial values <100 µg%. Coproporphyrinuria decreases rapidly and more so with the iv than the oral administration. Clinical conditions improve and the duration of the colic is definitely reduced. Slight activity or none at all is shown by the drug in repairing the anemia. This is probably due to the fact that EDTA, while rapidly decreasing the coproporphyrinuria, has no similarly rapid activity in reducing the protoporphyrinemia and therefore the obstacle to the synthesis of heme. EDTA must be administered in successive cycles to obtain the best results on the ratio between Pb elimination and dose of administration. The author reports his own experience on the simultaneous treatment with CaEDTA and BAL: administration of BAL, after some days of EDTA treatment is capable of producing a new increase in the elimination of Pb.

As far as the symptomatic treatment is concerned, mention is made of the recent use of cortisone and ACTH in the treatment of the colic and the results of vitamins and liver extracts in the treatment of anemia. (From author's summary)

- 1853** Saita, G., and Moreo, L. (Univ. Milan, Italy): Mielogramma, ricambio porfirinico, sideremia nel saturnismo sotto trattamento con versenato di calcio. (MYELOGRAM, PORPHYRIN METABOLISM, SIDEREMIA IN LEAD POISONING TREATED WITH CALCIUM VERSENATE.) *Medicina del Lavoro* 48:130-40 (Feb.), 1957.

Blood analysis in 25 cases of Pb poisoning treated with CaEDTA showed that this drug has a very limited effect on the recovery from anemia, in spite of its potent detoxifying action and of its striking effect on many symptoms of poisoning. An investigation, to find out why the hematologic effect of the drug was so delayed, was carried out by a follow-up of 6 cases before, during and after treatment with 2 courses of EDTA. Sternal myelogram, coproporphyrinuria, protoporphyrinemia,

sideremia and transferrinemia were determined. The behavior of sternal myelogram before and after treatment enabled the exclusion of a depressive action of EDTA on the bone marrow. Bone marrow function was quite satisfactory at the end of the treatment as far as both number of cells and maturation and mitotic rates were concerned. Only in subjects observed during colic, a decrease of the erythroblastic hyperplasia typical of the pretreatment myelogram was noted. This finding appeared logical to the authors apart from any effect of EDTA, because the end of the colic puts a stop to the intense erythropoietic stimulation which is interpreted as a reaction against the hyperhemolysis always present during an aggravation of Pb poisoning to an acute stage. Sideremia was always high, both before and after treatment. As far as porphyrin metabolism is concerned, while EDTA rapidly decreased coproporphyrinuria, it did not to any extent modify the very high protoporphyrinemia. The authors conclude that the biochemical picture of the anemia is therefore unchanged. This, together with the persistence of the obstacle to the synthesis of heme are given as causes for the limited action of EDTA in the recovery from anemia. (From authors' summary; 31 references)

- 1854** Sans, J. (Soc. Hyg. Ind. Med., Normandy, France): Problèmes du Médecin du Travail devant les Maladies Professionnelles, en particulier le Saturnisme. (PROBLEMS OF THE INDUSTRIAL MEDICAL OFFICER IN RELATION TO OCCUPATIONAL DISEASES, PARTICULARLY LEAD POISONING.) *Médecin d'Usine*, No. 9: 635-9, 1957.

The practical problem facing the industrial physician occurs in the recognition of excessive absorption, notification of the disease, and return to work. The author considers: (1) that a form for notification of occupational disease (at its onset) be provided by legislation, so that the physician may intervene in time to save the worker and possibly impose preventive measures to be taken by the factory. (2) To provide that notification may be made jointly by the physician treating the patient and the factory physician. (3) That the worker be returned to exposure only after careful and extensive clinical and laboratory tests have been performed. Also that the factory medical inspector study those cases where the employee and employers do not agree. (From author's summary)

- 1855** Saruta, N., and Yamaguchi, S.: A NEW DIAGNOSTIC METHOD OF OCCUPATIONAL LEAD POISONING FOR GROUP INSPECTION. Proceedings of the 30th General Meeting of Japan Association of Industrial Hygiene. *Journal of Science of Labour (Japan)* 33:540 (July), 1957.

Three hundred and sixty-nine workers in the printing shop of a newspaper office were examined as follows: (1) Pb content of the urine was determined; (2) each worker received 2 g of CaEDTA by mouth; (3) the Pb content of the urine was examined 3-6 hr later. It was considered that the difference between (3) and (1) represented more precisely the degree of Pb absorption than (1) alone. (From Occupational Safety and Health Ab-

**1856** Schmitt, F., Drassdo, A., and Trost, W.: Untersuchungen über die Höhe des Blutbleispiiegels bei der Berliner Bevölkerung in den Jahren 1954 und 1955. (STUDIES ON THE LEAD LEVELS IN THE BERLIN POPULATION IN THE YEARS OF 1954 AND 1955.) Medizinische Monatsschrift 11, No. 6:362-4, 1957. The serum Pb levels were determined by the dithi-zone method in 120 healthy persons representing the average population of Berlin, during the years of 1954/55. These subjects had never been exposed to Pb occupationally. They had basophilic stippling of erythrocytes of <100/million. Eighteen (15%) had a serum Pb level >100 µg% with a maximum of 122.5 µg%. The average value was 76.31 µg%; the highest 122.5 µg%; 25 (20.8%) had a serum Pb level between 70 and 80 µg%. Since no signs of Pb intoxication were noted at Pb serum levels up to 120 µg%, the authors propose this figure as a threshold under present conditions of life.

**1857** Sessa, T., and Guarino, A. (Univ. Naples, Italy): Su di un caso di miocardiopatia saturnina: considerazioni diagnostiche e medico-legali. (A CASE OF SATURNINE MYOCARDIOPATHY; DIAGNOSTIC AND MEDICOLEGAL ASPECTS.) Folia Medica (Naples) 40, No. 4 273-99, 1957. The fatal case of a 53-yr-old man who had worked in a Pb foundry for ~22 yr and whose final hospitalization was in Jan 1956 is described. He had begun work in the foundry in 1929. First signs of discomfort, such as vertigo, headache, asthenia and slight arterial hypertension had appeared after ~17 yr on the job. An enlarged liver, myocardial damage and visual disturbances were diagnosed 4 yr later. The man had a slight hypochromic anemia, urinary coproporphyrin (CP) was 200 µg/24 hr. As a result of this he was granted 40% disability on account of Pb poisoning and was removed from foundry work. In 1951 disability was increased to 50%. He was readmitted to the hospital in 1952, whereupon his disability was increased to 80% and he gave up work entirely. The clinical findings upon his hospitalization in 1956 which terminated in death 1 mo later are described in detail. Among laboratory findings, basophilic cells were absent, Pb in urine 3 µg%, Pb in blood 5 µg%; CP in urine 4 µg%. Necropsy findings included lesions of the kidney, typical in Pb poisoning, arteriosclerosis, myocardiosclerosis, hypertrophy of the adrenal cortex and bronchopneumonia. Tissue analysis by the dithi-zone method gave the following concentrations of Pb (µg/mg): heart 920, kidney 2600, liver 2850, suprarenals 2500, spleen 1200, lungs 2000. The importance of cardiac lesions in occupational Pb poisonings from the medicolegal aspect is pointed out. (61 references)

**1858** Srbová, J., and Teisinger, J. (Clinic, Occup. Dis., Prague, Czechoslovakia): Über die Resorption des Calciumdinatriumsalzes der Äthylendiamintetraessigsäure bei der peroralen Verabreichung zur Therapie der Bleivergiftung. (ABSORPTION OF CALCIUM DISODIUM SALT OF ETHYLENEDIAMINETETRA-

ACETIC ACID AFTER ORAL ADMINISTRATION IN THE TREATMENT OF LEAD POISONING.) Archiv für Gewerbepathologie und Gewerbehygiene 15, No. 6:572-80, 1957.

A new complexometric titration method for the determination of EDTA, using methylthymol blue and xylenol orange as indicators, is described. After oral administration of  $\text{CaNa}_2\text{EDTA}$ , Ca and possibly Na are split off in the acid gastric juice while EDTA remains unchanged.  $\text{CaNa}_2\text{EDTA}$  is readily soluble in the duodenal juice. Probably no Ca is split off due to the alkalinity of the medium.

In an experiment with 12 adult rats, fasted for 24-48 hr, after ligation of their duodenum, 1 cc of a 20% solution of  $\text{CaEDTA}$  was injected into the duodenum. The rats were killed after 2 hr and the  $\text{CaEDTA}$  in the intestines was determined. An absorption of 6.5-26%, av 17.6% of  $\text{CaEDTA}$  was found. In a control experiment when the animal was killed directly after the injection, 100% of the injected  $\text{CaEDTA}$  was found.

Four healthy persons were given each a total oral dose of 250 mg  $\text{CaNa}_2\text{EDTA}$  in tablets over a period of 8-11 hr; 3 other subjects received the same dose in solution together with alkaline mineral water. An average of 2.5% of the dose was excreted in the urine within 24 hr. After 26 hr, in 2 of the subjects the urine was negative, and for this reason the remaining were not investigated further. Five subjects were given each 6 wafers, consisting of 0.5 g  $\text{CaEDTA}$ , glucose and syrup, in 3 doses spaced 4 hr apart. An average of 2.8% of the administered  $\text{CaEDTA}$  was excreted in the urine over 24 hr. It is calculated that 53 µg EDTA/min was excreted by the kidneys and that the EDTA level in the blood was 4 µg%.

According to the authors, the mechanism of the  $\text{CaEDTA}$  effect is based on the acceleration of the spontaneous exchange of Pb among the blood cells and the surrounding medium. The rate of exchange cannot be increased by administration of high EDTA doses which, furthermore, would cause diarrhea. Another limitation of the EDTA-therapy is based on the fact that EDTA combines in the intestines with metals other than Pb, such as Fe and Cu which may lead to a deficiency of these essential elements. They advise that EDTA be used only for short-term therapy of mild Pb poisonings.

**1859** Stitch, S.R. (Med. Res. Council Radiobiol. Res. Unit, AERE, Harwell, England): TRACE ELEMENTS IN HUMAN TISSUE. I. SEMIQUANTITATIVE SPECTROGRAPHIC SURVEY. Biochemical Journal 67:97-103, 1957.

A method is described for the semiquantitative determination of some trace elements in human soft tissue and bone, by cathode-layer arc spectrography. Results are presented for the distribution of Al, Cd, Cu, Mn, Mo, Pb, and Rb. Cr, Ni, Ag, and Ti were detected infrequently in some organs. Accumulation of some elements in certain organs was observed; relatively high concentrations of Cd in kidney, Cu and Mo in liver, and Al in lung were observed regularly. A comparison of the distribution and concentration of certain elements in the tissues of various age groups is presented and discussed. The sensitivity for Pb was not good and it was generally detected in the liver only. The values obtained for Pb in this

organ (80 ppm) were in reasonable agreement with those reported by Kehoe et al (1940) ie, 130 ppm. Pb was found in the bones of some adults but not in those of infants or children. It was detected in some specimens of heart, kidney, lung, pancreas and the thymus.

- 1860** Sudo, Y. (Tokyo Jikeikai Med. Coll., Japan): STUDIES ON FRACTION OF SERUM PROTEIN IN LEAD WORKERS. (PART I) ON THE INCREASE OF  $\gamma_1$ -globulin. Journal of Science of Labour (Japan) 33:978-92 (Dec.), 1957.

Studies of the serum from 38 Pb workers showed that total protein did not significantly vary while  $\gamma_1$ -globulin and consequently  $\gamma_1$ -globulin increased. It was found that  $\gamma_1$ -globulin in the serum increased with the years of service of the Pb workers. (From author's English summary)

- 1861** Suzuki, Y., and Matsuka, Y.: ON THE STRENGTH AND ELONGATION OF HAIR OF LEAD AND MANGANESE WORKERS. Proceedings of the 30th General Meeting of Japan Association of Industrial Hygiene. Journal of Science of Labour (Japan) 33:541 (July), 1957.

The hair of 30 Pb workers and 14 Mn miners was examined in terms of denier, absolute strength and elongation. Although no correlation was observed between the Pb content of the hair and hair elongation, it was considered that the hair of Pb and Mn workers was less strong than that of normal healthy persons. (From Occupational Safety and Health Abstracts 8, No. 3:Abstr. No. 3131, 1958)

- 1862** Szewczykowski, W. (Univ. Marie Curie-Skłodowska, Lublin, Poland): Symptologia wczesnej ołowicy i wartość badań laboratoryjnych w jej rozpoznawaniu. (SYMPTOMATOLOGY OF EARLY LEAD POISONING AND VALUE OF LABORATORY TESTS FOR ITS DIAGNOSIS.) Annales Universitatis Mariae Curie-Skłodowska, Lublin-Polonia 12D:173-217, 1957.

A study was made of 65 workers of tile factories, examined in their work places and of 50 who were hospitalized. History was obtained on all; physical examination included Pb analysis in urine, urinary porphyrins, and basophilic stippling of erythrocytes (BSE). The Pb content of air was also determined. Fifty workers showing positive laboratory tests were subjected to clinical examination which included bone marrow biopsy, radiology of the alimentary canal, examination of the stomach contents, oscillometry of the vessels, Volhard's water test, and examination of the eye fundus. In 15, liver function tests were also performed. The results pointed to the fact that at the time when laboratory tests are positive, systemic disorders are already present. These are hematopoietic, as observed in the myelogram, spasticity of the colon, disorders in the motor and secretory activity of the stomach. In 30% a decrease in oscillation of the vessels of the upper limbs was found; in isolated cases there were disturbances in the water metabolism. There were no symptoms on the part of the central or peripheral nervous system or disturbances of liver function pointing to early Pb poisoning. The most useful

test was the examination of urine for porphyrins which the author considered to be a sensitive, constant, and easily performed test. Other tests (Pb in blood and urine, BSE) were found to be less sensitive and connected with a greater risk of error. (30 references)

- 1863** Tada, O. (Inst. Sci. Labor, Tokyo, Japan): DETERMINATION OF LEAD WITH DITHIZONE (REP. II). Journal of Science of Labour (Japan) 33:850-61 (Nov.), 1957.

A quantitative method which was described in the 1st report was precisely examined especially for the analysis of Pb in blood of workers with different occupations. The results were as follows, with number examined in parentheses, in  $\mu\text{g}/100\text{ g}$ : Battery (54), 13-117; electric wire (23), 18-102; refinement of metals (100), 6-98; treatment of oxide (41), 13-81; printing (122), 4-76; telegraph (Pb pipe (70), 4-59; waterworks (Pb pipe) (86), 4-53; sulfuric acid (112), 5-62; others (24), 6-61; unrelated to Pb (22), 2-30. (From author's English summary and table)

- 1864** Tahir, H.A., Dahi, M.A., and Samra, H.M. (Ministry Justice, Cairo, Egypt): NORMAL LEAD IN TISSUES, URINE, AND BLOOD OF EGYPTIAN INDIVIDUALS. Journal of the Egyptian Medical Association 40:491-500, 1957.

The following tissues of 20 normal individuals, without Pb exposure, were analyzed by the dithizone method for Pb mean concentrations: stomach  $0.037 \pm 0.022\text{ mg}/100\text{ g}$  fresh weight; liver  $0.122 \pm 0.067$ ; kidney  $0.074 \pm 0.049$ ; blood  $0.021 \pm 0.013$ ; and urine  $0.030 \pm 0.014\text{ mg}/\text{l}$ . No correlation was found between Pb concentrations and age or occupation.

- 1865** Takata, T. (DETERMINATION OF VITAMIN  $B_{12}$  IN BLOOD BY THE EUGLENA METHOD. II. VITAMIN  $B_{12}$  CONCENTRATION IN WHOLE BLOOD OF HEALTHY ADULTS AND PATIENTS WITH BLOOD DISEASES, AND IN HUMAN TISSUES AND ORGANS.) Bitamin 13:205-8, 1957.

The mean value of vitamin  $B_{12}$  concentration in whole blood of 6 anemic subjects (including Fe deficiency anemia and anemia due to Pb poisoning) was  $0.58 \pm 0.15\text{ }\mu\text{g}/\text{ml}$ . (range 0.45-0.80). (From Chemical Abstracts 54:7870, 1960.)

- 1866** Tara, S., and Françon, F. (Colombes, France): Deux cas de goutte saturnine à modalité mineure. (TWO CASES OF LEAD GOUT OF MINOR MODALITY.) Rhumatologie No. 5: 238-43 (Sept.-Oct.), 1957.

A 47-yr-old man working as a plumber for 30 yr had been afflicted with rheumatic signs resulting in gout for about 10 yr without exhibiting any other symptoms of Pb poisoning; blood findings and blood pressure were normal. No stippled cells were found. The authors explain that the patient, being a plumber, was exposed only to cutaneous exposure to Pb. Since his work involved filing Pb pipes with a rasp before soldering (the latter operation releasing only minimal amounts of respirable Pb) absorption was by the percutaneous route. (One of the authors had found this to be the case also with typesetters.) However, the constant daily exposure is apt to result in accumulation of Pb over a pe-

riod of 15-25 yr, thus giving rise to the gout. Another case of mild gout was observed in a 53-yr-old worker in the Gas Works in Paris who had been handling Pb for 25 yr. Here also, no signs of Pb poisoning (colic, stippled cells, etc.) were found. In contrast to these 2 slight cases of saturnine gout, 2 others previously described which were more severe were mentioned.

- 1867** Teisinger, J. and Fiserová-Bergerová, V. Vliv sodnovápenaté soli kyseliny ethylen-diamintetraoctové na hladiny železa a mědi v krvi a v moči. (THE INFLUENCE OF Na-Ca SALT OF EDTA ON IRON AND COPPER LEVELS IN BLOOD AND URINE.) *Casopis Lékaru Českých* (Prague), 96:1605-10 (Dec. 20), 1957.

Changes in the levels of Fe and Cu in serum and the excretion of both metals, after the administration of NaCaEDTA in a group of subjects with chronic Pb poisoning, have been observed. After injection, serum Fe and Cu increased in both groups to a maximum level from 4-5 hr later. The urinary excretion of both metals was also the same in control and experimental groups. On the day of injection about 12 times more Fe and 4 times more Ca appeared in the urine. With repeated administration Fe excretion decreased which suggests exhaustion of body stores. (From authors' summary) (From Bulletin of Hygiene 33:366, 1958).

- 1868** Thiebaut, F. (Strasbourg, France): Paralyse saturnine d'origine hydrique. (LEAD PARALYSIS CAUSED BY WATER.) *Strasbourg Medical* 8, No. 10:831-2, 1957.

A 54-yr-old woman showed a bilateral and symmetric radial paralysis of the upper extremities characteristic of Pb poisoning. Blood tests revealed a moderate anemia. Since her drinking water was found to contain 3-10 mg Pb/l the conclusion was drawn that the Pb poisoning had been caused by the water.

- 1869** Tietz, N.W., Hirsch, E.F., and Neyman, B. (Presbyterian-St. Luke's Hosp., Chicago, Ill.): SPECTROGRAPHIC STUDY OF TRACE ELEMENTS IN CANCEROUS AND NONCANCEROUS HUMAN TISSUES. *Journal of the American Medical Association* 165:2187-92 (Dec. 28), 1957.

Autopsy and biopsy specimens of the lung, liver, and kidney, analyzed by spectrography for content of metals, showed in lung tissue of patients with neoplastic and inflammatory diseases more often greater amounts of Pb, Cd, Fe, Cr, Si, and Ag than in patients without cancer. The liver of patients with neoplasms, regardless of the primary site, contained significantly more Pb, Mn, Fe, Be, Cr, Ni, Si, and Ag, and the kidney showed significantly higher Mo, Cr, and Ag. The ranges of Pb in the lung, liver, and kidney, respectively, were: 0->1.0, 0->1.3, and 0->1.5 mg/100 g dry tissue. It is concluded that the high content of metals in these organs of cancer patients suggests that since the metal content in the tumor tissue itself was found to be lower than that of the surrounding tissue, the storage of metals took place prior to the development of the disease rather than after.

- 1870** Trost, W.: Untersuchungen über die Höhe des Bleispiegels im Blut in den Jahren

1954 und 1955 in Berlin. (STUDIES ON THE LEAD LEVELS IN BLOOD DURING THE YEARS OF 1954 and 1955 in Berlin.) *Berlin Med.* 8: 149-52, 1957.

With the analytical method used on 120 normal people who had not been exposed occupationally to Pb, an average Pb level of 76 µg% was found in the blood. The highest value was 122 µg%. It is pointed out that in present-day Berlin higher normal Pb levels in the blood are to be expected and an upper normal limit of 120 µg% must be considered. (Abstractor's comment: The extent to which the relatively high normal values are due to analytical error could be evaluated by the interested reader. Unfortunately in addition to typographical errors, the sentence structure is subject to question.) (From *Deutsche Zeitschrift für die Gesamte Gerichtliche Medizin* 46:641 (Abstracts), 1957)

- 1871** Tsuchiya, K., and Tanaka, D.: AN ELECTROPHORETIC STUDY OF LEAD WORKERS' SERA. Proceedings of the 30th General Meeting of Japan Association of Industrial Hygiene. *Journal of Science of Labour* 33:536 (July), 1957.

On the basis of an extensive study, the authors conclude that the rise in the percentage of γ-globulin in the early stages of Pb absorption is due to the increase in the Pb content of the blood. They consider that it might be based on a form of immunological reaction to Pb or Pb combined with some component of the serum. (From *Occupational Safety and Health* 8, No. 3:3129, 1958).

- 1872** US Public Health Service, National Office of Vital Statistics: CHEMICAL POISONING. *Morbidity and Mortality* 6, No. 17:2, 1957.

Dr. J.D. Martin, Louisiana State Department of Health, reported the occurrence of 3 cases of Pb poisoning in 1 family. The patients experienced abdominal cramps, nausea, vomiting, diarrhea, and metallic taste from 45 min-2 hr after eating duck. The duck had been killed in the southwestern part of the State and had been stored in a freezer for approximately 2 mo prior to consumption. Chemical analysis of the remaining portion of the meat revealed the presence of 0.12% of Pb.

- 1873** Vartiainen, A.: Etylendiamintetraetikkahapon (EDTA) käyttö lääketieteessä. (MEDICAL USE OF ETHYLENEDIAMINE TETRAACETIC ACID (EDTA).) *Suomen lääkärilehti* 12:802-7 (Aug. 1), 1957.

- 1874** Viaud, M., Baron, A., Colas, J., Greaud, H., and Lhermitte, R.: Encéphalopathie saturnine grave avec stase papillaire; résultat du traitement par les chélateurs. (SEVERE LEAD ENCEPHALOPATHY WITH PAPILLARY STASIS; RESULTS OF CHELATING THERAPY.) *Médecin d'usine* (Paris) 19, No. 9:667-8; passim., 1957.

See Abstract No. 1973.

- 1875** Villaumé, J., Méniel, M., Lambert, G., and Deleplanque, G.: Les signes biologiques du saturnisme, les problèmes qu'ils posent au médecin du travail. (BIOLOGICAL SIGNS IN LEAD POISONING; PROBLEMS FOR THE INDUS-



TRIAL PHYSICIAN.) Proceedings of the Society of Industrial Medicine and Hygiene, Paris. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 18:697-8 (Nov.-Dec.), 1957.

At the request of the Factory Inspection bureau in Strasbourg the following tests were made on 20 workers who were exposed to Pb: (1) Complete hematological study before starting work; (2) daily count of stippled cells (SC) at the beginning, the middle and end of work; (3) determination of urinary coproporphyrins (CP) at the start and end of work; (4) determination of blood Pb at end of work; (5) observation of clinical signs (usually discrete). From the results, it was concluded that the usually observed signs do not permit early recognition of Pb poisoning; laboratory results are inconclusive, and reciprocal variations have no significant relation; anemia develops at a rather advanced stage of poisoning and signs may appear before the number of RBC is decreased; Pb levels in blood and urine and CP do not permit recognition of state of poisoning except when these figures are greatly increased; toxic symptoms may appear at practically normal values of these biologic functions. The variation in SC in the course of one day was surprising. Several counts should be made during the day. Only a constantly elevated figure (>3000/million RBC) presents a warning signal of acute poisoning.

- 1876** Vogt, W., and Cottier, H. (Univ. Bern, Switzerland): Nekrotisierende Nephrose nach Behandlung einer subakut-chronischen Bleivergiftung mit Versenat in hohen Dosen. (NECROTIZING NEPHROSIS AFTER TREATMENT OF A CASE OF SUBACUTE-CHRONIC LEAD POISONING WITH CaEDTA IN HIGH DOSES.) Schweizerische Medizinische Wochenschrift 87, No. 22:665-7, 1957.

A 38-yr-old man suffering from subacute-chronic Pb poisoning was treated with an erroneously high dose of  $\text{CaNa}_2\text{EDTA}$ . The dosage was ~600 mg/kg body weight/day. After a therapy of 5 days' duration an anuric uremia complicated by a massive lobar pneumonia occurred. The autopsy, which was performed immediately after death, revealed a necrotizing nephrosis with extreme swelling, desquamation, small-vacuolar degeneration and necrosis of the epithelial cells in the proximal tubules and in the loops of Henle. The Pb content of the kidneys was significantly higher than that of the liver, suggesting that CaEDTA was promoting Pb excretion by the kidneys. The possible toxic effect of CaEDTA and its chelate with Pb are discussed. (From authors' summary; 22 references)

- 1877** Vol'fovskaya, R.N.: Klinicheskie osobennosti i otdalennye posledstviya khronicheskoi intoksikatsii etilirovannyim benzinom. (CLINICAL CHARACTERISTICS AND SEQUELA OF CHRONIC INTOXICATION BY ETHYLATED GASOLINE.) In Trudy Yubileinoi Nauchnoi Sessii Posvyashchennoi 30-Letnei Deyatel'nosti Instituta 1924-1954. Lenin-grad, Ministerstvo Zdravookhraneniya RSFSR, Institute Gigieny Truda i Profzabolevaniy, 1957, pp. 399-405.

In summarizing her observations, the author states

that poisoning by TEL-containing gasoline exhibits a unique course of illness progressing from signs of nervous system disorders to those of internal organs which may progress even when removed from exposure. In other words, it is distinct from TEL poisoning. For this reason she considers that part of the illness is attributable to the chronic action of CO, since in 33 of 90 patients followed by her the COHb levels in blood were increased, so that a potentiating or additive action of CO may be assumed. In addition, the effect of inorganic Pb in the picture cannot be excluded.

- 1878** Weber, M., Opałko, S., and Robakiewicz, M. (Poland): L'administration du composé calcique du sel disodique de l'acide éthylenediaminotétracétique ( $\text{Ca-Na}_2\text{-EDTA}$ ) dans les cas cliniques du saturnisme. (USE OF SODIUM CALCIUM SALT OF ETHYLENEDIAMINETETRAACETIC ACID IN CLINICAL CASES OF LEAD POISONING.) In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 284-7.

The authors' experience was on 11 cases of acute intoxication by TEL (9 by exposure to vapor, and 2 by aspiration of the fluid); 49 exacerbated chronic cases exposed to poor working conditions in Pb trades; 26 chronic cases of moderate degree of poisoning. Administration was iv infusion of EDTA at 4.2 g in 250 ml isotonic saline solution over 3 hr; infusions were repeated 3 or 4 times at 2-day intervals. In severe cases both iv and oral EDTA was given, and in the mild cases, only oral. As summarized, the efficacy of EDTA can not be denied. In all patients it was found that the circulating Pb dropped rapidly and clinical signs soon abated. It was just as efficient in treatment of TEL poisoning as in Pb poisoning. The most efficacious form of treatment is the iv. Neither route, iv nor oral, was ever accompanied by signs of intolerance. On the basis of their experience, the authors believe that EDTA is capable of eliminating not only the circulating Pb, but also that stored in tissues. It can also serve as a means of diagnosis in doubtful cases of Pb poisoning.

- 1879** Weber, M., Opałko, S., and Rabakiewicz, M.: Stosowanie soli dwusodowo-wapniowej kwasu etyleno-dwuamino-czterooctowego ( $\text{EDTA-Ca-Na}_2$ ) w klinicznych przypadkach ołowicy. (USE OF SODIUM CALCIUM SALT OF ETHYLENEDIAMINETETRAACETIC ACID IN CLINICAL CASES OF LEAD POISONING.) Polskie Archiwum Medycyny Wewnętrznej (Warsaw) 27, No. 2:215-28, 1957.

See preceding abstract.

- 1880** Worms, R., Albahary, C., and Schlumberger, H.G. (Paris, France): Saturnisme hydrique à Paris. (LEAD INTOXICATION FROM WATER IN PARIS.) Presse Médicale 65, No. 9:177-9, 1957.

A normally healthy man, 52 yr old, complained of fatigue, lack of appetite and dyspnea. Medical examination showed nothing remarkable. Examination of the nervous system revealed radial paralysis on the right side, pointing by its characteristic signs to Pb poisoning which was confirmed by

an anemia with 2,860,000 erythrocytes and 60% basophilic cells. Urinary coproporphyrins in the 1st 4 days in the hospital ranged from 492-1590  $\mu\text{g/l}$ , rising during BAL treatment to 3000 and then decreasing to 146-212. The corresponding values for blood protoporphyrins were 317, 479 and 352  $\mu\text{g}/100\text{ ml}$ , respectively; urinary Pb 0.11-0.20, 0.06-0.30 and 0.20-0.35  $\text{mg/l}$ ; blood Pb 60, 60, and 65-125  $\mu\text{g}/100\text{ ml}$ , respectively. Pb in hair was 1.4  $\text{mg}/100\text{ g}$ .

The authors believe BAL treatment to have been ineffective. Improvement during the hospital stay was very slow. The man had never been exposed to Pb occupationally. He had lived on the 6th floor of a commercial building and used a faucet on the stair landing for his drinking water. Analysis of a sample taken during the day showed the presence of 0.3  $\text{mg Pb/l}$ . Further investigations revealed that water taken directly out of the feeder pipe in the basement contained 800  $\text{mg Pb/l}$  and 2.5  $\text{mg/l}$  after it was allowed to run for a few minutes. A sample taken from the tap on the 6th floor after it had not been used for some time contained 0.9  $\text{mg Pb/l}$ . It is pointed out that the concentration of 800  $\text{mg Pb/l}$  at the feeder pipe was due to remnants of Pb filings in the pipe which should have been rinsed out thoroughly at the time of installation. Blood, protoporphyrin and coproporphyrin tests done on the wife of the patient also suggested Pb exposure although she did not exhibit pathologic symptoms.

- 1881** Zahorski, W., and Myślak, Z. (Inst. Ind. Med., Zabrze, Poland): L'application du Ca-EDTA dans une action organisée contre le saturnisme dans l'industrie. (USE OF Ca-EDTA IN THE ORGANIZED ACTION AGAINST PLUMBISM IN INDUSTRY.) In XII International Congress on Occupational Health, Helsinki, Finland, 1957, Vol. III, Proceedings, pp. 242-3.

As first tested on 60 cases of Pb poisoning, oral doses of 2-3 g EDTA/day in 0.25-g tablets given every 2 hr for a total dose of 20 g gave good results. Since a 2-g oral dose every other day produced an elimination of Pb that was similar or even greater than that obtained by a daily dose, fractions of a total dose of 20 g were subsequently administered every other day over a period of 12-14 days. Counts of stippled erythrocytes, urinary coproporphyrin (CP), and Pb, and blood Pb were used as diagnostic criteria. Having established that the CP elimination by nonexposed subjects given EDTA does not exceed 1  $\text{mg}/24\text{ hr}$  in the 1st 3 days, the mobilization test was used to confirm diagnosis of Pb poisoning. Based on these experiments, a prophylactic program for the nonferrous smelting industry was developed with the active participation of factory physicians. In industries with high exposure, Pb poisoning recurred 2-3 mo after return to work. A 2nd treatment allowed the workers to return to work for a number of months without further signs of Pb absorption. The authors conclude that a greater application and systematic and frequent examination would diminish the number of workers who would be forced to leave these industries.

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- 1882** Albach, E. (Evangelian Hosp., Berlin Spandau, Germany): Zur gewerblichen Bleivergiftung. (OCCUPATIONAL LEAD POISONING.) Deutsche Medizinische Wochenschrift 83, No. 31:1323-7, 1958.

Symptoms of Pb poisoning are reviewed and discussed. The value of determining blood Pb and urinary porphyrins, in addition to detection of anemia and red cell basophilic stippling, is emphasized. Dietary effects on blood Pb and urinary Pb and porphyrin excretion are indicated and control of this variable to avoid misinterpretation of laboratory data is stressed. (33 references)

- 1883** Albahary, C., Truhaut, R., and Boudène, C. (Inst. Ind. Hyg., Med.; Toxicol. Lab., Coll. Pharmacy, Paris, France): Depistage du saturnisme par le test de la plomburie provoquée par le versenate de calcium disodique. (THE DIAGNOSIS OF LEAD POISONING FOLLOWING URINARY ELIMINATION OF LEAD INDUCED BY CALCIUM DISODIUM VERSENATE.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 19:121-31 (Mar.-Apr.), 1958.

CaNa<sub>2</sub>EDTA was administered to about 50 individuals by different routes and the urinary Pb excretion induced by the versenate was measured polarographically. The authors conclude from their experiments that determination of the rate of urinary Pb excretion induced by iv administration of EDTA provides a very good means for the diagnosis of saturnism, particularly in cases of unrecognized, disputable or hysterical and atypical cases. The following series of tests were made: (1) Four men with signs of Pb poisoning and 3 controls were given iv infusions of 2 g EDTA/day for 3 days; a 5th subject received 0.50 g/day for 3 days. (2) The results on urinary Pb excretion in a welder from the above group were compared when EDTA was administered by iv infusion (2 g/day for 3 days, or 1.0, 0.5, 0.5 g, respectively, per day), by iv injection (0.50 g/day for 2 days), or when BAL (450  $\text{mg}/\text{day}$  for 3 days) was administered. Three other subjects and 6 controls were given 1-3 iv injections of 0.50 g EDTA each. (3) Six subjects and 3 controls were treated orally with 4 g EDTA/day, distributed in 2 daily doses, for 3-6 days. (4) Ten subjects and 1 control inhaled 1 g EDTA as an aerosol.

Venous infusion with 2 g EDTA/day for several days is generally considered to be the best method of detoxication, but it is complicated and cumbersome. Intravenous injection with 0.5 g EDTA has proved to be satisfactory both therapeutically and for the purpose of diagnosis. The authors are unable to ascertain whether an iv dose of 1 g EDTA is more efficacious than a 0.5 g dose since the induced Pb excretion varies widely in different subjects. They believe that induced Pb excretion increases with the degree of poisoning; however, if the Pb exposure has been far in the past, mobilization of Pb by the versenate may be slow. An excretion curve reaching a plateau is more indicative of Pb poisoning than a bell-shaped curve. Controls sometimes show abnormal, transient increased Pb excretion. The period elapsed between

injection of EDTA and maximum Pb excretion and the threshold limit of Pb excretion are significant criteria for the diagnosis.

In the cases studied the maximum excretion was reached between 3-10 hr, usually after 6 hr. The threshold limit was estimated as 800  $\mu\text{g Pb/l}$ ; values above this limit call for diagnosis of saturnism. Oral treatment with EDTA is not efficient. The threshold limit of urinary Pb excretion by this method is 400  $\mu\text{g/l}$  within 24 hr. Inhalation of 1 g EDTA as aerosol in a 20% suspension for 20-30 min is unsatisfactory therapeutically but it is a convenient method for diagnosis. The urinary Pb excretion increases 2-6 fold; the threshold limit is about 400  $\mu\text{g Pb/l}$ . The mobilization of Pb is so rapid that the urine needs to be tested only for 10 hr following inhalation. The authors suggest that inhalation of small quantities of EDTA may possibly be used for protection in occupational Pb exposure provided further studies confirm its innocuousness. EDTA does not act as a detoxicant in Hg poisoning. Furthermore the authors do not expect that EDTA will activate the urinary elimination of essential metals, such as Fe, Cu, Cd, Mn and others or that it may promote vitamin deficiency. (26 references)

- 1884** Albahary, C., Truhaut, R., and Boudène, C. (Soc. Ind. Med. Hyg., Paris, France): Impregnation plombique; épreuve de plomburie provoquée par aerosol de versénate de calcium disodique. Possibilité d'une prophylaxie. À propos d'une enquête dans une entreprise d'accumulateurs. (LEAD INTOXICATION; MOBILIZATION OF LEAD BY AN AEROSOL OF DISODIUM CALCIUM VERSENATE. POSSIBILITY OF PROPHYLAXIS. A STUDY IN A STORAGE BATTERY FACTORY.) Proceedings of the Society of Industrial Medicine and Hygiene, Paris. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 19:485-7 (Sept.-Oct.), 1958.

The Pb content of dust in a storage battery factory was 36% in malaxation operations, 34% in filing and 70% in soldering. A blood test of 13 volunteers from different departments gave the following data for stippled cells/100 leukocytes: 2 employees 0; 4, 10-50; 2, 50-100; 5, 100-200. In 6 men out of the 2 last groups  $\text{Na}_2\text{CaEDTA}$  inhalation gave a urinary Pb excretion 3-30 times that of the initial one. No anemia was noted in any case but 1 of the men showed a notable increase of non-hemoglobin globular Fe. Administration of EDTA by the respiratory route is recommended for diagnostic purposes and possibly as prophylaxis but not for therapy. However, the loss of Zn and other metals by prophylactic administration of EDTA as aerosol must be considered.

- 1885** Baader, E.W. (Univ. Munster, Germany): L'aspect clinique de l'intoxication saturnine professionnelle. (CLINICAL ASPECT OF OCCUPATIONAL LEAD POISONING.) Maroc Médical 37, No. 395:409-15, 1958.

The symptoms of Pb intoxication, diagnosis, and pathogenesis are reviewed. The gingival Pb line, the occurrence of punctate blood cells, chronic saturnine nephritis, saturnine paralysis and encephalopathy and the effect of Pb on the genital

glands are discussed in detail. The author points out that fraudulent Pb intoxication can be recognized by an analysis of the feces; since the Pb content of the feces during occupational Pb intoxication is not higher than 2.8 mg/100 g, a concentration of 4 mg/100 g found by the author in a man 4 wk after removal from exposure indicated that the subject had swallowed Pb voluntarily.

- 1886** Balbo, W., and Patrizi, L.: Contributo allo studio dell'azione del sale calcio disodico dell'acido etilendiaminetetracetico nell'intossicazione acuta e cronica da piombo. (EFFECT OF THE CALCIUM DI-SODIUM SALT OF THE ETHYLENEDIAMINETETRA-ACETIC ACID IN ACUTE AND CHRONIC LEAD POISONING.) *Zacchia* 21:315-33, 1958.

Seven Pb workers, 3 of whom showed definite signs of Pb intoxication, were given iv 1.2 g  $\text{CaEDTA/day}$  for 20 days. Urinary Pb excretion increased immediately and the Pb level in the blood decreased simultaneously. Stippled cells disappeared and the patients improved subjectively and objectively although polyneuritic symptoms remained and there was little or no effect on the coproporphyrinuria. Prophylactic  $\text{CaEDTA}$  treatment was proposed. (From *Deutsche Zeitschrift für die Gesamte Gerichtliche Medizin* 49:490 (Abstracts), 1960)

- 1887** Bártoš, V.: Zkušenosti závodního lékařů s léčením otrav olovem komplexonem EDTA. (EXPERIENCES OF INDUSTRIAL PHYSICIANS WITH COMPLEXON EDTA THERAPY OF LEAD POISONING.) *Pracovní lékařství* 10:48-51 (Mar.), 1958.

- 1888** Belamarić, T., and Dorić, D. (Army Hosp., Zagreb, Yugoslavia): O nekim problemima trovanja tetraetil-olovom i etiliziranim benzinom. (CERTAIN PROBLEMS RELATED TO POISONING WITH TETRAETHYL LEAD AND ETHYL GASOLINE.) *Vojnosanitelski Pregled* 15, No. 4:304-7, 1958.

A review with 28 references.

- 1889** Berard-Magistretti, A. (Aosta, Italy): Paralisi parziale del terzo paio di destra ed altri segni oculari in operaio intossicato da piombo. (PARTIAL PARALYSIS OF THE RIGHT OCULOMOTORIUS IN ADDITION TO OTHER EYE SYMPTOMS IN A WORKER WITH LEAD POISONING.) *Lavoro Umano* 10:449-59, 1958.

In the reported case of chronic Pb poisoning, the signs included monolateral partial paralysis of the oculomotorius, pupillary disorders, moderate temporal pallor and vascular and retinal disturbances. (From author's summary)

- 1890** Biondi, S. (Univ. Naples, Italy): Sull'artigianato in rapporto all'automobilismo. (WORKERS IN AUTOMOBILE REPAIR SHOPS AND SERVICE STATIONS.) *Rassegna di Medicina Industriale* 27:579-97 (Nov.-Dec.), 1958.

Work performed in automobile repair shops is described and illustrated in 13 figures. Work encompasses that of mechanics, body repairmen, electricians, tire repairmen, and pump attendants. These men are exposed to various types of poisoning, such as by TEL, CO, solvents, and nitrates. They are often compelled to work in uncomfortable or tiring po-

sitions, and pump attendants are subject to work in inclement weather. Clinical examination, however, showed only a considerable frequency of respiratory diseases among pump attendants. (12 references)

- 1891** Boulet, P., and Mirouze, J. (Fac. Méd., Montpellier, France): CHELATION. ITS IMPORTANCE IN THERAPY OF METAL POISONING. *Thérapeutique, Semaine Hôp.* 34:TH 816-TH 818, 1958.

The principal metallic intoxicants which can be treated by chelating agents are Pb, products of nuclear fission, Cu, Zn, Pu, Fe, Cr, Co, Be, Ca, Mn, Cd, and Ni. Chelating agents have also been used in hypercholesterolemia. (From Chemical Abstracts 53:4573, 1959)

- 1892** Boulet, P., Mirouze, J., Barjon, P., Paulet, C. de, Paulet, C. de (Mrs.), and Schmouker, Y.: USE OF CHELATING AGENTS IN SATURNISM (CHRONIC LEAD POISONING). *Thérapeutique Semaine Hôp.* 34:Th 819-Th 823, 1958.

Four cases of Pb poisoning treated with CaEDTA are presented. The 1st and 3rd cases had greatly increased urinary elimination of Pb, while the 2nd and 4th showed only a moderate increase. Nevertheless, the Pb intoxication was cured in all 4 cases. The high level of Pb found in the blood was not diminished under treatment, but was rendered non-toxic by the formation of a stable Pb complex. Many of the clinical manifestations of chronic Pb poisoning then disappeared. (From Chemical Abstracts 53:3494, 1959)

- 1893** Bracken, E.C., Beaver, D.L., and Randall, C.C. (Vanderbilt Univ. School Med., Nashville, Tenn.) HISTOCHEMICAL STUDIES OF VIRAL AND LEAD-INDUCED INTRANUCLEAR BODIES. *Journal of Pathology and Bacteriology* 75, No. 2:253-6, 1958.

Intranuclear inclusion bodies which characteristically develop in kidney and liver cells in cases of Pb poisoning are compared to those of viral origin in order to establish whether heavy-metal induced inclusions do not contain DNA and thus differ from virus-induced inclusions.

Pieces of human kidney with hyaline intranuclear inclusions of the renal convoluted tubules and pieces of liver from hamsters infected with the Kentucky A (hamster-adapted) strain of equine abortion virus were used. The kidney pieces came from a 21-mo-old white male who had died of Pb poisoning caused by eating interior paints. Aside from a hemoglobin level of 8.2 g/100 ml, strongly positive test for coproporphyrins, X-ray lines in long bones and granular radiopaque material in the colon, the blood contained 0.29 mg Pb/100 g (whole blood), the urine, 0.40 mg Pb/l. Autopsy revealed severe cerebral edema and atrophy with ventricular dilatation; Pb levels in the liver, kidney, and feces were 3.1, 1.8, and 157.0 mg/100 g, respectively, and 0.90 mg/l in the urine. Due to the clear-cut case of Pb poisoning, no examination for a possible viral infection was made.

Sections of both materials were stained with Schiff's reagent and by a modified Feulgen procedure. All sections stained with Schiff's reagent without prior hydrolysis showed essentially nega-

tive staining of the inclusions. Both the viral and the Pb-induced inclusions stained strongly positive by the Feulgen procedure.

On the assumption that inclusions might not contain deoxyribonucleic acid (DNA), and that the staining might be a false-positive reaction, sections were hydrolyzed and extracted in lipid solvents before and after being stained. This resulted in negative Feulgen staining. Cells containing intranuclear inclusions of viral origin were treated in parallel in the same way as chemically induced inclusions and gave identical Feulgen staining. The authors conclude that there is no clear-cut experimental evidence that chemically induced inclusions do not contain DNA. It is likely that viral intranuclear inclusions are abnormal products of cellular metabolism rather than virus particles embedded in a cellular matrix.

- 1894** Buckup, H., and Remy, R. (Ind. Med. Inst. of State Ind. Med. Officers, Bochum, Germany): Die Therapie und Prophylaxe von Bleierkrankungen. (THERAPY AND PREVENTION OF LEAD POISONING.) *Ärztliche Forschung* 12, No. 2:92-100, 1958.

As summarized by the authors in their review, CaNa<sub>2</sub>EDTA, administered in the earliest possible stages of Pb-poisoning, is the therapy of choice in this disease. Besides this, a manifold symptomatic treatment which includes ascorbic acid, vitamin B complex, and SH-groups is necessary. Dietetic and climatic measures are also important. The prophylaxis against Pb damage is primarily a problem of organization and technique. The characteristic early stage, the so-called "pre-saturnism," offers the best chance to recognize the disease in time in endangered persons and to control it by regular supervision. These persons can be removed from Pb exposure and can be subjected to prophylactic treatment. In addition, a lacto-vegetarian diet and the avoidance of a high uptake of fat and alcohol is advocated. For a limited period and under the supervision of a doctor the following measures appear to be also of use: Administration of CaNa<sub>2</sub>EDTA ascorbic acid, vitamin B complex, and amino-acids poor in saccharides (such as methionine). (50 references)

- 1895** Caccuri, S. (Univ. Naples, Italy): HEPATOPATHY AND INDUSTRIAL TOXICOLOGY. *Recenti Prog. Med.* 25:211-41, 1958.

Pb was among the elements reviewed for its effects on the liver. (145 references) (From Chemical Abstracts 55:12631, 1961)

- 1896** Cataldi, R., and Odaglia, G. (Inst. Ind. Med., Genoa Univ., Italy): Observations sur la coagulation du sang dans l'intoxication professionnelle aiguë de plomb. (OBSERVATIONS ABOUT THE COAGULATION OF BLOOD IN ACUTE OCCUPATIONAL LEAD POISONING.) *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 19:467-71 (Sept.-Oct.), 1958.

In 13 cases of acute Pb poisoning, the coagulation time of the blood during a colic attack was slightly increased in 5 and significantly increased in 2. The prothrombin activity of the plasma and the serum prothrombin conversion accelerator (SPCA)

were slightly reduced in 8 of the cases. Residual prothrombin remained unchanged with the exception of 2 cases in which it was slightly increased. These 2 patients, who suffered from serious abdominal colics and vomiting with constipation in 1 case and diarrhea in the other, showed a 60% reduction of prothrombin activity and 65% of SPCA. They also revealed a marked change of global coagulability and an increase of residual prothrombin but no quantitative alterations of platelets. A thromboelastogram after dosage with vitamin K confirmed a deficiency of thromboplastin-thrombogenesis. (15 references)

- 1897** Danilović, V. (Belgrade, Yugoslavia): CHRONIC NEPHRITIS DUE TO INGESTION OF LEAD-CONTAMINATED FLOUR. *British Medical Journal* 1:27-8 (Jan. 4), 1958.

Since a high incidence of chronic nephritis had been noted among the inhabitants of villages along the Serbian river Kolnbara, a study of 12 families living in 1 of the affected villages was undertaken. Thirty-seven members of these 12 families had died from chronic nephritis during the last 15 yr; of the 44 members still living, 23 were suffering from nephritis, the remaining 21 healthy ones being mostly children and young adults. A history of Pb colic in a number of patients pointed to a possible contamination of food by Pb. It was found that the corn flour which was used, was ground in an old watermill heavily contaminated with Pb. Samples of the flour had a Pb content 5-10 times above the safety margin. The patients complained of lassitude, headache, abdominal and muscular pains; 4 had suffered from Pb colics; the blood pressure was elevated in 20 cases and 2 presented a Pb line. Most of them revealed a mild hypochromic anemia; 2 had punctate basophilia. Azotemia was present in 19 cases. The Pb content of the blood was  $\geq 100$ -200  $\mu\text{g}/100\text{ ml}$ ; urinary coproporphyrins were increased, proteinuria was present in 16 cases. Postmortem examination of a fatal case showed 600  $\mu\text{g Pb}/100\text{ g}$  in the liver, 320  $\mu\text{g}/100\text{ g}$  in spleen and kidneys, 4 mg/kg in the scalp hair and 10 mg/kg in the axillary hair (normal 0.2-0.6 mg/kg). It was pointed out that the disease may exist in a mild form for many years while the blood urea is slowly rising. When it exceeds 100 mg/100 ml, the condition of the patient deteriorates and death may occur within a few months-2 yr.

- 1898** Dantin Gallego, J. (Natl. Inst. Ind. Med., Safety, Spain): Epidemiologia y tratamiento de las intoxicaciones profesionales debidas a metales pesados. (EPIDEMIOLOGY AND TREATMENT OF OCCUPATIONAL POISONING DUE TO HEAVY METALS.) *Revista Ibys* 3:175-208 (May-June), 1958.

A short historical review of Pb poisoning is followed by a report concerning the occurrence and frequency of Pb poisoning in Spain and the distribution of blood Pb levels in the various occupations with Pb exposure. In a tabulation of some of the values obtained by the Institute, blood Pb ranged from 8-239  $\mu\text{g}/100\text{ g}$  and the mean, 12-175  $\mu\text{g}$ . Manifestations of Pb intoxication, symptomatology, and the role of proto- and coproporphyrin in the metabolism of Pb poisoning are discussed.

Statistics of blood Pb levels in acute, subacute and chronic occupational poisoning are given. Treatment, discussed in detail, covers the general, symptomatic and chelating therapies of Pb poisoning and includes the history and philosophy of chelation, the various methods in use in the past and present, and their beneficial and harmful effects. The chemical composition of EDTA,  $\text{CaNa}_2\text{EDTA}$  and Ca Hausmann, and the mode of chelation by these drugs, are described in detail. The review closes with a brief report of author's own cases treated by various drugs such as Na citrate,  $\text{CaEDTA}$ ,  $\text{BAL-CaEDTA}$ , and Lambratene, and the results of Pb and Mn chelation, are illustrated in graphs showing Pb levels in blood, urine, feces and cerebrospinal fluid. (83 references)

- 1899** Dinischiotu, G.T., Nestorescu, B., Rădulescu, I.C., Ionescu, C., Preda, N., and Ilutza, G. (Inst. Igiena si Sănătate publică, Bucharest, Romania): (CHEMICAL FORMS OF ELIMINATED URINARY LEAD.) *Acad. rep populare Romine, Inst. terap., Probleme terap.* 9, No. 4:69-79, 1958.

In a group of 44 subjects with a physiological absorption of Pb and in 77 subjects under conditions of occupational Pb absorption, the urinary elimination of Pb was determined both by mineralization and coprecipitation. A non-coprecipitable Pb fraction was found in the urine of only those exposed to elevated occupational Pb absorption, and in direct connection with the process of the accumulation of the toxic substance. The relation between the total urinary Pb/the coprecipitable Pb is 1 in healthy subjects, increases to 1.47 in those with elevated absorption, and reaches 2 in patients with recognized symptoms of saturnism. The non-coprecipitable fraction of urinary Pb consists of large organic molecules, cannot be dialyzed, and is of nonpolar character. (From *Chemical Abstracts* 53:15344, 1959)

- 1900** Dinischiotu, G.T., Preda, N., Rădulescu, I.C., Ionescu, C., and Ilutza, G.: INVESTIGATIONS ON THE TREATMENT OF LEAD INTOXICATION BY MEANS OF  $\text{Ca EDTA Na}_2$  (THE MONOCALCIUM DISODIUM SALT OF ETHYLENEDIAMINETETRAACETIC ACID). *Rumanian Medical Review* 2:20-1 (Jan.-Mar.), 1958.

- 1901** Duchateau (Med. Inspectorate, Libramont Center, Belgium): Un cas d'intoxication professionnelle à minima par le plomb. (MILD CASE OF OCCUPATIONAL LEAD POISONING.) *Archives Belges de Médecine Sociale, Hygiene, Médecine du Travail et Médecine Légale* 16, No. 4:175-7, 1958.

A 34-yr-old man, engaged in Pb soldering for 5 yr had been subjected to annual basophil stippled erythrocytes (BS) blood tests which never revealed the presence of basophil stippled erythrocytes. In the 5th yr a count of 30 BS/100 leukocytes was found and a few days later he complained of colics and fatigue. The author points out that according to the literature the threshold for BS is 100-300 in a light field or 2000 in a dark field. He explains that the higher rate obtained by counting in a dark field is due to the fact that cells which appear as chromatophils in a light field,

appear as stippled cells in a dark field. A blood count of the worker repeated 1.5 mo later showed 400 BS. After removal from Pb exposure the count returned to normal. However, shortly after he started to work again, the colics recurred and a blood test showed 500 BS. He returned again to work after recovery and by employing certain precautionary measures no relapse occurred.

- 1902** Dyskin, A.A. (USSR): Pnevmoniya kak sledstvie aspiratsii etilirovannogo benzina. (PNEUMONIA AS A RESULT OF ASPIRATION OF ETHYLATED GASOLINE.) Klinicheskaya Meditsina 36:117-9 (Dec.), 1958.

In the cases described, 4 men, 20-23 yr old, suffered from aspiration pneumonia attributed to the aspiration of gasoline while sucking it through a hose to start a flow from one container into another. Clinical symptoms appeared in all cases 1-2 hr after exposure: labored breathing, pressure in the chest, cough with bloody mucus, sharp pains in the right side, shortness of breath; other symptoms developed: headaches, weakness, euphoria, stomach disorders, sleeplessness. First aid was given 2-6 hr after exposure. It consisted of gastric lavage, laxatives. Three men were hospitalized after 1st aid, the 4th after 24 hr. Upon hospitalization, body temperature was 37.6-38.4°C; it returned to normal very gradually within 4-6 days. Results of urine, blood, X-ray analyses, etc., are given. The urine of one patient contained Pb (no values). Therapy consisted of heavy doses of antibiotics combined with sulfanilamide compounds, cardiac glucosides, glucose, oxygen and vitamins. The clinical symptoms disappeared within 7-10 days. No complications occurred. It is concluded that the symptoms of pneumonia as a result of gasoline aspiration differ considerably from those found in cases of common aspiration pneumonia.

- 1903** Fautrel, M. (Paris, France): Exploitation statistique de données biologiques sur le pré-saturnisme clinique professionnel. (STATISTICAL EVALUATION OF BIOLOGICAL DATA FOR THE DIAGNOSIS OF EARLY OCCUPATIONAL LEAD POISONING.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 19:5-20 (Jan.-Feb.), 1958.

The author chose the findings reported by Desoille, et al (1955) in the "presaturnism" stage for a statistical analysis of their relative values diagnostically, prognostically or therapeutically. Since significant typographic errors had appeared in that printing, he reproduces the 2 tables in corrected form. The variables analysed were: stippled erythrocytes, Pb concentrations in blood and urine, coproporphyrin (CP) in urine, and protoporphyrin (PP) in blood of 23 workers exposed to high levels of Pb and 11 exposed to small risk. The mean levels and the standard deviations of serial measurements on the same person in the unexposed group were then used to set physiological limits for the variation of those measures in unaffected men. The t test of student and a non-parametric test developed by Mann and Whitney gave an indication of the clinical measures which differentiated significantly between those exposed to

Pb and the others. Urinary Pb levels in the 2 groups seemed to be the only measure which differed by no more than would be reasonably attributed to chance variation.

The practical value of any one of these indices of chronic Pb poisoning depends on its correlation with the others. It is pointless to duplicate measures which give substantially the same answer. The author points out that the ordinary product moment correlation coefficients may not be appropriate for the distributions concerned and suggests Kendall's t coefficient based on rank orders. By its use, he shows that in the exposed group, the results of the 2 types of porphyrin estimations are closely associated with each other but not with the stipple cell count. Both stipple cell count and the urinary CP level may be used in the detection of an occupational Pb hazard in groups of men. Similar methods can be applied in the medical supervision of individuals, and the author gives examples of the application in this context of some of the newer nonparametric statistical techniques. On the basis of the limited experience reported in this study, he suggests that stipple cell counts repeated at least twice, are of diagnostic value in the early detection of Pb poisoning.

- 1904** Fleischhacker, M., and Djurić, D. (Inst. Med. Res., Zagreb, Yugoslavia): Vliv vitaminu B<sub>12</sub> na koproporfyriurii při otravě olovem. (EFFECT OF VITAMIN B<sub>12</sub> ON COPROPORPHYRIN IN LEAD POISONING.) Pracovní lékařství 10, No. 1:3-7, 1958.

The authors followed urinary coproporphyrins (CP) in 9 cases of Pb poisoning over a period of 36 days during treatment with vitamin B<sub>12</sub>. This therapy did not influence the excretion of CP. In cases where there was a tendency for decrease in CP they assumed that this was due to interruption of exposure rather than to the effect of vitamin B<sub>12</sub>. (23 references)

- 1905** Frank, R.W.: HEALTH CONTROL IN THE CERAMIC INDUSTRY. Proc. Porcelain Enamel Inst. Forum 20:138-40, 1958.

See Abstract No. 2005.

- 1906** Gallus, A.: Najczęstsze choroby zawodowe, wywołane czynnikami szkodliwymi, występującymi przy obsłudze silników spalinyowych (THE MOST COMMON OCCUPATIONAL DISEASES CAUSED BY NOXIOUS INTERNAL COMBUSTION ENGINES.) Wiad. Lek. 11, No. 3:97-105, 1958.

Carbon monoxide poisoning is the most common accident observed in working with these engines. Intoxication with petrol vapors and TEL is also sometimes observed. Virtually no other harmful influences should be anticipated. (From Excerpta Medica, Sect. 17, 5:Abstr. No. 964, 1959)

- 1907** Gandois, R. (Limoges, France): Le saturnisme dans les industries du décor de la céramique et sa prévention. (LEAD POISONING IN INDUSTRIES ENGAGED IN DECORATING CERAMICS AND ITS PREVENTION.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 19:40-5

(Jan.-Feb.), 1958.

Compared with conditions 40 yr ago, the occurrence of Pb poisoning in the ceramics decorating process has virtually disappeared. Nonetheless, the author cautions against ignoring a risk that still exists, as based on his 5-yr experience in industry. The main risks occur with applying the paints with wads and spray, as is done in decalcomania. The decorators become exposed to Pb dusts in the painting operation and in buffing. The compounds contained in the paints are Pb oxide, alkaline borate or ferrite, silicate or borosilicate.

At the onset of the surveillance program, signs of excessive absorption were found. The results, after preventive measures were instituted, showed a disappearance of severe poisoning. The preventive measures in the work rooms are described. The importance in Pb exposure of the test for stippled erythrocytes and methods for their determination are discussed. The author prefers to count the number of stippled cells in reference to normal erythrocytes. A count of 1 stippled cell/1000 normal cells is considered as the threshold value. A content of 2.5/1000 requires removal of the subject from exposure. The difference of the stippled count in venous and peripheral blood is pointed out, so that 2 successive counts are commendable. (13 references)

**1908** Gaultier, M. (Paris, France): Le saturnisme alimentaire. (NUTRITIONAL LEAD POISONING.) Vie Médicale (Paris) 39, No. 4:406-8, 1958.

Since the incidence of occupational Pb poisoning has been greatly reduced by rigorous medical supervision and progressive industrial hygiene, Pb poisoning by the oral route has gained in importance. If the usual daily intake of 0.5 mg of Pb, which is fully excreted in feces and urine, is increased by only 1 mg, Pb accumulates in the body sufficiently to cause disease. The author presents a review of the signs and symptoms in chronic poisoning, which include nervous impairment as a characteristic sign pointing the way to correct diagnosis; paralysis of the muscles; confused mental states etc; the various diagnostic tests, including mobilization with chelates, and treatment with EDTA concludes the discussion.

**1909** Griggs, R.C., and Harris, J.W. (Cuyahoga County Hosp.; Western Reserve Univ. School Med., Cleveland, O.): ERYTHROCYTE SURVIVAL AND HEME SYNTHESIS IN LEAD POISONING. Clinical Research 6:188 (May), 1958.

The survival time of autotransfused erythrocytes, tagged with  $^{51}\text{Cr}$ , was observed in 4 adult males with industrial Pb intoxication. The half-life of the erythrocytes was observed to be 20, 20, 25 and 26 days compared to a normal of 30 days. There was no indication for any preferential organ accumulation as an indication of erythrocyte sequestration. Quantitative determinations of the heme precursors, ALA, and porphobilinogen (PBG) were made for all persons exposed to Pb. The excretion of ALA temporarily decreased to normal levels after intravenous EDTA administration, but elevated urinary levels persisted for months. In contrast, in 3 patients with acute intermittent porphyria the excretion of ALA and PBG was marked-

ly elevated.

The authors conclude that these studies provide additional evidence that heme synthesis is altered and the rate of erythrocyte destruction is accelerated by Pb poisoning. The determination of urinary ALA excretion appears to be a sensitive indicator of Pb poisoning.

**1910** Gülzow, M., and Minden, H. (Acad. Social Hyg., Med. Education, Berlin-Lichtenberg, Germany): Das abdominale Syndrom Blei-kranker. (THE ABDOMINAL SYNDROME OF LEAD POISONING.) Das Deutsche Gesundheitswesen 13:1375-80 (Oct. 23-30), 1958.

Signs and symptoms of 100 patients with Pb poisoning and of 228 workers exposed to Pb are tabulated and the following conclusions are drawn: Massive Pb intoxication produces a characteristic spastic-atonic abdominal syndrome which is localized in the whole digestive tract and mainly in the intestine. In the stomach disturbances of secretion (sub- and anacidity) and changes of the mucosa (swelling, hyperemia) are noted. These phenomena are reversible as other signs of intoxication abate. Late damage of the intestine (colitis) and stomach (chronic gastritis) is rare. The occurrence of gastroduodenal abscesses is denied, and that of ulcers due to Pb poisoning can be accepted only under extreme reservation. (From authors' summary)

**1911** Guerdjikoff, C., and Desbaumes, P. (Dept. Ind. Hyg., Lab cant. chem., Geneva, Switzerland): Un problème peu connu d'hygiène industrielle: l'intoxication professionnelle par le stéarate de plomb. (A LITTLE-KNOWN PROBLEM OF INDUSTRIAL HYGIENE: OCCUPATIONAL POISONING CAUSED BY LEAD STEARATE.) Revue Médicale Suisse Romande 78, No. 5:320-33, 1958.

Two cases of industrial poisoning by Pb stearate are reported. (1) A 47-yr-old man had been employed in a factory making Pb-sheathed telephone cables for 4 yr, 3.5 yr of these in manual contact with Pb. During the last 6 mo he was engaged in the manufacture of Pb sheaths for submarine cables. For this purpose, he was cutting Pb pipe of different diameter which were dipped first in a bath of liquid stearic acid at  $180^\circ$  and then in a tin bath. Each operation taking about 30 sec, he processed several hundreds of jackets daily, on 3-4 days/wk. The man did not notice any untoward effects for 5 mo when suddenly severe epigastric pains, nausea, vomiting, asthenia and anorexia started. Numerous erythrocytes with basophil granulations (% not given) were found in the blood; the whole syndrome indicated Pb poisoning. Neither the cutting of the pipes (Pb content in air at eye level  $0.047 \text{ mg/m}^3$ ) nor the tinning which was done at a temperature well below the melting point of Pb, could have caused the Pb intoxication. However, above the baths, the Pb level in the atmosphere was  $3\text{-}3.6 \text{ mg/m}^3$  and the Pb was found to be present as stearate. Laboratory tests reproducing the process revealed the formation of white fumes consisting of stearic acid and organic Pb compounds when the pieces wetted in stearic acid were steeped into the Sn bath, and the stearic acid bath was found to become enriched with Pb, containing



0.99% Pb after 2 days' use and 2.09% after 8 days. The possibility of a similar Pb pollution in the food canning industry is pointed out. (2) A 40-yr-old man worked for 11 wk in the manufacture of synthetic resin where he handled a mixture containing 3-6% Pb compounds (carbonate or stearate) as stabilizer. No signs of intoxication were noted while Pb carbonate was used. However, 18 days after he started to use a mixture of 60% Pb carbonate and 40% Pb stearate for 75 min/day, he developed severe abdominal pains typical of Pb poisoning, besides pyrosis, anorexia, pallor, asthenia and sensation of heaviness in the extremities. He recovered readily after treatment with versenate. The Pb content in the air at different stages of the operation ranged from 0.16 to 3.9 mg Pb/m<sup>3</sup> for Pb carbonate and to 30.2 mg/m<sup>3</sup> for carbonate-stearate.

The author assumes that the stearate particles remain longer suspended in the air while the Pb carbonate particles settle down more rapidly. A worker using solely Pb carbonate as a stabilizer showed the first manifestations of poisoning after 4 yr on the job (12 references.)

- 1912** Hadengue, A., and Lamberton, J.N. (Inst. Med. Travail, Paris, France): Valeur pratique des hématies à granulations basophiles dans le dépistage du saturnisme professionnel. (PRACTICAL VALUE OF ERYTHROCYTES WITH BASOPHIL GRANULES IN THE DETECTION OF OCCUPATIONAL LEAD POISONING.) Maroc Medical 37, 416-9 (Apr.), 1958.

The authors point out that blood cells with basophilic stippling are typical for early Pb poisoning. They may not be found in patients with Pb-induced paralysis or nephritis who have been removed from Pb exposure for a certain time. The specificity of basophilic stippling for Pb poisoning is still under dispute. Determination by staining and counting methods is discussed. A concentration in the leukocytes of 30% is suspicious, and increased levels repeatedly found at 8-day intervals are indicative of Pb intoxication. Regular tests for basophilic granules represent good practice in occupational medicine. A regular schedule of examinations is proposed although the costs for these tests are admittedly high.

- 1913** Haeger, B. (Malmö General Hosp., Sweden): STUDIES ON A  $\delta$ -AMINOLEVULIC ACID-LIKE SUBSTANCE IN URINE FROM LEAD WORKERS. Scandinavian Journal of Clinical and Laboratory Investigation 10, No. 2:229-30, 1958.

Urine collected from a Pb worker with a daily excretion of ~0.03 mg/ml of the unknown substance was used to determine whether it was ALA or a related substance. Four experiments, described briefly, strongly suggested that the ALA-like substance consisted at least mainly of ALA. The experiment will be dealt with in greater detail in a future paper.

- 1914** Harishima, S., Tsuchiya, K., Kondo, H., Motouchi, M., Sakaguchi, T., and Mori, A. (Keio Univ. Japan): (THERAPY AND PREVENTION OF LEAD POISONING WITH CALCIUM VERSENATE.) Keio J. Med. 7 (Mem. No.):93-

105, 1958.

When Pb poisoned dogs were treated parenterally with EDTA, plasma Pb increased greatly while the Pb content of liver and kidneys was markedly decreased compared to untreated Pb poisoned dogs. EDTA administration did not prevent the decrease in the albumin/globulin ratio. Clinical and prophylactic use of EDTA in Pb exposed workers gave the following results: (1) iv therapy did not increase Pb in the blood; urinary Pb was at the highest level 3 hr after administration; (2) oral therapy was ineffective; (3) oral prophylaxis for >6 mo decreased blood and urinary Pb and prevented anemia and other symptoms. (From Excerpta Medica, Sect. 17, 6:Abstr. No. 1589, 1960)

- 1915** Harris, C.E.C. (St. Mary's Hosp., Montreal, Canada): A COMPARISON OF INTRAVENOUS CALCIUM DISODIUM VERSENATE AND ORAL PENICILLAMINE IN PROMOTING ELIMINATION OF LEAD. Canadian Medical Association Journal 79:664-6 (Oct.15), 1958.

The effects of iv administered EDTA and oral penicillamine, respectively, were studied in 2 patients (both foundrymen) suffering from Pb poisoning. Both versenate and penicillamine increased Pb excretion, elimination was slightly greater with EDTA. But it is felt that the ease of administration of penicillamine and its lowered toxicity combine to outweigh the trifling superiority of EDTA.

- 1916** Henderson, D.A. (Queensland Inst. Med. Res., Brisbane, Australia): THE AETIOLOGY OF CHRONIC NEPHRITIS IN QUEENSLAND. Medical Journal of Australia 1:377-86 (March 22), 1958.

The paper is mostly a review of earlier studies (38 references). The author combines the results of the studies in 4 summaries: (1) On the basis of mortality data between 1876 and 1947, the excess mortality from "chronic nephritis" in Queensland is best explained by the action of a nephrotoxic agent on the children of Queensland. Such an agent would have commenced acting about 1880, initiating changes in the kidney leading to death from chronic renal disease 10-40 yr later, and gradually ceased to act after 1920. (2) Clinico-pathologic analysis of a sample of chronic renal disease in the 20-59-yr age group in Queensland showed that only a small proportion of illnesses are due to generally recognized causes such as glomerulonephritis, pyelonephritis or hypertension. The majority of cases which produce the excess mortality in Queensland do not present the features of these diseases, and are due to some other cause. (3) No direct evidence that childhood Pb poisoning was responsible for the high incidence of chronic renal disease in Queensland can be obtained today. However, the several lines of circumstantial evidence reviewed in this section are independent and consistent. There was a high incidence of renal disease in persons known to have had Pb poisoning in childhood; a frequent history of childhood plumbism was obtained in the chronic renal disease group investigated; a significantly raised bone Pb content was found in that group; there was a correlation in familial incidence; bone Pb values correlated with the age incidence of chronic renal disease, and with the historic sequence in child-



hood plumbism; and there was a correlation between the frequency of high bone Pb values and the excess mortality from chronic renal disease in that state. Of greatest significance is the finding that a history of childhood Pb poisoning and excess bone Pb values occurred only in a particular group of cases which had been separated on independent clinicopathologic grounds. This combination of findings it is held, leaves no room for doubt that the excess mortality from chronic renal disease in Queensland has been due solely to Pb absorption in childhood. (4) There is a great deal of evidence that Pb can produce a chronic renal lesion in man. Critical analysis of a number of surveys of Pb workers, in which a high incidence of hypertension, arteriosclerosis or renal disease was not found, shows that they cannot be used as evidence against this general statement.

- 1917** Herbert, F.K. (King's College, Newcastle upon Tyne, England): THE COPROPORPHYRIN PRECURSOR OF HUMAN URINE AND ANOTHER PIGMENT FORMED FROM A CHROMOGEN. *Biochemical Journal* 69:10P-11P, 1958.

Ether extracts (with or without acetic acid) of human urine obtained and kept in the dark were examined for coproporphyrin precursors after removal of porphyrin with 1% HCl. The extracts were concentrated and examined for absorption spectrum and then exposed to light and reexamined. With the exception of 5 Pb poisoning cases no absorption was observed prior to irradiation which produced coproporphyrin. The 5 cases of Pb poisoning had metalloporphyrins, as well as the precursor. A 2nd pigment was formed from a chromogen under similar conditions with a spectrum in ether having an absorption spectrum maximum at 637 m $\mu$ .

- 1918** Horiuchi, K., and Horiguchi, S. (Osaka City Univ., Japan): LEAD INTOXICATION. *Rinshō to Kenkyū* 35:544-51, 1958.

A review with 39 references. (From *Chemical Abstracts* 53:7424, 1959)

- 1919** Hsü, J.H., and Yao, K.P. (Shanghai 1st Labor Hosp., China): SODIUM CITRATE IN THE PREVENTION AND TREATMENT OF LEAD POISONING. *Chinese Journal of Internal Medicine* 6:97 (English summary); 836-42 (Sept.), 1958.

Fourteen cases of Pb poisoning were treated by oral administration of Na citrate at 8-15 g/day. Of the 14 cases treated with Na citrate, 11 received 8-15 g/day for 14-25 days orally, and 3 were treated iv. Pb colic was present in 13, and in 3 Ca gluconate had to be used to control it before administration of Na citrate. Colic usually subsided in 1-4 days but tenderness persisted for 4-7 days. A rapid increase in urinary Pb was observed, reaching a peak in 2-5 days (4 times the pretreatment value). A decrease then occurred to pretreatment levels and even lower in  $\approx$ 2 wk; resumption of therapy for a few days resulted in new peaks, with a gradual levelling off. The authors consider that intermittent therapy with Na citrate is preferable. Based on this experience, they studied the preventive action of the drug on 56 workers in 2 storage battery plants over a 5-mo period by giving each orally 2 g 2 times daily 6 days/wk. Observation

over 6 mo showed that within 2 wk-1 mo, appetite was increased and in 3 mo fatigue and weakness were considerably decreased in most cases. At the beginning of administration, 1/3 of the workers felt soreness in joints, and a few felt dizziness, both of which subsided after 1 mo of treatment. The authors conclude that in factories where protective measures are not yet available, this method of preventing Pb poisoning is effective and economical. (31 references)

- 1920** Karlog, O., and Møller, K.O. (Univ. Copenhagen, Denmark): THREE CASES OF ACUTE LEAD POISONING. ANALYSES OF ORGANS FOR LEAD, AND OBSERVATIONS ON POLAROGRAPHIC LEAD DETERMINATIONS. *Acta Pharmacologica et Toxicologica* 15, No. 1:8-16, 1958.

A simplified polarographic method for the determination of Pb by using commercial dithizone without previous purification, is described. The Pb content was determined in the organs of 3 women, 18-21 yr old, who had died after ingestion of PbO in attempts to produce abortion. The dose of PbO was unknown in 2 cases; in the 3rd case it was  $\approx$ 15 g. Death occurred after 2.5, 7 and 30-33 days, respectively. Autopsy showed yellow pigmentation of the tissues and organs, petechial bleeding in the skin and serous membranes and degeneration of liver and kidney. The Pb content,  $\mu$ g/g, in the 3 cases was determined as follows: stomach wall -, 5-; stomach contents 13, 15, -; small intestine contents -, 51, 3 (however, in 20 cm of intestine, 6500 mg found as PbO); large intestine contents -, 10,000, 5; blood -, 5, -; bone marrow -, 7, -; liver 16, 95, 40; kidney 46, 41, 4; muscle 7.3, 2, -; bone -, -, 2; spleen 5, 3, 8; uterus -, 3, -; brain 1, 3, -. Fetus bones, liver, kidney and muscle of case 1 contained 21, 21, 1, 1  $\mu$ g/g Pb, respectively. The fact that the liver of the fetus contained more Pb than that of the mother supports the view that Pb-poisoned mothers may bear infants with severe Pb damage.

- 1921** Kikyo, S., Inami, I., Serizawa, S., and Yoshimura, Y. (Yokohama Univ. School Med., Japan): AUTOPSY CASES OF ACUTE TETRAETHYL LEAD POISONING. *Acta Pathologica Japonica* 8 (Suppl.):917-23, 1958.

In the reported 7 cases of TEL poisoning, death occurred  $\approx$ 1 mo after initial exposure to 1.52 mg Pb/m<sup>3</sup> as TEL. Urine and blood showed 4-837  $\mu$ g and 79-420  $\mu$ g Pb/100 ml, respectively. Autopsy revealed no unique pathologic changes, but findings included dilatation of small blood vessels, renal tubular degeneration, fatty liver and edematous swelling of leptomeninges. The highest Pb values were found in liver (1.8-3.3 mg/100 g), followed by kidney, pancreas, brain, heart, spleen and lung. (From *Chemical Abstracts* 54:23015, 1960)

- 1922** Kissel, P., Hartemann, P., Debry, G., and Jerome, M. (France): Forme ataxique de la polynévrite saturnine. (ATAXIC FORM OF LEAD POLYNEURITIS.) *Revue Neurologique* 99:581-5 (Nov.), 1958.

The case of a 65-yr-old woman suffering from paralysis of both forearms is reported. Blood tests confirmed the presence of Pb poisoning. The woman admitted drinking water which frequently

had been standing in the pipes for 8-10 days while she was away. She recovered after treatment with EDTA. (11 references)

- 1923** Labadie, P. (Reg. Fund, Social Sec., Bordeaux, France): L'interprétation statistique des tests hématologiques. Application au dépistage et à la prévention des maladies professionnelles. (STATISTICAL INTERPRETATION OF HEMATOLOGIC TESTS. THEIR APPLICATION FOR THE DIAGNOSIS AND PREVENTION OF OCCUPATIONAL DISEASES.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 19:149-60 (Mar.-Apr.), 1958.

Based on statistical calculations, average values and physiological variations were established for red and white blood cell counts, hemoglobin and polynuclear neutrophils in normal males and females. The method used showed that only relative significance was attached to the Hb level, polynuclear counts and particularly to the white cell count. The most significant value is the red cell count because its distribution is perfectly gaussian in normal conditions and appears not to be influenced by minor physiopathologic incidents in everyday life. Every confirmed decrease below 4,000,000 in females and 4,300,000 for males signifies the existence of an abnormal phenomenon, the occupational or nonoccupational nature of which remains to be determined. Experience has shown that in such cases a change of occupation is often a wise measure. The author concludes that as applied by him for latent Pb and benzene poisoning, group studies show that the noxious influences have not yet been eliminated; they have only been decreased in intensity to such a degree that they may be considered harmless for a healthy organism. It is therefore still necessary to carry out regular biological controls in order to test the efficacy of the preventive measures and to sort out, in time, individuals who are not in perfect health and who are therefore more susceptible.

- 1924** Lasch, F., and Schneider, G. (Regional Hosp. Villach, Kärnten, Austria): Die Bedeutung von Blei- und Porphyrinbestimmungen in Blut und Harn bei der Bevölkerung von Gegenden mit Bleigewinnung und -verarbeitung für die Differentialdiagnose und Begutachtung von Bleigefährdung und Bleiintoxikation. (SIGNIFICANCE OF LEAD AND PORPHYRIN DETERMINATION IN BLOOD AND URINE OF POPULATION IN AREAS OF LEAD PRODUCTION AND MANUFACTURE FOR DIFFERENTIAL DIAGNOSIS AND EXPERT TESTIMONY INJURIOUS EFFECTS OF LEAD AND POISONING.) Wiener Zeitschrift für Innere Medizin 39, No. 7:274-85, 1958.

Extensive and comparative investigations were carried out on the blood and urinary Pb levels and the excretion of porphyrin in Pb-exposed workers (40) and inhabitants (50) of an area with intensive Pb mining and manufacture (Bleiberg mines and Gailitz near Arnoldstein). The findings on Pb blood, urinary Pb and porphyrinuria were for the workers at risk and with Pb poisoning: 20-340 µg%, 7.7-292 µg/l and 22-2540 µg/l respectively; inhabitants not exposed occupationally showed: 14-206 µg%, 5-146 µg/l and 8-120 µg/l. The findings

showed that the levels found in people not exposed to Pb occupationally in a great many cases corresponded to those of the Pb workers and in some cases even to the Pb intoxication levels, although no signs of poisoning were evident. The authors considered that the Pb content of the regional drinking water might account for this. Analyses of several wells and water supplies used by the inhabitants gave low Pb levels (4-7 µg/l) in Arnoldstein and much higher content (30-70 µg/l) in Gailitz; drinking water of the resort near Bleiberg contained 12 µg%. Although under prevailing circumstances parallel analyses of blood and water Pb levels could not be performed, it appeared that the higher Pb levels in the water were responsible for the high blood Pb levels. For this reason it was believed necessary to establish "normal" values by taking into consideration the increased Pb contents in the water in regions with extensive Pb mining and processing in order to get valid comparative values for differential diagnoses. The symptomless "worker at risk" must therefore be viewed differently under these conditions, so that any needed preventive and therapeutic measures can be introduced correctly.

- 1925** Leckie, W.J.H., and Tompsett, S.L. (Univ. Edinburgh, Scotland): THE DIAGNOSTIC AND THERAPEUTIC USE OF EDATHAMIL CALCIUM DI-SODIUM (EDTA, VERSENE) IN EXCESSIVE INORGANIC LEAD ABSORPTION. Quarterly Journal of Medicine 27:65-82 (Jan.), 1958.

There has been some difference of opinion on the optimum dose and mode of administration of EDTA in cases of excessive Pb absorption. An investigation was therefore planned to determine the factors responsible for modifying the action of this chelating agent in vivo. Eight men constantly exposed to Pb absorption in a wire mill were selected and 8 other men suffering from pulmonary tuberculosis served as controls. Symptoms of acute Pb poisoning were present in only 1 patient; in 4 others the level of urinary coproporphyrin was significantly raised. Others, though all showing stippled erythrocyte, had no symptoms other than a metallic taste in the mouth. Patients with excessive absorption of Pb without symptoms and with an excretion of Pb within normal limits will excrete abnormally high amounts as a result of EDTA therapy, which thus becomes of diagnostic value. The optimum dose of EDTA was found to be 2 g and was best administered in an iv infusion of saline over 6 hr daily for 5 days, the courses were separated by 3 or 4 days and the total dose was limited to 5 g/30 lb body weight. After such an infusion all patients with excessive Pb absorption excreted Pb in the urine at the rate of over 1.5 mg/24 hr. Pb excretion in the controls similarly treated varied between 0.22 mg and 0.65 mg/24 hr. The clinical procedures leading up to these conclusions are described in considerable detail. Also discussed are the elective sites of Pb storage in the body and how this stored Pb may be released under stress. One of the authors' patients given parathormone with EDTA showed no change in urinary Pb, and hydrocortisone actually depressed excretion. Earlier it had been suggested that EDTA might transiently depress the bone marrow and produce T-wave changes in the electrocar-

diagram. In this series patients whose hemoglobin values were low at the beginning of treatment showed rises during treatment from 72-90% in 3 wk. No other toxic effects in nearly 100 iv infusions were noted. (22 references)

- 1926** Leonard, A.R., and Lynch, G. (Berkeley City Dept. Pub. Health, Calif.): DISHWARE AS A POSSIBLE SOURCE OF LEAD POISONING. California Medicine 89:414-6 (Dec.), 1958.

California public health officials in 1958 were advised by a housewife that applesauce placed in an imported oriental bowl had removed considerable pigment from the interior of the bowl. The bowl and samples of other dishes, still unused, were subjected to qualitative and quantitative analyses. These were part of improperly fired dishware received in a large shipment from Japan in 1955, which were found to have soluble pigmented glazes containing large amounts of Pb. Analyses of some of these dishes showed Pb content per dish from 800-1000 mg, which is well above the acute, toxic dose. The adhesive quality of the glazes varied considerably from very loose to very tight. The improperly fired dishes had been distributed to commercial markets, eating places and homes throughout the country. Since the issuance of public warnings many reports of fading pigment on such dishes after periods of acid exposures were received. In 1 family reporting this, the wife was under medical care for vague abdominal distress. Both she and her husband showed ~10 days after exposure to the bowls had ceased, urinary Pb of 0.094 and 0.072 mg/l (both higher than normal values).

- 1927** Lerza, P., and Fierro, D. (Univ. Genoa, Italy): Contributo allo studio radiologico dell'apparato digerente nel saturnismo. (CONTRIBUTION TO THE X-RAY STUDY OF THE GASTRO-INTESTINAL TRACT DURING LEAD POISONING.) Medicina del Lavoro 49:787-810 (Dec.), 1958.

In an X-ray study of the gastrointestinal tract of 72 patients with Pb poisoning, it was observed that the rather frequent functional changes are mostly hypertonic-spastic and involve all sections of the digestive tract. There are diffuse and localized cordlike contractions or irregular and deep colon haustrations, gastric hypertony and persistent antral hypertony, hypertony and irregular segmentation of the ileum and a spastic condition of the duodenum. The changes observed are tabulated in detail for each patient, and illustrated in 15 figures.

Such a radiological syndrome is not considered by the authors to be typical enough of Pb poisoning for the purpose of differential diagnosis from other pathologic conditions of the digestive tract. (36 references)

- 1928** Lyaonau (Leonov), V.A. (White Russ. SSR Acad. Sci.): Medyka-Biyalagichnae znachenne mikraelementau. (MEDICOBIOLOGICAL IMPORTANCE OF TRACE ELEMENTS.) Vestsi Akademii Navuk Belaruskai SSR, Seryya Biyalagichnykh Navuk 1958, No. 1:71-80. The importance of microelements for the normal biological functioning of human organism is discussed. Data are tabulated for the contents of I, As, Sn,

Pb, Cu, Zn, and/or Al, Si, Mn, Ti, Ag, Ni, Cr, Ba, Li, Cd, Co, Mo, W, and Ga in various internal organs and glands, blood, bones, hair, nails, and the intestinal wall, muscle, and/or brain tissue, respectively. The Pb values were derived from the data published by Kiroi and Voinar.

- 1929** Mackiewicz, J. (Psych. Clin., Warsaw, Poland): (PSYCHIC DISORDERS IN CERTAIN OCCUPATIONAL POISONINGS.) Arch. med. sadowej 10:43-6, 1958.

The author describes cases of occupational poisoning from the point of view of the psychiatrist. In 4 yr, 40 cases of occupational poisoning were admitted with various diagnoses, eg, schizophrenia, psychoneurosis, depression. She elaborates on only those cases where poison had been responsible for the illness. Apart from the well known poisons such as Co and Pb, the less well known agents which but seldom cause psychic symptoms (CS<sub>2</sub>, naphtha, gasoline, S, Cl, Tl) are discussed in detail. The question why not all persons, working under the same conditions, show psychic alterations is considered on the basis of type of nervous activity, resistance, and such circumstances as hunger, fatigue, alcoholism, and psychic traumas. For these reasons occupational health personnel point out that in occupational poisoning any psychic symptoms should be observed. (From Deutsche Zeitschrift für Gesamte Gerichtliche Medizin 48:471 (Abstracts), 1959)

- 1930** Maranzana, P.: Manifestazioni oculari monosintomatiche da saturnismo cronico professionale. (OCULAR MANIFESTATIONS AS SOLE SYMPTOM IN CHRONIC OCCUPATIONAL LEAD POISONING.) Med. legale e assicuraz. 6: 76-89, 1958.

Three cases of suspected Pb poisoning were described in whom the sole and 1st symptom was a neuroretinic optic lesion. Two received indemnity; 1 of these was a worker in a Pb foundry, the other a plumber and both showed an increase of coproporphyrinuria. The possibility was pointed out that in these cases eye lesion may have appeared suddenly after a time of well-being, as a consequence of some occupational exposure many years ago, without apparent damage at the time of exposure. (From Medicina del Lavoro 50:389 (Abstracts), 1959)

- 1931** Marmet, J.: Industrietoxikologische Untersuchungen bei Bleiarbeitern. (TOXICOLOGIC STUDIES OF LEAD WORKERS.) Dissertation, Eidgenössische Technische Hochschule, Zürich, 1958, 128 pp.

The Pb concentration in air was measured in 7 Pb-processing plants. The methods used for the collection of samples (membrane filter), and for the determination of Pb in air (dithizone method of Snyder and Cholak) and in blood (Woessner and Cholak) are described in detail. In many work sites a level greatly exceeding the MAC was found. Analyses of the Pb content of blood and urine and of the urinary porphyrin in Pb workers also mostly gave values beyond the tolerated limits. The correlations between urine, blood and porphyrin values were studied. A correlation was found between urinary Pb content and exposure. The author concludes that the hazard at any one location is de-

terminated best by analysis of the Pb content in air at the breathing level of the worker. At a Pb concentration in air of 0.15 mg/m<sup>3</sup> the thresholds of urinary and blood Pb are not exceeded; a urinary porphyrin excretion of 0.6 mg/l corresponds with these values. The final conclusion is that a hazard in Pb-producing plants in Switzerland still exists. (205 references)

- 1932 Marrubini, G. (Univ. Milan, Italy): Il criterio chimico-tossicologico nella diagnosi medico-legale di alcune tecnopatie. Intossicazione da piombo, da mercurio, da tricloretilene. (CHEMICAL-TOXICOLOGICAL CRITERIA IN THE FORENSIC DIAGNOSIS OF SOME OCCUPATIONAL DISEASES: LEAD, MERCURY AND TRICHLOROETHYLENE INTOXICATION.) Riv. Inf. Mal. prof. 45:954-73, 1958.

A review of the literature is presented. (From Deutsche Zeitschrift für die gesamte gerichtliche Medizin 49, No. 2:321 (Abstracts), 1959)

- 1933 Merville, R., Dequidt, J., Corteel, M.L., and Fontaine, G. (Lab. Toxicol., Lille, France): Étude électrophorétique des protéines sériques dans le saturnisme professionnel. (ELECTROPHORETIC STUDY OF THE SERUM PROTEINS IN CHRONIC OCCUPATIONAL LEAD POISONING.) Lille Med. 3, No. 3:139-43, 1958.

The subjects of the study were 21 employees of an accumulator factory, all of whom showed some signs and symptoms of Pb poisoning. Eleven of them were given ambulant treatment with CaNa<sub>2</sub>EDTA, at the end of which the serum was examined again. The electrophoreses were carried out for 4 hr at 310 v on S and S paper 2045 a Mgl. In 16 cases a decrease of albumins and increase of  $\gamma$ -globulins was found. The effects of treatment on the protein pattern were variable. It also appeared that there was no correlation between the degree of disturbance of the protein pattern and the severity of poisoning or the duration of exposure. (From Excerpta Medica, Sect. 17, 5:Abstr. No. 222, 1959)

- 1934 Mignolet, F., Dejace, J., Compère, A., and Herry, J.: Traitement de deux cas de petit saturnisme par le tétracémate calcique. (TREATMENT OF TWO CASES OF MINOR LEAD POISONING WITH EDATHAMIL CALCIUM.) Revue Médicale de Liège 13:154-6 (Mar. 1), 1958.

- 1935 Minden, H., and Thiele, H. (Acad. Soc. Hyg., Ind. Hyg. and Med. Educ., Berlin-Lichtenberg, Germany): Der Porphyrinstoffwechsel bei der Bleivergiftung. (PORPHYRIN METABOLISM IN LEAD POISONING.) Archiv für Gewerbepathologie und Gewerbehygiene 16, No. 4:396-404, 1958.

The porphyrin metabolism was studied in 100 subjects with Pb poisoning; in 13 cases the urinary porphyrins were separated by paper electrophoresis. The quantity of porphyrins with a higher number of COOH groups increased as the poisoning became more severe. In chronic poisoning the damage was additive. No protoporphyrins were found in the urine. A general disturbance of the heme synthesis was assumed.

Four rabbits (and 1 control) were treated sc, twice weekly, with 100-150 mg Pb acetate/kg for 2 wk. The porphyrin elimination was variable, reaching a maximum of 320  $\mu$ g%. Electrophoretic tests revealed an increase of porphyrins with growing numbers of COOH groups, concomitant with progressive damage. In another experiment, using 5 rabbits and 2 controls, the addition of cocarboxylase during the 1st 3 days of Pb poisoning did not influence significantly the course of the Pb intoxication. (27 references)

- 1936 Moeschlin, S. (Med. Clinic, Mun. Hosp., Solothurn, Switzerland): Klinik und Therapie der Bleivergiftung. (THE CLINICAL PICTURE AND THERAPY OF LEAD POISONING.) Zeitschrift für Unfallmedizin und Berufskrankheiten 51, No. 2:129-49, 1958.

This is a long paper in which the author gives an account, with many references, of Pb poisoning as it occurs and is treated at the present time. Although Pb poisoning has become much less common, typical cases of it still occur but many of these remain undiagnosed. The account deals with the ways in which Pb is absorbed into the body and the sources of the poison in industry with mention of TEL in engine exhausts. The mode of action of Pb particularly on the blood and nervous system, and the amounts of Pb found in the blood serum and the urine, are described. Clinical symptoms and signs are considered at length with an account of methods used for the analysis of the urine for porphyrins and of the blood for cellular changes. There is a discussion of the significance of the findings of these examinations. Specific and symptomatic therapy in cases of Pb poisoning is described at some length, with particular reference to the value of Na citrate in some circumstances and of CaNa<sub>2</sub>EDTA. Particular attention is given to the latter, which though very powerful in bringing about rapid excretion of Pb may have adverse effects. These have been recorded by other workers, and have been experienced in the author's practice. It is recommended that EDTA should be used in doses lower than those that have often been employed. The recommended treatment for adults is: not >20 mg of EDTA/kg of body weight given by drip infusion or not >2.0 g orally daily for 3 days, then 3 days' pause. This sequence may then be repeated 5-10 times according to the clinical picture. This treatment must be carefully controlled by urine examinations and stopped at once if marked albuminuria is found.

The author comments that although the industrial worker is so well shielded from exposure to Pb, it is a tragedy that in Switzerland ~300,000 kg of Pb derived from TEL in gasoline are annually exhausted into the atmosphere. In the course of time this Pb may exert its toxic action on the general population. (50 references)

- 1937 Mokranjac, M.S., Radmić, S., Stojimirović, B., Danilović, N., and Durisic, M. (Fac. Pharm., Beograd, Yugoslavia): THE ACTION OF PENICILLIN IN MAN EXPOSED TO AN INCREASED ABSORPTION OF LEAD. Acta Pharm. Jugoslav. 8:27-30, 1958.

The results of studies on the effect of penicillin on the change of Pb content in the blood and urine

of persons exposed to an increased absorption of Pb of long duration (several years) are given. It was found that penicillin mobilizes the Pb significantly. (From Chemical Abstracts 52:17511, 1958)

- 1938** Mokranjac, M.S., Radmic, S., and Soldatović, D. (Coll. Pharmacy, Belgrade, Yugoslavia): Normalno olovo u krvi raznih životinja i delovanje penicilina na mobilizaciju olova kod normalnih životinja i ljudi. (NORMAL CONCENTRATIONS OF LEAD IN THE BLOOD OF VARIOUS ANIMALS AND THE MOBILIZATION OF LEAD BY PENICILLIN IN NORMAL ANIMALS AND MAN.) Acta Pharmaceutica Jugoslavica 8:41-5, 1958.

The method developed by the authors was used to determine the normal concentrations of Pb in the blood of numerous animals (in  $\mu\text{g}/100\text{ ml}$ ): cattle, 12-15; pig, 18-23; horse, 10-15; sheep, 10-16; calf, 6-12; dog, 6-10; turkey, 5; duck, 5-7; chicken, 5-6; hen, 8-9. Experiments were then performed to determine whether the administration of penicillin modified the Pb content of blood of rabbits and pigs, as well as of healthy subjects not exposed to Pb (before penicillin, 35-42  $\mu\text{g}/100\text{ ml}$ ). The results showed that the Pb content of blood of normal animals or of persons not exposed to increased Pb was not changed by penicillin.

- 1939** Myslak, Z. (Inst. Med. Pracy, Zabrze, Poland): (THERAPEUTIC AND PROPHYLACTIC ACTION OF CALCIUM VERSENATE IN LEAD POISONING. IV. DIAGNOSTIC MOBILIZATION OF LEAD BY CALCIUM VERSENATE.) Medycyna Pracy 9: 285-91, 1958.

Urinary Pb levels were determined polarographically in 23 patients with Pb poisoning treated with Ca-EDTA: in cases with acute poisoning excretion was 2.1-17.9 mg/day; in chronic cases, 1.5-9.1 mg; in mild cases, 1.2-8.1 mg. In controls (no occupational Pb exposure) 0.203-0.980 mg Pb/day was eliminated. Daily excretion  $>1.0\text{ mg Pb}$  was, therefore, considered to constitute evidence of Pb poisoning. (From Chemical Abstracts 53:18294, 1959)

- 1940** Nello, P.R., Panesi, M., and Villani, C.: Rilievi sui soggetti esposti al rischio della intossicazione professionale da piombo. (OBSERVATIONS ON SUBJECTS EXPOSED TO OCCUPATIONAL LEAD INTOXICATION.) Bollettino Soc. Med. Chir. Pisa 26:302, 1958.

In 6 out of 12 typographical workers engaged in manual or automatic composition, the authors found a reduction of the glomerular filtration rate, of the renal plasma and blood flow, and of the tubular "mass flow"; in no case was an increase of azotemia noted; 2 showed slight albuminuria and microhematuria. One man had an elevated arterial pressure and his EKG showed an overload of the left ventricle. The signs observed are due, according to the authors, to the harmful action of Pb upon the kidney and parenchymal and vascular structures. (From Medicina del Lavoro 50:388 (Abstracts), 1959)

- 1941** Nicolet, S.: La prevention du saturnisme. (PREVENTION OF LEAD POISONING.) Ztschr. Unfallmed. u. Berufskrankh 51, No. 2:122-

9, 1958.

A list of 15 industries and occupations is given in which a Pb hazard may exist, with short accounts of 10 cases of Pb poisoning, and the ways in which the patients had absorbed the metal. Pb intoxication is slowly diminishing in frequency in Switzerland, where the annual number of persons compensated has been reduced from 37 in 1945 to 26 in 1954. A short account is given of the prevention of Pb poisoning which is based on: (1) recognition of the risk, (2) elimination of the risk, (3) general hygienic measures, (4) personal hygiene, (5) medical examination before engagement and at intervals thereafter, and (6) education in security of all who may be at any time working with Pb, which includes engineers, foremen and workers. (From Bulletin of Hygiene 34, No. 1:58, 1959)

- 1942** Nowacki, J.: Ołowica w kaflarniach wielkopolskich. (LEAD POISONING IN GLAZED TILE PLANTS.) Med. Pracy 9, No. 5:367-72, 1958.

Medical examinations of 162 workers in 9 different glazed tile plants were carried out. In addition to the medical examination, determinations of Hb, the number of reticulocytes and coproporphyrin level in the urine were performed. It is stated that the frequency of Pb poisoning in the glazed tile industry is much greater than the number of working places with direct exposure to Pb would indicate. The greatest frequency of Pb poisoning was seen among workers employed at kilns. Among women employed in tile glazing, the frequency of Pb poisoning is twice as great as among men doing the same work. (From Excerpta Medica, Sect. 17, 5:Abstr. No. 2732, 1959)

- 1943** Pagnotto, L.D., Elkins, H.B., and Bayka, I. (Massachusetts Div. Occup. Med., Boston): ORAL ADMINISTRATION OF EDATHAMIL CALCIUM DISODIUM (CALCIUM DISODIUM VERSENATE): A.M.A. Archives of Industrial Health 17: 29-33 (Jan.), 1958.

Two subjects, A and B, treated themselves orally (Jan.) with a total of 10 g  $\text{CaNa}_2\text{EDTA}$  in tablet form over a period of 4 days. Urine samples were collected daily at  $\sim 5\text{ PM}$ . Pb excretion in the urine increased during the 1st days of treatment but fell off when EDTA was discontinued. In subject A, a maximum Pb excretion of 0.47 mg/l urine was reached; in subject B, it was elevated but less high than in subject A. About 6 mo later, subject A and a new subject C repeated the experiment, ingesting a daily dose of 1.4 g  $\text{CaNa}_2\text{EDTA}$  (half of the amount of experiment 1) until the urinary Pb excretion reached pretreatment levels. This 2nd course did not stimulate Pb excretion in subject A to the previous level while Pb values of subject C paralleled the earlier results in subject A.

A method for the determination of free EDTA in the urine by adding excess Pb was worked out and it was found that each molecule of EDTA prevented the precipitation of  $\sim 2\text{ Pb atoms}$ . Thus, the EDTA in experiment 1 complexed in the urine of subject A and B 26 and 19 mg Pb, respectively, while in experiment 2 the complexed amount of Pb was 31 and 40 mg, respectively, for subject A and C (after

totals of 10 and 11 g EDTA). Based on the estimate that each molecule EDTA precipitates 2 atoms of Pb, the absorption of EDTA was <0.3% although there was enough free EDTA in the urine to complex up to 7 mg Pb/l urine. After treatment was stopped, EDTA was fairly rapidly eliminated, and after 3 days little or none was found in the urine. The coprecipitation method for the determination of Pb in the urine of patients treated with EDTA is described. It consists in adding excess dichromate to the urine, reducing with arsenous acid and precipitating the freed Pb by Ca oxalate.

- 1944** Pentschew, A. (Sofia, Bulgaria): Intoxikationen. (INTOXICATIONS!) In Handbuch der Speziellen Pathologischen Anatomie. Berlin, Julius Springer, 1958, XIII/2, B:2399-2502.

The action and pathology of Pb and TEL on the brain are included in the sections of the "general part" discussing poisons which produce structural changes in the central nervous system without affecting to any extent the energy metabolism; poisons which affect the brain secondarily by their effect on certain organs and systems; blood-brain barrier; the time factor in acute and chronic poisoning - allobiosis. In connection with the time factor, the author states that although formerly it was held that the small amounts of Pb circulating in the blood could cause an accumulation of Pb in the brain, thereby producing toxic signs in it, Straub (1911) observed that no Pb can be detected in the brain of men or animals poisoned by Pb in spite of the presence of characteristic cerebral changes. Straub termed this "cumulation of insults" which in turn was defined as "allobiosis" by Heubner (1937), ie, numerous repetitions of single states of intoxication, which in themselves are ineffective and imperceptible, may effect an organic change which persists when the poison itself is no longer present. In experiments with rabbits, the author observed a phenomenon related to allobiosis: Repeated administration of suboccipital injections of fractions (1/4-1/20) of the MLD of Pb (as acetate) at 2-4-day intervals was tolerated without harm until suddenly, after another injection, grave cerebral signs of intoxication appeared and the animals died within a short time. It was found that the total amount of Pb administered to the time of death was always the same and corresponded to the MLD. It was apparent that repeated administration of ineffective amounts produced a hypersensitivity to Pb. The author points out that this sensitization is not of an allergic nature, but a peculiar abnormal state which is a habituation in reverse. This phenomenon has been observed clinically in man. The incalculability of Pb encephalopathy may have a plausible explanation, eg, a dramatic outbreak of acute encephalopathy after a simple angina or some other disease in which minimal amounts of Pb are mobilized from deposits, although the patient had been considered to be healthy for many years. In exploring this question with other heavy metals, 6 chosen at random, Al, Au, Th, Fe, Hg, and Mn, acted in a similar manner. With Ag and Cu, a habituation took place. A "special part" (pp 1929-87) is devoted to Pb poisoning. This includes an appendix covering TEL poisoning, where this condi-

tion as observed in children is pointed out as being of interest. The review is based principally on Tolgskaya and Reznikov's observations, and closes by stating that in contrast with Pb encephalopathy induced by Pb, that by TEL is characterized particularly by an insufficient vascular tension. The fact that Pb attached to the ethyl radical is incapable of exerting its pressure-increasing action on vessels, is probably connected with the simultaneous onset of disturbance of the central blood pressure regulation in the direction of a hypotension. For this reason the epileptic attacks, so characteristic as a sign of Pb encephalopathy, are absent. Some relationship probably exists also between blood pressure and vascular tension to the increase in brain volume in the form of edema or swelling of the brain. This is generally absent in TEL encephalopathy. An appendix on porphyrias completes the section on Pb.

- 1945** Popescu, I.Gh., Ioanid, N., Bors, Gh., and Radian, I. (Inst. Legal Med. "Prof. Dr. Mina Minovici," Bucharest, Romania): Relazione fra le lesioni saturnine e la ripartizione del piombo negli organi di un bimbo nato morto da madre affetta da saturnismo. (RELATION BETWEEN LESIONS AND THE LEAD DISTRIBUTION IN ORGANS OF A STILLBORN FROM A MOTHER, WITH LEAD POISONING.) Zaccia 21:62-72, 1958)

The study of 1 case showed that Pb passes from mother to fetus through the placenta, is taken up chiefly by some organs, and produces lesions in liver and kidney. By a polarographic method (after ashing) the following Pb concentrations were determined, in mg/100 g: placenta 0.145, fetus lung 0.075, intestine 0.112, liver 0.145, skin and muscle 0.158, umbilical cord 0.308, bladder 1.65, heart 0.451, kidney 0.632, blood 1.808, spleen 1.995, stomach 1.123, mother's blood 0.191.

- 1946** Popescu, I.G., Ioanid, N., and Bors, Gh. (Fac. farm., Bucharest, Romania): THE PROBLEM OF SATURNISM. ACUTE AND CHRONIC INTOXICATION WITH LEAD. Lucrarile prezentate conf. natl. farm., Bucharest 1958, pp. 241-7.

Post-mortem examinations carried out on patients who had died of Pb poisoning indicate that in the case of chronic intoxications Pb accumulates in all organs, but in bones, cartilage, teeth, nails, and hair in quantities 3-5 times as great as in organs well supplied with blood. Acute intoxications affect mostly the brain, nerves, and glands. The quantities of Pb eliminated by the organism through the urine correspond to the total Pb quantity in the organism. The polarographic method can be used to determine the Pb in the urine. (From Chemical Abstracts 53:6437, 1959)

- 1947** Popper, L. (City Hosp., Vienna, Austria): Das heutige Bild der Bleivergiftung. (THE CURRENT STATE OF LEAD POISONING.) Wiener Klinische Wochenschrift 70, No. 1:9-12, 1958.

Symptoms and signs of Pb intoxication are discussed. The author points out that due to hygienic measures in the industry, occupational hazards are today widely eliminated and that no con-

crete cases of Pb poisoning due to exposure from exhaust gases in city air have become known. The author summarizes his discussion as follows: Pb intoxication today hardly ever proceeds to the serious stage of permanent hypertension, contracted kidney and Pb encephalopathy. An increase of stippled erythrocytes and of elimination of porphyrin as well as the Pb line indicate only an increased absorption of Pb. The first signs of poisoning are headache, dyspeptic trouble and constipation; the typical colic may occur; occurrence of anemia or of a moderate transitory rise of blood pressure is infrequent and slight motor neuritis is still more infrequent. In the differential diagnosis occupational history and blood and urine analyses must be considered as well as the type of colic and neuritis; painful neuritis is not indicative of saturnism. Pb analyses in blood and urine are useful in doubtful cases but must be evaluated with regard to the whole picture.

- 1948** Portigliatti Barbos, M. (Univ. Turin, Italy): Sulla valutazione dell'intossicazione da piombo da ritenzione di proiettili. (EVALUATION OF LEAD POISONING CAUSED BY RETENTION OF PROJECTILES.) *Minerva Medico-legale* 78, No. 1:32-7, 1958.

A moderate anemia and the presence of stippled red cells were observed in a 46-yr-old man 4 mo after he had been hit accidentally by a shotgun. A blood analysis gave 66  $\mu\text{g}$  Pb and X-ray tests showed 29 pellets in his body. Two similar cases were reported. A 30-yr-old farmer showed 153 pellets; his blood contained 88.8  $\mu\text{g}$  Pb and 23  $\mu\text{g}$  protoporphyrin and his urine 26  $\mu\text{g}$  coproporphyrin/l. A 36-yr-old laborer had a Pb content of 80  $\mu\text{g}$  and 300  $\mu\text{g}$  protoporphyrin in the blood and 82  $\mu\text{g}$  urinary coproporphyrin/l. Other cases were cited from the literature. (20 references)

- 1949** Preiskel, D. (Hornsey Central Hosp., London, England): CHRONIC LEAD POISONING: MYOPATHY OR NEURITIS? *Annals of Physical Medicine* (London) 4:293-6 (Nov.), 1958.

A 60-yr-old man had been a metal polisher for over 16 yr. In the beginning he had polished Al and stainless steel, for the last 3.5 yr he had worked with gunmetal castings made of 85% Cu, 5% Sn, 5% Zn and 5% Pb. When seen at the hospital he complained that for 3 wk he had felt weakness of the wrists and was unable to hold things firmly. X-ray tests showed some weakness of the wrist extensors and paralysis of both long extensors of the thumbs. No gum line was detected. Blood studies indicated a mild hypochromicity with obvious polychromasia and punctate basophilia. The urine showed increased coproporphyrins. A considerable degree of recovery was obtained by therapy with a chelating agent for 3 wk.

The author points out that clinically, this case falls within the definition of so-called Pb myopathy (Pb "neuritis"). Electromyographic studies revealed no myopathic pattern. If the muscles were the primary site of the Pb intoxication, the myopathy would be expected to mask the neuropathy. But the findings which were those of a motor polyneuritis support the opinion that Pb causes paralysis by its action on nerve cells and not on muscle.

- 1950** Radosevic, Z., Šaric, M., Knežević, J., and Beritic, T.: CLINICAL OBSERVATIONS ON THE EFFECT OF LEAD ON THE KIDNEY. *Arhiv Za Higijenu Rada i Toksikologiju*. 9:233-57, 1958.

In a study of 54 Pb-poisoned patients lasting kidney changes were observed only in 2 subjects who had been exposed to high Pb concentrations for 20-35 yr. Twenty-four patients showed functional kidney alterations with no abnormality in the urine. Six patients had increased blood pressure; 2 of these were the subjects mentioned above; in the others the hypertension was transitory. The authors conclude that kidney injuries in Pb poisoning should not be called nephropathia saturnina since only at high or repeated exposures progressive kidney changes occur; otherwise, the possible renal alterations are functional and reversible. (From authors' summary) (81 references)

- 1951** Reith, J.F. (Univ. Utrecht, Netherlands): RESIDUES OF TOXIC ELEMENTS DERIVED FROM PESTICIDES ON AND IN VEGETABLES AND FRUIT. TOXICITIES; TOLERANCES; SAFETY FACTORS. *Voeding* 19, No. 6:297-313, 1958.

The hazards involved in consumption of vegetables and fruit containing residues of inorganic pesticides are discussed. Cause for concern is the possible chronic effect of continually eating food-stuffs treated with pesticides. In this report the chronic toxicities of Sb, As, Br, Cu, F, Hg, Pb and Se are considered. In applying data obtained by long-term experiments in rats to men, calculations in this report are based on the comparison of the caloric intakes of rat and man. Concerning Pb the following statements are made: 200 g of vegetables and fruit containing 7 ppm Pb would correspond to 1.4 mg Pb. Continual ingestion by human beings of >1 mg Pb/day is considered hazardous. However, in general only a small part of vegetables and fruit will be treated with pesticides.

- 1952** Rimniceanu, R., Beuran, T., Florescu, P., Aramă, O., Nestor, A., and Vasiliu, I.: Consideratii pe marginea unei actiuni de depistare a saturnismului într-o întreprindere poligrafică. (A DETECTION CAMPAIGN OF LEAD POISONING IN A POLYGRAPHIC PLANT.) *Med. Interna* (Bucharest) 10, No. 2:285-91, 1958.

The clinical and laboratory examination of 175 workers at a printing-plant demonstrated a low percentage of Pb poisoning (1.14%) and the absence of massive increased absorption. These beneficial results are due to prophylactic measures and to modern technological conditions. In many cases, the clinical signs preceded manifestations which could be demonstrated by means of laboratory methods. (From *Excerpta Medica*, Sect. 17, 5:Abstr. No. 2094, 1959)

- 1953** Ringoir, S.: Loodintoxicatie. (LEAD INTOXICATION.) *Belgisch Tijdschrift voor Geneeskunde* 14, No. 7:363-6, 1958.

The author reports the case of a 57-yr-old farmer, who was hospitalized because of complaints about increasing loss of strength especially in the hands. At the time of his hospitalization he did not suffer from paresthesia any more but he showed bilateral radial paralysis of the arms. Many blue-

black dots were seen near the bottom of the lower incisors. This led to the investigation of a possible intoxication. Urinary Pb was 25 µg/24 hr which is regarded to be normal, porphyrinuria was negative, basophilic granulation 10/1000, no Pb line in the long bones. Because of the clinical findings a test therapy with CaEDTA was carried out. For 4 days 2.5 g CaEDTA/day was administered (Mosatil-Bayer) in an intravenous infusion of 0.5 l of 5% glucose for 4 hr. Dutch authors recommend 2-4 g/24 hr for 5 days, the French 500 mg every 8 or 12 hr for 5 days. As a result of the therapy it was found that Pb excretion was respectively 3.36 mg and 4.07 mg/24 hr on the 1st and 2nd days of the treatment. The Pb in blood was 662 µg%. This, together with a 230/130 blood pressure, and the finding of 18.9 mg/l Pb in his drinking water at home made the author conclude that the patient had been intoxicated by Pb.

As a reason for reporting this case the author mentions that while no Pb was originally found in the urine, it was mobilized by CaEDTA. Also, a rare phenomenon was noted, ie, bilateral extensive paralysis (maximum 1.5%), which began in the index finger, while normally it starts in the 3rd or 4th finger. The case is interpreted to illustrate the wide individual difference in sensitivity to Pb, since the other members of the family showed no obvious signs of Pb poisoning.

- 1954** Rubino, G.F., Pagliardi, E., Prato, V., and Giangrandi, E. (Univ. Turin, Italy): ERYTHROCYTE COPPER AND PORPHYRINS IN LEAD POISONING. *British Journal of Haematology* 4, No. 1:103-7 (Jan.), 1958.

Twenty-two patients (21 men, 1 woman) with clinical symptoms and/or hematologic or urinary signs of Pb poisoning were examined. All had been exposed occupationally to a high risk of Pb poisoning. Some (14) had Pb concentrations in the blood >60 µg/100 ml and a urinary Pb excretion >100 µg/24 hr. Others (8) had previously had attacks of Pb colic, but at the time of this study their Pb concentration in the blood and their urinary Pb excretion was within normal limits (except 1). Clinical tests gave the following results: mean erythrocyte count 3.94 million/mm<sup>3</sup> (range 1.99-5.51); mean Hb concentration 11.2 g/100 ml (range 5.2-14.9). Mean protoporphyrin concentration 241.9 µg/100 ml (range 84-832, excluding 1 case). Erythrocyte CP mean 3.05 µg/100 ml, maximum 10 µg; 9 cases <1.5 µg/ml, which is within normal limits. Urinary CP excretion >100 µg/24 hr in 14 cases and normal in the remaining patients whose contact with Pb had ceased at least 1 yr previously. Plasma Fe was increased in ~10 cases, maximum value was 210 µg/100 ml. Plasma Cu was normal in almost all cases. Erythrocyte Cu was increased in all but 3 cases.

The hypothesis is advanced that Cu increase is related to the abnormal permeability of the erythrocyte membrane which occurs in this type of anemia and that the excess Cu accumulates in the erythrocytes as a consequence of damage to the surface of the cells. (21 references)

- 1955** Sadchikova, M.N. (Inst. Ind. Hyg. Occup. Dis., Acad. Med. Sci., USSR.): CLINICAL ASPECTS OF ETHYLATED GASOLINE INTOXICA-

TION IN AUTOMOBILE DRIVERS. *Sovetskaya Meditsina* 21, No. 4:99-102, 1958. In Levine, B.S.: U.S.S.R. Literature on Air Pollution and Related Occupational Diseases. Washington, U.S. Department of Commerce, Office of Technical Services, 1960, Vol. 2, pp. 245-50.

While no evidence of poisoning by exposure to TEL-containing gasoline has been reported by foreign authors, Soviet authors (Mytnuk, Ravkin, Drogichina, Kevork'yan, Reznikov, and others) from 1934-55 have observed that prolonged contact with TEL-gasoline causes chronic poisoning symptoms similar to those produced by small doses of TEL. Such poisoning has been observed occasionally in refuelers of airplanes, workers in testing stations, gasoline mixers, etc. The clinical syndrome includes asthenia and typical autonomic nervous system disturbances: bradycardia, hypothermia, vascular hypotonia, abnormal salivation, headaches, vertigo, undue fatigability, interrupted sleep, nightmares, and emotional disturbances. Graver forms of chronic poisoning were seen during World War II, but in recent years poisoning by TEL and by TEL-gasoline has occurred comparatively rarely. While in 1953 Reznikov had found some mild acute and subacute intoxications, but no chronic cases; the Leningrad Institute of Industrial Hygiene and Occupational Diseases has diagnosed TEL-gasoline poisoning rather frequently: 28 drivers from 1950-54. In most, this was due to swallowing some gasoline while clearing the gasoline feeding system by blowing through it, or by engine defects permitting fumes to enter the truck cab, or by failing to comply with the rules of personal hygiene. The findings in this group are detailed; aside from the "triad" of classical signs of bradycardia, hypothermia, hypotonia (occurring only isolatedly in most), reflex response, dermatographic changes, etc, were observed. None showed typical symptoms of Pb poisoning (stippled cells, urinary porphyrin). Some of the patients were heavy alcoholics which exaggerated the severity of the mental disturbances. Personal idiosyncrasies and individual sensitivity also were observed (infections, physical and mental traumas, etc). The mild forms were generally reversible and ended in complete recovery. The most effective treatment was extended sleep combined with 40% glucose solution iv, vitamins, pine baths, physiotherapy. Excerpts from case histories of a subacute and a chronic poisoning are presented. The author recommends that for the prevention of poisoning, trucks be inspected regularly, and that prescribed safety regulations for handling TEL gasoline be followed strictly; also that greater effort be exerted during routine examinations to detect early symptoms.

- 1956** Saita, G., and Moreo, L. (Univ. Milan, Italy): Piombo e porfirine nella bile dei saturnini trattati con versenato di calcio. (LEAD AND PORPHYRINS IN THE BILE OF PATIENTS WITH LEAD POISONING TREATED WITH CALCIUM VERSENATE.) *Medicina del Lavoro* 49:376-84, (May), 1958.

Fourteen cases of saturnism were studied for Pb content in urine, bile and feces during treatment with CaEDTA given for 3-4 days at a dose of 2 g



daily by iv or oral administration. The Pb content in the bile followed the usual pattern, ie, a rapid increase. The increase was lower in bile than in the urine, when compared to initial values: in the bile the increase was 1.3-6.3 times the values obtained before treatment (in the urine up to 75 times). In the bile Pb values >2 mg/l were seldom found; larger amounts were found in urine in most cases. Fecal excretion was also increased; the increase was similar to that observed in the bile. The average increase of Pb content in the bile and feces was almost the same for iv and oral administration of the drug. Urinary Pb was much higher after iv administration. Coproporphyrins in the bile decreased after EDTA treatment, the same as in urine. Bile excretion of protoporphyrin IX was scarcely influenced. (14 references)

- 1957** Sano, S. (Kyoto Univ., Japan): 1. THE EFFECT OF MITOCHONDRIA ON PORPHYRIN AND HEME BIOSYNTHESIS IN RED BLOOD CELLS. *Acta Haematologica Japonica* 21, No. 2 (Suppl.):337-50, 1958.

As summarized by the author in his review, based on 42 references, mitochondria play a very important role in the 3 steps of porphyrin and heme synthesis: condensation of glycine and active succinate; oxidative decarboxylation from uro- and coproporphyrin (CP) into protoporphyrin; Fe incorporation into porphyrin rings. In Pb poisoning, disorder of porphyrin biosynthesis is in the step of synthesizing ALA from glycine and inhibition of ALA dehydrase and porphobilinogenase; increased CP in urine is derived from the increased CP and ALA in the blood. Increased ALA may result in CP in urine through the action of kidney mitochondria.

- 1958** Scoca, G., and Atella, P. (Univ. Rome, Italy): DIAGNOSTIC VALUE OF BLOOD AND URINARY LEAD FOR ASCERTAINING SATURNISM. *Zacchia* 21:334-51, 1958.

Determinations in 220 cases (workers exposed to the danger of Pb poisoning) by the dithizone method (after destruction of the organic matter), showed the following blood Pb values ( $\mu\text{g}/100\text{ ml}$ ): (1) <30 in nonpathological cases, (2) 30-80 when the limit of tolerance began to be passed, (3) 80-164 in cases of clear intoxication. The urinary Pb excretion values had no diagnostic meaning and were not correlated with those of blood. (From Chemical Abstracts 53:18266, 1959)

- 1959** Sharaevskaya, Z.N.: SPECTRAL ANALYSES OF HARD TISSUES OF TEETH AND ALVEOLAR PROCESS OF MAN UNDER NORMAL CONDITIONS AND IN PARADONTOSIS. *Stomatologiya* No. 2:12-14, 1958.

Ca, P, Mg, Na, Al, Si and traces of Fe, Mn, Cu, and Pb were found in salt form in the enamel, dentine, and alveolar process. The content of members of the 1st group changed imperceptibly in health or pathological conditions, except for Mg. The content of members of the trace element group, Cu in particular, was easily affected by shifts in metabolic processes. (From Referat Zhur., Khim., Biol. Khim. 1958, Abstr. No. 29612; Chemical Abstracts 53:5471, 1959)

- 1960** Sharaevskaya, Z.N.: THE CONTENT OF TRACE ELEMENTS IN HARD DENTAL TISSUES IN THE ALVEOLAR PROCESS IN HEALTH AND IN PARADONTOSIS. *Problemy Stomatologii* (Kiev: Gosudarst. Izdatel. Med. Lit., Ukr. SSR), Sbornik 4:99-102, 1958.

Among other elements Pb and Mn were found by spectral analysis in the enamel, dentine and in the alveolar process of teeth in normal subjects and patients with paradontosis and dental caries. Pb was increased in patients with paradontosis. (From Referat. Zhur. Khim., Biol. Khim. 1959, Abstract No. 24698; Chemical Abstracts 54:13374, 1960)

- 1961** Silvestri, U. (Univ. Bologna, Italy): Ricerche spettrografiche sulla composizione in elementi in tracce del siero di sangue. (SPECTROGRAPHIC RESEARCH ON THE AMOUNTS OF TRACE ELEMENTS IN BLOOD SERUM.) *Bollettino della Società Italiana di Biologia Sperimentale* 34:1745-7, 1958.

In human serum, Pb is among the elements (with Zn, Sr, Co), that appear in variable and prevalently high amounts.

- 1962** Spiegelberg, H., and Spiegelberg, U. (Psych. and Neurol. Clinic Univ. Hosp., Hamburg-Eppendorf, Germany): Zur Frage zentralnervöser Spätschäden nach schwerer akuter Bleitetraäthylvergiftung. (LATE DISORDERS OF THE CENTRAL NERVOUS SYSTEM AFTER SEVERE ACUTE TETRAETHYL LEAD POISONING.) *Fortschritte der Neurologie, Psychiatrie und Ihrer Grenzgebiete* 26, No. 5: 248-59, 1958.

At age 25, while serving in the Air Force, the patient was exposed to acute inhalation of TEL. A severe deliriant psychosis and disturbances of the digestive and circulatory system developed. When the patient was examined 14 yr later a psychopathologic syndrome still persisted. The syndrome was characterized by cerebral changes and decreases in the affective faculty. A study of the dream life of the patient also supported the diagnosis of deliriant psychosis. Many references.

- 1963** Stanković, M., and Stanković, B.: THE EFFECT OF SULPHUROUS WATER ON LEAD EXCRETION FROM THE ORGANISM. *Glas. Hig. Inst. SRBYE* 7, No. 3-4:75-80, 1958.

The problem of the effect of sulfurous water on urinary Pb excretion was studied. A group of 25 workers, and also a control group of 15 workers, both exposed to Pb in their working areas, were removed from the job and treated in a sulfurous mineral bath. The average amount of Pb excreted in the urine during 21 days of treatment showed a slight increase in the middle of the course. The concentration of Pb in the blood decreased in the 1st day of the course and then increased slightly, but it was still lower than the level in the pretreatment period. The coproporphyrin (CP) level in the urine dropped to 43% of the pretreatment level. There was no direct proportional correlation of Pb and CP amounts excreted in the urine during the course of treatment. It was found that this mode of treatment caused some elimination of Pb from the organism, but not so

considerable that it could be used as efficient treatment of Pb-exposed workers. (From *Excerpta Medica*, Sect. 17, 6:Abstr. No. 434, 1960)

- 1964** Sudo, Y. (Tokyo Jikeikai Med. Coll., Japan): STUDIES ON FRACTION OF SERUM PROTEIN IN LEAD WORKERS. (PART II.) ON THE EFFECT OF THE ADMINISTRATION OF Ca-EDTA. *Journal of Science of Labour* 34:738-48 (Sept.), 1958.

After Pb workers, as referred to in a previous report, were given oral doses of CaEDTA for a period of 2 mo, the reticulocytes and the content of  $\gamma_1$ -globulin decreased while the Hb level, the specific gravity of the blood and the total protein and albumin in the serum increased. (From author's English summary)

- 1965** Suntych, F.: CHRONIC LEAD INTOXICATIONS. *Prakt. lekar.* 38:343-6, 1958.

The author presents a report on some patients with proved chronic Pb intoxication which started in hazardous occupations; in a few cases the intoxication was not occupational. (From *Scientific Reports on Industrial Hygiene and Occupational Diseases in Czechoslovakia 1958* 3:Abstr. No. 132, 1959)

- 1966** Suzuki, Y., Nishiyama, K., and Matsuka, Y. (School Med., Tokushima Univ., Japan): STUDIES ON LEAD CONTENT AND PHYSICAL PROPERTIES OF THE HAIR OF LEAD POISONING. *Tokushima Journal of Experimental Medicine* 5:111-9, 1958.

Pb content and physical properties of the hair were studied in rabbits with experimental Pb poisoning and in humans handling Pb in their occupation. In rabbits, the Pb content of hair began to increase ~2-4 wk after hematological symptoms of Pb poisoning. Pb (as acetate) was injected sc in doses of 1-10 mg/kg in 8 rabbits for 3 mo (total, 280 mg/kg); 2 rabbits served as controls. The increase of Pb content of hair continued until 2 mo after the last administration of Pb. Four months after administration Pb in hair was greater than in visceral organs as was almost the same as Pb in bone.

In man Pb in hair was determined in 112 workers; on 57 of them, Pb in blood and urine, urine CP, sp g of blood, and stippled cell counts were made; 22 workers not exposed to Pb served as controls. With increased absorption, Pb content of hair increased; along with this increase, elongation and strength of hair decreased. The degree of Pb exposure could be found by measuring the Pb content of hair as follows: <30  $\mu\text{g/g}$ , nonoccupational normal Pb exposure; 30-110  $\mu\text{g/g}$ , occupational normal Pb exposure; >110  $\mu\text{g/g}$ , dangerous Pb exposure. This applies only to men, as the Pb content of women's hair may be larger. The diagnostic and medico-legal aspects of the findings are pointed out.

- 1967** Szegedy, L. (Budapest, Hungary): Adatok a chronicus ólom-tetraaethyl mérgezéshez. (DATA ON CHRONIC TETRAETHYL-LEAD POISONING.) *Orvosi Hetilap* 99, No. 30:1037-9, 1958.

Based on observation of 2 cases the relatively rare chronic form of TEL poisoning was discussed. In both cases the clinical picture was dominated

by neurological symptoms such as ataxia, tremor, and atrophy of the small hand muscle.

- 1968** Teisinger, J., and Fišerová-Bergerová, V. (Inst. Ind. Hyg. Occup. Dis., Prague, Czechoslovakia): Über den Einfluss des zur Therapie der Bleivergiftung angewendeten Calciumdinatriumsalzes der Äthylendiamintetraessigsäure auf den Eisen- und Kupferspiegel im Blut und Urin. (THE INFLUENCE OF Na-Ca SALT OF EDTA ON IRON AND COPPER LEVELS IN BLOOD AND URINE.) *Archiv für Gewerbepathologie und Gewerbehygiene* 16, No. 4:478-89, 1958.

See Abstract No. 1867.

- 1969** Tishkoff, G.H., Granville, N.B., Rosen, R., and Dameshek, W. (New England Center Hosp., Boston, Mass.): EXCRETION OF  $\delta$ -AMINOLEVULINIC ACID IN LEAD INTOXICATION. *Acta Haematologica* 19, No. 6:321-6, 1958.

Three female patients, age 41, 3, and 39 yr, respectively, with clinical and hematological findings of Pb poisoning, were treated with 1.5 g CaEDTA and  $\text{CaNa}_2\text{EDTA}$  twice daily for 2 days. Urinary levels of ALA and porphobilinogen (PBG) were determined in 7 normal subjects and the 3 patients. The average normal levels were  $31.4 \pm 5$  and  $3.5 \pm 0.7 \mu\text{M} \times 10^{-3}/\text{ml}$  of urine, respectively. Two patients had elevated levels of ALA with normal or low levels of PBG. The 3rd patient initially had a normal value of ALA with an elevated PBG concentration. Following therapy with EDTA the ALA level increased markedly while the PBG concentration decreased to normal or low values. All patients had increased urinary Pb levels during treatment. The authors point out that urinary levels of these 2 substances may serve as a diagnostic aid in Pb intoxications and in the differential diagnosis from acute intermittent porphyria.

- 1970** Tolot, F., and Czuchro (France): Fréquence comparée des manifestations saturnines chez les sujets exposés au risque. Éléments de pronostic. (COMPARISON OF THE FREQUENCY OF SATURNINE MANIFESTATIONS IN EXPOSED SUBJECTS. PROGNOSTIC SIGNS.) *Proceedings of the Society of Industrial Medicine and Hygiene*, Lyons. *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 19:606-11 (Nov.-Dec.), 1958.

The following conclusions were drawn on the basis of 44 cases of Pb poisoning: the frequency of Pb colics is indicative of the poisoning; the digestive manifestations are concomitant with the occurrence of basophilic stippling of erythrocytes, true polyneuritis is infrequent, while 50% of subjects exposed for >10 yr and almost all subjects exposed for >15 yr exhibit a chronic hypertensive nephritis. Chelating agents are valuable in therapy. Subjects showing blood disorders and colics should be removed from exposure.

- 1971** Unseld, D.W. (Würzburg, Germany): Ein neuer Test ("Mosatilttest") zum Nachweis von Bleiablagerungen im Körper. (A NEW TEST (MOSATIL-TEST) FOR THE DETECTION OF

LEAD DEPOSITS IN THE BODY.) Klinische Wochenschrift 36, No. 7:328-30, 1958.

The effect of Mosatil on urinary Pb excretion was studied in 2 groups of 4 subjects each. Group A had never been exposed to Pb; group B consisted of subjects with previous Pb poisoning, but all symptoms of Pb poisoning had disappeared due to treatment and their Pb content in blood and urine had returned to normal. In group A the Pb values before Mosatil treatment were 13-36  $\mu\text{g}\%$  in the blood and 5-28  $\mu\text{g}/\text{l}$  in urine; after Mosatil, 9-31  $\mu\text{g}\%$  and 42-104  $\mu\text{g}/\text{l}$ , respectively. The corresponding values for group B were: before Mosatil 21-40  $\mu\text{g}\%$ , 20-75  $\mu\text{g}/\text{l}$ ; after Mosatil 15-34  $\mu\text{g}\%$ , 360-650  $\mu\text{g}/\text{l}$ .

The authors conclude that obviously Mosatil does not only promote Pb elimination from the blood via the kidneys, but it also mobilizes deposited Pb and causes its elimination by the urine. (Fecal Pb was not determined.) Thus, any significant increase of urinary Pb caused by Mosatil indicates that the body has stored Pb. Urinary Pb values between 100 and 300  $\mu\text{g}/\text{l}$  and blood values  $>40 \mu\text{g}\%$  were considered as indicative of Pb storage. The test is carried out in practice as follows: Urine is collected for 3 days and a blood sample is taken once. During the following 3 days 1 ampulla of Mosatil is injected intravenously daily and the urine during these 3 days is collected; no 2nd blood sample needs to be taken. The Pb level in the blood of 41 normal persons was found to range between 17 and 37  $\mu\text{g}\%$ .

**1972** US Public Health Service, National Office of Vital Statistics: LEAD POISONING. Morbidity and Mortality 7, No. 17:2, 1958.

Dr. J.M. Bruce, Louisiana State Dept. of Health, reported a case of Pb poisoning in an adult woman. The woman had been suffering from anemia for several years; during the past year, repeated urinalyses showed that she was excreting excessive amounts of Pb in her urine. Her living quarters were over a saloon which her husband operated. Investigation of the premises revealed the source of Pb to be a 1/2-in slab of Pb in the bottom of an ice chest on which rested a 25-lb block of ice. Ice was chipped from the block with a sharp, multipronged instrument and then scooped directly into glasses for drinks. A sample of ice was obtained; it was noted that there was a residue of grayish powder resembling Fe filings on the bottoms of the sample bottles in which the ice had melted. Analysis of this material revealed that it was Pb. The woman suffering from plumbism is an alcoholic and, presumably, in her husband's bar imbibed freely of drinks served with the ice containing relatively large amounts of Pb.

**1973** Viaud, M., Greau, H., Colas, J., Baron, A., and Lhermitte, R. (Nantes, France): L'encéphalopathie saturnine avec stase papillaire; intérêt du traitement par les chélateurs; (à propos d'un cas). (LEAD POISONING ENCEPHALOPATHY WITH PAPPILLEDEMA; VALUE OF TREATMENT WITH CHELATING AGENTS; (REPORT OF A CASE).) Revue Oto-neuro-ophtalmologie 30, No. 3:191-8, 1958.

A 29-yr-old woman showed anemia, temporary aphasia and hemiplegia, violent headache, bilateral papilledema, visual disturbances and facial paralysis.

Her husband, though treated for nephritic colics, showed Pb pallor and gingival line. The couple had lived for 2 yr in a flat where tap water passed through a long Pb pipe; the water contained 9.5 mg/l (mm in text probably misprint). Intravenous treatment with 1 g EDTA/day, divided into 2 doses, for periods of 5, 5 and 4 days with intervals of 4 and 5 days, respectively, was well tolerated and yielded good results.

**1974** Vol'pert, E.I. (Sci. Res. Inst. First Aid, Leningrad, USSR): O diagnostike svintsovoi koliki v praktike neotlozhnoi khirurgii. (DIAGNOSIS OF LEAD COLIC IN EMERGENCY SURGERY.) Vestnik Khirurgii im Grekova I.I. 80, No. 5:88-90, 1958.

During the last 5 yr 27 patients with Pb colic were admitted to the author's clinic with erroneous diagnoses of: intestinal obstruction, 8 cases; acute abdomen, 4; appendicitis, 2, etc. The case histories were reanalyzed, and 2 of them are described. The author stresses that the presence of anemia with a background of acute intestinal occlusive manifestations requires a thorough assessment of past history, together with repeated general and specific blood and urine laboratory studies to exclude the possibility of Pb colic.

**1975** Weber, M.: Zaburzenia czynności nerek w ołowicy. (KIDNEY DISORDERS IN LEAD POISONING.) Medycyna Pracy 1958 (Nov.-Dec.): 435-43.

On the basis of observations made on 80 cases of Pb poisoning, the author considers that cases of nephritis due to Pb poisoning are at present very rare. Kidney disorders appear in general at the more severe stages of chronic poisoning. They are related to the vasoconstrictive action of Pb and appear when the Pb content of the blood reaches high values. No kidney effects were observed in the cases of poisoning with TEL. (From Occupational Safety and Health 9:Abstract No. 2150, 1959)

**1976** Weinig, E., and Schwerd, W.: Nil nocere! Gefahren bei der Behandlung der Bleiintoxikation mit Calciumversenat ("Mosatil," "Komplexon"). (NIL NOCERE! HAZARDS OF TREATMENT OF LEAD POISONING WITH CALCIUM VERSENATE ("MOSATIL," "COMPLEXON").) Münch. med. Wochschr. 100:1788-9 (Nov. 14), 1958.

The author cautions against the use of CaEDTA on the basis that 3 fatal cases have been reported in the literature in connection with the use of the drug in the treatment of Pb poisoning, and describes another case. Polarographic determination of the Pb content of the kidney showed at autopsy 340  $\mu\text{g}\%$  Pb. In cases of disturbed kidney function the tubular epithelium becomes damaged by spastic vascular contractions and secondary ischemia, leading to an acute tubular necrosis. A mild hypertension and an incipient azotemia serve as warning symptoms. EDTA treatment leads to an increased mobilization of Pb. As the above cases show, in chronic cases with acute flare-up great care must be taken. (From Zentralblatt für Arbeitsmedizin und Arbeitsschutz 10:269 (Abstracts), 1960)

**1977** Wittgens, H., and Heider: Sehnervenentzündung

dung und Bleivergiftung. (INFLAMMATION OF THE OPTIC NERVES AND LEAD POISONING.)  
 Ärztliche Dienst DB 19:71-3, 1958.

A 57-yr-old male had been employed by the National Railway Service from 1942-1948 in the casting of bearings, working 35-38 hr/wk. In 1948, he was transferred to other work due to optic disturbances. In 1946, he had had an injured right cornea. Other entries in his medical history included Pb neuritis in Jan-Feb 1948 and inflammation of the optic nerve June-Sept 1948. According to the patient, he had been supervised medically every 6 mo. Other complaints had included gastric and intestinal catarrh, inflammation of the gastric mucosa (1956) and flu (1956). In 1956, he felt pressure on the stomach but no ulcer was found. This pressure, constant and independent of meals, recurred at the time of the visual disturbances. Patient stated he smoked 3-4 cigarettes/day, did not drink and had had no venereal disease.

The ophthalmologic and neurologic clinics of the university gave the following information: Treatment in 1948 for edema of the papilla (right) and a moderate partial post-neuritic papillary atrophy (left). At that time, the physician considered the possibility of Pb intoxication but no other signs of Pb intoxication (such as toxic forms of erythrocytes) were found. There were no signs of cerebral processes; encephalogram and spinal fluid were normal. The cause of the optic disturbance was assumed to be a nerve inflammation. No basis for a Pb neuritis was found.

The ophthalmologist consulted in the case in 1956 (?) found bilateral atrophy of the optic nerve as a result of inflammation of the nerves in both eyes in May 1948. The atrophy had caused a significant limitation of the visual field and a moderate reduction in the visual acuity of the right eye.

The etiology of the illness was not clarified. Pb intoxication was ruled out as unlikely on the basis of lack of circumstantial evidence.

1959

1978 Antonov, Y.G.: (TRACE ELEMENTS IN THE THYROID GLAND OF MAN.) Nauk. Zap. Stanislavs'k Med. Inst. 1959, No. 3:175-9.  
 The presence of Pb in the normal human thyroid gland was shown by spectral analysis. The trace element concentrations are generally reduced in diseased thyroids. (From Chemical Abstracts 58:14515, 1963)

1979 Belknap, E.L., and Belknap, E.L., Jr. (Marquette Univ. School Med., Milwaukee, Wis.): CLINICAL CONTROL OF HEALTH IN THE STORAGE BATTERY INDUSTRY. Industrial Medicine and Surgery 28:94-9; discussion, 100-1 (Mar.), 1959.

Progress made over the years in protecting workers in the storage battery industry was described. Pb concentrations in air which during 1944-56 ranged from 1.22-23.56 mg/10 m<sup>3</sup>, in 1958 were reduced to 0.22-3.3 mg/10 m<sup>3</sup>. In 1958 a study was made on 15 men who had worked for 3-32 yr. Clinical and qualitative tests included presence of Pb line, stippled cells (SC), hemoglobin (Hb), hematocrit and urinary porphyrins, quantitative tests of Pb level

in urine and blood. In analyzing the results of the qualitative and quantitative tests the following conclusions were drawn: Qualitative tests proved effective in 14 out of 15 cases in estimating levels of Pb absorption and never failed in warning of heavy Pb absorption in time for protecting the men. Quantitative examination of the urine for Pb is a useful supplementary aid in evaluating Pb absorption and blood tests are of great value for medical-legal and research problems. Qualitative and quantitative blood or urine tests for Pb are not of themselves diagnostic of Pb intoxication but are merely signs of Pb absorption to be judged in the whole clinical picture. Qualitative studies of blood for Hb and SC carried out serially every few days and occasional urine porphyrin tests are advisable for the protection of workers in the storage battery industry. (15 references)

1980 Bencini, A. (Univ. Florence, Italy): La piruvicemia in soggetti esposti al rischio di idrargirismo e saturnismo cronico professionale. (PYRUVEMIA IN SUBJECTS EXPOSED TO THE RISK OF CHRONIC OCCUPATIONAL MERCURY AND LEAD POISONING.) Bollettino della Società Italiana di Biologia Sperimentale 35:1350-2, 1959.

A study was made on 32 subjects of whom 15 were exposed to Pb and 17 to Hg. The blood level of Pb and Hg, urinary Pb and coproporphyrins were determined. Pyruvic acid, as determined by Friedman-Haugen's method, was increased particularly in the Pb subjects and did not seem to correspond to the Pb level in the biological fluids and the duration of exposure. The values were in Pb poisoning, 2.30 mg%, in Hg poisoning 1.80, in controls, 1.20. The hyperpyruvemia seemed to be accompanied in 10 of 12 Pb cases by a typical neurologic syndrome. The hyperpyruvemia was found to be related to the action of Pb and Hg on the sulfhydryl groups of pyruvic oxidases with subsequent inactivation of the enzyme.

1981 Beritic, T. (Yugoslavia): Trovanje olovom i problem endemskih nefropatija. (LEAD POISONING AND THE ROLE OF ENDEMIC NEPHROPATHY.) Lijecnicki vjesnik 81:523-5 (July-Aug.), 1959.

The relationship between endemic nephropathy and Pb as the cause of it is reviewed on the basis of 23 references.

1982 Bersworth, F.C., and Rubin, M.: PROPHYLACTIC CALCIUM CHELATE COMPOSITIONS FOR HEAVY METAL POISONING. U.S. Patent 2,875,129 (Feb. 24), 1959, to Dow Chemical Co.

The use of certain Ca chelate such as EDTA compositions, blended with food products, for prophylactic treatment of metal poisonings, such as Pb poisoning, was reported. These prophylactic food products, for consumption or injection, contain 1-3% by weight of a neutral or alkali metal salt of the Ca chelate. (From Chemical Abstracts 53:10672, 1959)

1983 Botha, S.E., Brossa, S.Q., and Martínez, E.F.: (PREVENTION AND TREATMENT OF LEAD-

POISONING WITH THE USE OF COMPLEXES.)  
Med. y seguridad trabajo 6:43-51 (Jan.-  
Mar.), 1959.

The use of EDTA is discussed. (From A.M.A. Archives of Industrial Health 21:75 (Jan.), 1960)

- 1984** Brieger, H., and Rieders, F. (Jefferson Med. Coll. Philadelphia, Pa.): CHRONIC LEAD AND MERCURY POISONINGS: CONTEMPORARY VIEWS ON ANCIENT OCCUPATIONAL DISEASES. Journal of Chronic Diseases 9:177-84 (Feb.), 1959.

The paper outlines how recently published results of clinical observations and research have improved and enlarged theoretical insight and practical experience. Chronic Pb poisoning in children is greater today than in adults and occupational poisoning is still frequent in spite of the fact that exposure to Pb has been greatly reduced in the known "hazardous" industries. A history of hazardous exposure to Pb supports a diagnosis of Pb poisoning and in order to diagnose, symptoms and signs of Pb poisoning have to be in evidence. New information now available to help in diagnoses includes: present threshold limit value of Pb dust and fumes in air (8 hr daily exposure) is 0.02 mg/m<sup>3</sup>; Pb concentration in whole blood (American population) ranges from 0.01-0.05 mg/100 mg (mean 0.03) with 95% of the Pb being in the erythrocytes; Pb concentration in urine is 0.01-0.08 mg/1000 ml (mean 0.03+ mg); EDTA can be used to successfully determine latent excess deposition of Pb (>1.0 mg Pb/24 hr indicates increased Pb deposits although 0.5 mg/24 hr has been mentioned as a critical value); Pb in the spinal fluid may be increased in Pb poisoning, as high as 0.35-0.493 mg/100 ml being reported; coproporphyrinuria is a marked effect of excess Pb absorption and coproporphyrin III should not exceed 0.08 mg/24 hr; steady increase of stippled cells in persons exposed to Pb indicates absorption; reticulocytosis and hemolysis are also indications.

Of the organic Pb compounds, TEL is the most important one and it has been questioned recently whether poisoning by TEL is true chronic poisoning or, rather, subacute poisoning. At present the use of EDTA for the treatment of Pb poisoning is highly successful in preventing the continuation of injury by the metal. However, damage already done must continue to be treated by conservative methods. Other chelating agents such as penicillamine are under investigation as orally effective prophylactic and therapeutic agents in metal poisoning. (39 references)

- 1985** Brugsch, H.G. (Massachusetts Dept. Labor, Ind., Boston): FATAL NEPHROPATHY DURING EDATHAMIL THERAPY IN LEAD POISONING. AMA Archives of Industrial Health 20:285-92 (Oct.), 1959.

A review of the title subject, based on 41 references is summarized as follows: EDTA is still a good drug to be used when needed, but as in so many recently introduced drugs, the time may not be too distant when it will be substituted by a safer chelating agent. EDTA should be given only with proper evaluation of the patient's renal status before, during, and after therapy. This should include a renal function test (PSP and

concentration-dilution), NPN or BUN, and at least 2 urinary sediments at the beginning of therapy and repeated whenever necessary. Courses of therapy by slow iv infusion should be short (probably not >3 days), widely spaced (>2 wk apart), and with a daily total dose of not >2 g in adults.

- 1986** Burstin, M.: Coliques de plomb et appendicite. (LEAD COLIC AND APPENDICITIS.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 20:189-91 (Mar.-Apr.), 1959.

The author presents a case of Pb colic incurred by a worker in a storage battery plant, which had been diagnosed as appendicitis with subsequent operation. He points to the difficulty of differential diagnosis and reviews earlier reported cases. A differential diagnosis should be based on the following: job of the patient; Burton's Pb line; a basophil count of >10%; persistent porphyrinuria of >100 µg/24 hr; urinary Pb of >0.07 mg/l; absence of fever; dull periumbilical or epigastric pains which radiate into the lumbar region, the rectum and genital organs; absence of true muscular contractions; rectal palpation does not induce additional pain in the cecal region; the pulse is hard and corresponds to a rise in hypertension.

- 1987** Byers, D.H. (US Dept. Health, Educ., Welfare, Cincinnati, O.): AN EVALUATION OF BLOOD LEAD ANALYSES. Industrial Medicine and Surgery 28:117-20; discussion, 120-1 (Mar.), 1959.

The determination of Pb in blood is one of the most valuable tests for Pb poisoning. Figures established abroad for normal limits of Pb in blood generally agree with those in the USA. Significant deviations are found in Japan (upper normal limit of 0.03 mg/100 g) and Italy (0.09-0.10 mg/100 g). Pb concentrations in blood >0.06-0.08 mg/100 g indicate a greater than normal absorption of Pb. In view of the importance of accurate blood Pb analyses and the difficulties and exacting requirements of reliable microanalysis for Pb in blood a project for the evaluation of Pb analyses from a group of cooperating laboratories was started by the US Public Health Service. Final results have not yet been obtained at the present time. (30 references)

- 1988** Camerada, P., Congiu, M., Leo, P., and Piredda, P. (Univ. Cagliari, Italy): Sul comportamento del livello serico delle mucoproteine e dell'acido sialico in lavoratori del piombo. (THE SERUM LEVEL OF MUCOPROTEIN AND SIALIC ACID IN LEAD WORKERS.) Bollettino della Societa' Italiana di Biologia Sperimentale 35:1502-4 (Nov. 30), 1959.

Tests were made in 20 subjects who had been working in the Pb industry for >15 yr. Analyses of urinary Pb and coproporphyrin and punctated basophilic cells indicated a modest degree of Pb intoxication. For mucoprotein in blood a medium value of  $132.2 \pm 24.3$  mg% was found in 30 controls, while the optical density of sialic acid was  $0.163 \pm 0.028$  which was 24% below the value for normals.

- 1989** Camerada, P., Congiu, M., Leo, P., and Piredda, P. (Univ. Cagliari, Italy): Il comportamento della fibrinolisi euglobulinica in lavoratori del piombo. (EUGLOBULIN FIBRINOLYSIS IN LEAD WORKERS.) Bollettino della Societa' Italiana di Biologia Sperimentale 35:1504-5 (Nov. 30), 1959.

The fibrinolytic activity was studied in the blood of 27 Pb foundry workers, none of whom showed serious clinical signs of Pb intoxication. However, routine tests of urinary Pb and coproporphyrin and punctated basophils indicated a certain degree of saturnism. Euglobulin fibrinolysis ranged from 150-328 min with a medium value at  $216.5 \pm 41.6$  min which is practically the same as in normal subjects. The extremely high values had been found in 2 men exposed to Pb for >20 yr (303 min) and in a subject with signs of hypertensive arteriosclerosis (328 min).

- 1990** Camerada, P., Congiu, M., Leo, P., and Piredda, P. (Univ. Cagliari, Italy): Sul comportamento del potere fibrinolitico, della colesterolemia e delle  $\beta_2$ -lipoproteine in soggetti intossicati da piombo. (FIBRINOLYTIC ACTIVITY, CHOLESTEREMIA, AND  $\beta_2$ -LIPOPROTEINS IN SUBJECTS WITH LEAD POISONING.) Rassegna Medica Sarda 61:1197-1206 (Nov.-Dec.), 1959.

The investigation was carried out on 67 male workers of a Pb foundry (20-59 yr old, av 43.23; duration of exposure 4-27 yr, av 14.2.) None exhibited clinical signs of poisoning, but in all a certain degree of intoxication was evident in laboratory tests. The results of the tests performed showed decreased plasma fibrinolytic activity was found in persons exposed to Pb intoxication. Normal cholesterol and high  $\beta_2$ -lipoproteins levels were observed in sera of almost all these subjects. These findings are discussed in relation to the development of atherosclerosis in Pb poisoning. (48 references)

- 1991** Camerada, P., Congiu, M., Leo, P., and Piredda, P. (Univ. Cagliari, Italy): Sulle modificazioni del seromucoide e dell'acido sialico nel siero di soggetti esposti all'intossicazione da piombo. Possibile ruolo dell'acido sialico nella patogenesi del saturnismo. (MODIFICATIONS OF THE SERUM MUCOID AND OF SIALIC ACID IN THE SERUM OF SUBJECTS EXPOSED TO LEAD POISONING.) Rassegna Medica Sarda 61:1259-67 (Nov.-Dec.), 1959.

Studies on 51 Pb workers, 25-59 yr old, employed for 6-27 yr, showed increased seromucoide and significantly decreased sialic acid levels in blood. It is suggested that sialic acid probably acts as a chelating agent for Pb in blood as well as in tissues. (24 references)

- 1992** Casula, D., Cherchi, P., Piredda, S., and Spinazzola, A. (Univ. Cagliari, Italy): Ricerche sul comportamento del quadro sieroenzimatico nell'intossicazione saturnina. Nota I - La colinoesterasi, la procainoesterasi e la aspirinoesterasi. Nota II - Attivita' transaminasiche, atti-

vita' aldolasica e attivita' malico e lattico-deidrogenasiche. (RESEARCH ON THE BEHAVIOR OF THE SERUM ENZYME PICTURE IN LEAD POISONING. I. CHOLINESTERASE, PROCAINESTERASE AND ASPIRINOESTERASE. II. TRANSAMINASE ACTIVITY, ALDOLASE ACTIVITY AND MALIC AND LACTIC DEHYDROGENASE ACTIVITY.) Rassegna Medica Sarda 61:839-46; 847-53 (Nov.-Dec.), 1959.

I. A group of 47 Pb foundry workers, a number of whom were hospitalized in the authors' clinic for evaluation as to Pb poisoning, were examined for the cholinesterase (ChE), procainesterase (PrE), and aspirinesterase (AsE) activities in serum; the remainder were so examined during periodic visits to the plant. The method of Stedman and Easson (modified) was used for ChE; Paget and Huc's (modified by Camerada and Leo) for PrE, and Vincent and Parrant's for AsE. ChE activity was normal in 1/2 of the cases; reduced values were found in 17, and in 4 they were considered pathologic. PrE values were pathologic in only 2 cases, subnormal in 10; all others were normal. AsE determination showed no pathologic values in any of the cases; in 9 they were subnormal. The authors conclude that the variations of the 3 enzymes could probably be related to a diminished production of these enzymes by the liver. (24 references)

II. The same number of workers were followed for the evaluation of glutamic oxalacetic and glutamic pyruvic transaminases, the aldolases and the malic and lactic dehydrogenases activities. It was found that the activity of none of the enzymes examined were affected in chronic Pb poisoning. (16 references)

- 1993** Cumings, J.N.: HEAVY METALS AND THE BRAIN. Springfield, Ill., Charles C. Thomas, 1959, 161 pp.

The heavy metals reviewed are Cu, Hg, and Pb, with a brief historical summary for each metal. Cu is discussed in detail from the standpoint of hepatolenticular degeneration. The presentation of Hg poisoning covers inorganic Hg (chronic intoxication only), organic mercurial compounds, and acrodynia. Pb is dealt with only in relationship to the findings of Pb encephalopathy as seen in children and in adults. Points covered are: etiology, clinical features in relationship to inorganic and TEL intoxication, radiology, electroencephalogram patterns, clinical pathology, histopathology, chemistry, and treatment. The 3 main sources of Pb poisoning reviewed in reference to the above categories are: (1) industrial processes involving inorganic Pb compounds, (2) those involving organic Pb compounds, (3) nonindustrial. (546 references for Cu, 60 for Hg, 274 for Pb)

- 1994** David, A.: (SIDEROBLASTS AND SIDEROCYTES IN LEAD POISONING.) Pracovní Lékařství 11:290-3 (Aug.), 1959.

In chronic Pb poisoning the non-hemoglobin Fe in the bone marrow is elevated, which manifests itself by an increased number of sideroblasts (average 60%, maximum 97% in 22 patients) their granules being mostly coarse and multiple and usually (contrary to other types of anemia) in the close vicinity of the nucleus. The impaired Fe metab-

olism is not confined to normoblasts but affects also reticuloendothelial cells, as can be proved by the accumulation of Fe in these elements. These changes provide evidence of the dyshemopoietic character of the anemia produced by Pb. The author discusses the possibility that the Fe utilization is not only impaired in the normoblasts but also in the reticuloendothelial cells. The marrow contains a higher number of siderocytes while in the peripheral blood no significant increase as compared with normal values was detected. Therefore counting of siderocytes cannot be recommended for the diagnosis of Pb poisoning. (English summary)

**1995** David, A.: (BONE MARROW IN CHRONIC LEAD POISONING.) *Pracovní Lékařství* 11:285-9 (Aug.), 1959.

See article published in *Archiv für Gewerbepathologie und Gewerbehygiene* 17, No. 3:329-38, 1959.

**1996** David, A. (Occup. Dis. Clinic, Prague, Czechoslovakia): Das Knochenmark bei gewerblicher Bleivergiftung. (THE BONE MARROW IN OCCUPATIONAL LEAD POISONING.) *Archiv für Gewerbepathologie und Gewerbehygiene* 17, No. 3:329-38, 1959.

Bone marrow was studied in 35 patients (34 men, 1 woman), aged 17-60 yr, who had been exposed to Pb for 2 mo-31 yr and exhibited signs of chronic Pb poisoning. The myelograms showed the following quantitative and morphological changes which are illustrated in 12 figures: (1) hyperplasia of the bone marrow, increase of erythroblasts, often accompanied by a shift to the left though without increased mitotic activity; (2) basophil stippling of the erythroblasts, atypical nuclei (polyploidy, karyorrhexis) of the erythroblasts, failure of hemoglobin formation. The granulocytopenia was unchanged. In the erythroblasts (sideroblasts) and in the reticuloendothelial cells the cytochemically detectable Fe increased, indicating a disturbance of the Fe metabolism in these cells. The findings supported the theory of a dyshematopoietic and simultaneously hemolytic Pb anemia and indicated an inhibition of the maturation of the erythroblasts and a disturbance in the process of plasma and nuclear division and hemoglobin formation. The increased activity of the phagocytes pointed to a hemolytic component. After therapy with EDTA the myelogram became normal within a short time. However, 3 out of 7 patients tested showed a marrow poor in cells following therapy. Care in the regulation of the dosage of EDTA is recommended to avoid disturbance of the mineral metabolism which is indispensable for erythropoiesis. (Modified author's summary) (37 references)

**1997** De Fallois, G. (Nantes, France): Manifestations digestives atypiques de l'intoxication saturnine non professionnelle. Résultats du traitement par les chélateurs. (ATYPICAL DIGESTIVE MANIFESTATIONS OF NON-OCCUPATIONAL LEAD POISONING.) *Archives des Maladies de L'Appareil Digestif et des Maladies de la Nutrition* 48:1126-32 (Oct.), 1959.

Two cases of Pb intoxication caused by Pb pollu-

tion of the drinking water in a village are reported. A 29-yr-old woman suffered from severe colic-type pain with vomiting and subicteric conjunctiva. Laboratory findings showed red cells, 2,510,000; white cells, 10,600; basophilic stippling, 3.20%. A diagnosis of Pb colic with hemolytic anemia was made. A 44-yr-old man with a medical history of Steinert's disease, with bilateral paralysis of the extensors of the fingers, complained of abdominal pain and vomiting. Clinical examination revealed a slight Burton's line and Gubler stains, 3.23% basophilic stippling, coproporphyrinuria and albuminuria. Examination of his wife who also complained of pain showed a very distinct Burton's line and Gubler stains, 3.26% of basophilic stippling and traces of coproporphyrin in urine. Amounts of Pb in the blood of both husband and wife were 172 and 146 µg/100 ml, respectively. Analysis of the water showed 0.40 mg Pb in the well-water and 15 mg/l in the tap water after the water had been standing for 12 hr. The Pb content of the water was attributed to contamination from the soil. Therapy consisted of CaNa<sub>2</sub>EDTA perfusions of 20 ml daily in 500 ml serum glucose for 8 days, supplemented by 6 tablets/os for 24 hr. In all cases the cure of the acute state of Pb intoxication was achieved.

**1998** De Nicola, P., Giordano, M., and Moncalvo, F. (Univ. Pavia, Italy): L'applicazione della biopsia intestinale alle malattie professionali. II. La biopsia intestinale nel saturnismo. III. La biopsia intestinale nel benzolismo. IV. La biopsia intestinale nelle complicazioni tubercolari della silicosi. (INTESTINAL BIOPSY IN OCCUPATIONAL DISEASES. II. INTESTINAL BIOPSY IN LEAD POISONING. III. INTESTINAL BIOPSY IN BENZENE POISONING. IV. INTESTINAL BIOPSY IN THE TUBERCULOUS COMPLICATIONS OF SILICOSIS.) *Omnia Ther.* 11, No. 1:1-21, 1959.

Intestinal biopsy in cases of chronic Pb poisoning revealed hyporegenerative atrophic duodenitis with degeneration of the mucous cells, parvicellular infiltration, atrophy of the glands, hyperemia, and diffuse hemorrhages. (From *Excerpta Medica*, Sect. 17, 7:Abstr. No. 849, 1961)

**1999** Dinischiotu, G.T., Rădulescu, I.C., and Muică, N. (Univ. Clinic Occup. Dis., Bucharest, Romania): Hämodynamische Studien in der industriellen Bleikrankheit. (HEMODYNAMIC STUDIES IN OCCUPATIONAL LEAD POISONING.) *Archiv für Gewerbepathologie und Gewerbehygiene* 17, No. 2:148-67, 1959.

Twenty cases (27-47 yr old) with chronic Pb poisoning were subjected to the tests prescribed by the Wezler-Büger method; 12 of the cases, with colic, were tested during and soon after the attack; 7 were tested after a long interval after recovery from colic. In addition to the tests prescribed by the above method (heart rate, systolic, diastolic, median blood pressure, minute volume, etc.) the Hines and Brown cold pressor test was carried out in some instances; altogether 200 circulatory determinations were made.

The results, as summarized by the authors, showed that in the course of chronic Pb poisoning,



without acute exacerbation, the values for heart output, peripheral total resistance, 2nd phase of ventricular systole, minute volume, pulse wave rate, elastic resistance of air chamber, peripheral total resistance, and heart function, were within normal limits. The median blood pressure showed somewhat low values. In the course of Pb colic, there was a pronounced increase in peripheral resistance, causing a condition similar to that produced by noradrenalin. In the period following Pb colic, over a rather long period manifestations of poor regulation occurred with a tendency to hypotonia and dysmetric reactions during the cold pressor test. These disturbances were attributable to the action of Pb on the vegetative nervous system. (37 references)

- 2000** Dinischiotu, G.T., Rădulescu, I.C., Preda, N., and Georgescu, A.M. (Occup. Dis. Clinic, Univ. Bucharest; Inst. Hyg. Health, Romania): Die klinischen Kategorien des industriellen Saturnismus. (CLINICAL CATEGORIES OF INDUSTRIAL LEAD POISONING.) Archiv für Gewerbepathologie und Gewerbehygiene 17, No. 2:127-47, 1959.

The etiologic factors of Pb poisoning (1), the individual variations in reaction to Pb (2), and the mechanism of Pb poisoning and its relation to the "time" factor (3) are reviewed. In part 1 the authors point out that although in the Pb industry, various other contaminants exist, which may be contributing factors, Pb plays the principal role in producing the Pb syndrome. In part 2, the principal signs resulting from Pb exposure are discussed, with tabulation of the number of basophils, the degree of coproporphyrinuria and the occurrence of the 1st colic, in relation to the period of exposure of Pb-affected workers examined by the author. In part 3 the different phases of Pb poisoning are discussed. With regard to diagnosis the following distinctions are made: Pb-poisoned individuals, those suspected of having Pb-poisoning, those with increased Pb absorption, and the unaffected. A scheme is proposed which illustrates the development of saturnism as the author sees it in a number of categories from "physiological absorption" to "detoxification." The theoretical and practical applications of these categories in the medical control of Pb poisoning are discussed. (32 references)

- 2001** Dorfman, J. and Davis, M. (Rocky Hill, Conn.) PLUMBISM FOLLOWING THE USE OF A BLOW-TORCH ON PAINT. Connecticut Medicine 23:460-2 (July), 1959.

A 52-yr-old white male, who, as a house painter, had recently worked with a blow-torch to remove old paint from a nearly 100-yr-old house, was admitted to the State Veterans Hospital, Rocky Hill, Conn., on March 26, 1957. The patient complained of weakness in the legs, poor appetite, a low back pain, and mild diarrhea. His medical history included appendectomy at age 27, peptic ulcer about 20 yr ago, and hospitalization for coronary occlusion with myocardial infarction in 1954. There was a history of chronic bronchitis. Abnormal physical findings at the present hospitalization were edentulous mouth, tenderness in the lower quadrants of the abdomen, atrophy of the right testis, small ex-

ternal hemorrhoids and slight enlargement of the left lateral lobe of the prostate. There was no evidence of disease involving the nervous system.

The laboratory reported an unusual number of stippled red cells in the blood smear. White blood cell count and differential were not remarkable. Hb was 11.5 g. Samples of blood and urine taken on April 2 disclosed 0.30 mg of Pb/1 urine (normal 0.01-0.08 mg/1) and 0.14 mg Pb/100 g blood (normal 0.01-0.05 mg Pb/100 g). Bone marrow showed hyperplasia, predominantly of the myeloid elements, with stippled red cells. A reticulocyte count on April 9 was 3.2%, a platelet count on April 15 was 167,000/mm<sup>3</sup>. X-ray findings included widening of the mucosal folds throughout the stomach. Gastroscopy was recommended but refused by the patient.

Treatment was with Probanthine, Demerol, multivitamins and a nutritional formula to relieve malnutrition. Small doses of saturated solution of K iodide were given, starting April 5, for 2 wk. The patient's symptoms gradually subsided, with the backache being the last one to disappear. The anemia responded to hematinic. When last seen, the findings were 0.07 mg Pb/100 g of blood and 0.19 mg Pb/1 urine which contained 4+ porphyrins. He was deemed to have had recovered sufficiently to be discharged on May 2. The poisoning was probably caused by the inhalation of Pb fumes resulting from the application of the blow torch to painted wood without a face mask or any other precautions. Upon discharge the patient was advised to observe the rules of safety when working with paint and to continue taking the hematinic, unless otherwise instructed by his physician.

- 2002** Durić, D., Šarić, M., and Malek, D. (Inst. Med. Res., Zagreb, Yugoslavia): Vrijednosti olova u nekim organima kod osoba, koje za života nisu bile specifično izložene olovu. (LEAD VALUES IN SOME ORGANS OF PEOPLE SPECIFICALLY NON-EXPOSED TO LEAD DURING THEIR LIFETIME.) Arhiv za Higijenu Rada i Toksikologiju 10, No. 3: 217-20, 1959.

Pb values were determined in spleen, liver and kidney of 15 persons (15-82 yr old) who had died a natural or violent death. None of these subjects had been specifically exposed to Pb during their lifetime. The Pb analyses were carried out by a dithizone method modified by Weber, Vouk and Voloder. As tabulated, the Pb contents ranged in mg/100 g fresh tissue as follows: spleen, 46-613; liver, 12-510; kidney, 46-405 and compared with literature data on normal Pb values.

- 2003** Fallani, M. (Univ. Florence, S. Maria Nuova Hosp., Florence, Italy): Considerazioni sopra alcuni casi di intossicazione saturnina nei demolitori di accumulatori. (NOTES ON SEVERAL CASES OF LEAD POISONING IN DEMOLISHERS OF STORAGE BATTERIES.) Rivista degli Infortuni e delle Malattie Professionali 46:371-6 (Mar.-Apr.), 1959.
- Subacute Pb poisoning was described in 6 demolishers of electric accumulators and in a doubtful 7th case with only 10 days' exposure. Signs of Pb poisoning, such as nausea and abdominal colics, occurred in the 6 men, aged 24-43 yr, after ~20 days' work. Their Pb content in blood and urine



ranged from 20-190  $\mu\text{g}$  and 75-260  $\mu\text{g/l}$ , respectively; urinary coproporphyrin values were 18-170  $\mu\text{g}$ ; basophilic stippled cells were present in all of the 6 patients.

- 2004** Fleischhacker, M., and Skurić, Z. (Hyg. Inst. GNO, Zagreb, Yugoslavia): Profesion-  
alno otrovanje olovnm stearatom. (OC-  
CUPATIONAL POISONING BY LEAD STEARATE.)  
Arhiv za Higijenu Rada i Toksikologiju 10,  
No. 2:187-8, 1959.

Pb stearate is used as a stabilizer for polyvinyl chloride. A 37-yr-old worker after 3-mo work with Pb stearate, developed severe headache, vomiting, constipation and abdominal pain. He was admitted to the hospital and a diagnosis of Pb poisoning and duodenal ulcer was made. Clinical tests showed 45,000 stippled cells/1,000,000 RBC, 77/1000 reticulocytes, and 723  $\mu\text{g}$  porphyrin/24 hr. Recovery was very slow.

- 2005** Frank, R.W. (Ferro Corp., Cleveland, O.):  
HEALTH CONTROL IN THE CERAMIC INDUSTRY.  
Industrial Medicine and Surgery 28:102-4;  
discussion 104-5 (Mar.), 1959.

In the ceramic industry fritted glasses, porcelain enamel for metal and glaze for clay bodies may contain 2-70% Pb. In the beginning all employees exposed to Pb were screened for stippled cells. However, the urinary porphyrin test was found to provide a 13% greater accuracy. A porphyrin test is now made in each pre-employment physical examination. Under normal circumstances, an employee will produce a negative porphyrin test at the pre-employment examination; from 2-6 wk following start of work urinary porphyrins will be elevated to the +1 or +2 level and the elevation will disappear within the next 2-6 wk. Three hundred employees are checked/month. Trace and +1 positives indicate individual or group trends; +2's are referred to the physician and supervisor.

The author proposes that the allowable concentration of 20  $\mu\text{g}$  Pb/ $\text{m}^3$  of air should be revised to provide an allowable concentration for each Pb compound. In his experience a Pb content in air up to 60  $\text{mg}/\text{m}^3$  was not accompanied by signs of Pb absorption. Temperature and valence may influence the toxicity.

- 2006** Fratianne, R.B., Griggs, R.C., and Harris, J.W. (Cuyahoga Co. Hosp.; Western Reserve Univ. School Med., Cleveland, O.):  
AUTOSURVIVAL OF ERYTHROCYTES TREATED IN VITRO WITH LEAD CHLORIDE. Clinical Research 7:384, 1959.

Erythrocyte abnormalities in patients with chronic Pb intoxication are: a significantly shortened autosurvival time; a normal or slightly decreased osmotic fragility (OF) that after 24 hr sterile incubation, becomes abnormally resistant to osmotic stress even though the mechanical fragility (MF) becomes abnormally increased (Aub's "brittle, contracted cell"). Identical OF and MF alterations are induced when normal cells suspended in saline or serum are incubated with  $\text{PbCl}_2$ . Sterile defibrinated blood samples were obtained from 4 hematologically normal males, appropriate amounts of  $\text{Pb}^{++}$  and  $^{51}\text{Cr}$  were added and the mixture incubated for 1 hr at  $37^\circ\text{C}$ . Tests showed that the de-

sired osmotic and mechanical fragility abnormalities had been reproduced. The cells were then re-infused into the donors and survival times determined: the erythrocyte half-lives were observed to be 18, 22, 26 and 32 days, compared to a normal minimum of 30 days. By special tests it was demonstrated that the alterations in osmotic fragility did not persist after reinfusion. In view of the largely irreversible  $\text{K}^+$  efflux lesion induced by Pb it is of interest to note that the in vitro treatment of erythrocytes with Pb induced an irreversible lesion associated with a shortened survival time on the basis of an acquired intrinsic cell defect. (From authors' abstract)

- 2007** Galambos, J.T., and Dowda, F.W. (Atlanta, Georgia): LEAD POISONING AND PORPHYRIA.  
American Journal of Medicine 27:803-6  
(Nov.), 1959.

A review of the literature revealed only a single documented case of acute intermittent porphyria (AIP) associated with Pb poisoning. Another case of Pb poisoning in a 44-yr-old man, followed by AIP is described. This man had been working as a grinder, removing Pb solder from automobile bodies, for 9-10 wk. Although he used precautionary measures, he often got flakes of Pb into his mouth and nose. His Pb level was 0.98  $\text{mg}\%$  in the blood and 0.53  $\text{mg/l}$  in the urine. Family history was noncontributory. Urinalysis showed white cells; Hb, 13 g/100 mg red cells, 4.5 million and large number of stippled cells. Large numbers of uroporphyrins (UP) in urine, coproporphyrins 2572.5  $\mu\text{g}/24$  hr. After EDTA treatment and 2 mo after discharge CP was 1086.8 and UP 657.2  $\mu\text{g}/24$  hr; erythrocyte protoporphyrin 41  $\mu\text{g}$  and CP 1.0  $\mu\text{g}/100$  ml.

The relationship between Pb poisoning and porphyria is discussed. The fact that only a single documented case and one questionable one of AIP associated with Pb poisoning have yet been reported, makes it rather unlikely that Pb can cause AIP in a person with otherwise normal porphyrin metabolism. (28 references)

- 2008** Galambos, J.T., and Peacock, L.B. (Emory Univ., Atlanta, Ga.): THE USE OF CHELATING AGENTS IN THE TREATMENT OF ACUTE PORPHYRIA. Annals of Internal Medicine 50: 1056-61 (April), 1959.

A 50-yr-old worker in a casket manufacturing company had been exposed to Zn and Pb dust for 17 yr. He had been well until Dec. 1956, when he began to have abdominal cramps and marked constipation, followed by progressive weakness in the upper extremities. His urine Pb was 1.412  $\text{mg/l}$  and blood Pb, 8  $\mu\text{g}/100$  g.  $\text{CaNa}_2\text{EDTA}$  was begun (1 g twice daily iv); his muscle weakness became more marked. The patient noted that his urine became reddish in color. Routine blood and urine examination upon transfer to another hospital showed no abnormality, no stippled cells on repeated examinations, white cell count was 17,700/ $\text{mm}^3$ , Hb, 12 g%. Before the 2nd course of EDTA, urinary Pb was 430  $\mu\text{g}/24$  hr, coproporphyrin was 3120 and uroporphyrins, 8250  $\mu\text{g}/24$  hr, porphobilinogen was positive. After 2 additional courses of EDTA the condition worsened rapidly, he developed bronchopneumonia and complete muscular and respiratory

paralysis and died 41 mo after 1st admission. The most significant autopsy finding was marked degeneration of the myelin, with clumping and forming of fat globules within the myelin sheaths. In conclusion, the authors caution against indiscriminate use of chelating agents in the therapy of acute intermittent porphyria. In this case, each course of treatment was followed by worsening, necessitating discontinuation of therapy. They suggest that the clinical usefulness and the mechanism of action of chelates in the treatment of porphyria require further evaluation. (13 references)

- 2009** Gastoł, B. (Provincial Consultant Ind. Hyg., Cracow, Poland): Spostrzeżenia dotyczące przewlekłego zatrucia benzyną etylizowaną wśród zatrudnionych na stacjach benzynowych. (CHRONIC INTOXICATION IN GASOLINE PUMP ATTENDANTS DUE TO GASOLINE TETRAETHYLLEAD.) *Medycyna Pracy* 10:39-42 (Jan.-Feb.), 1959.

In a group of 232 petrol pump attendants, 30% showed signs of chronic TEL poisoning, with insomnia, headaches, vertigo and anxiety. The author suggests periodical health examinations every 6 mo. (From author's summary)

- 2010** Gentile, G. (Univ. Messina, Italy): Può il metil-2-n-propil-2-propandiolo-1,3-dicarbammato (meprobamato, miltaun, perequil) essere utilmente usato nell'avvelenamento cronico da piombo? (THE POSSIBLE USE OF METHYL-2-N-PROPYL-2-PROPANDIOLO-1,3-DICARBAMATE (MEPROBAMATE, MILTOWN, PEREQUIL) IN CHRONIC LEAD POISONING.) *Folia Medica (Naples)* 42:819-24 (July), 1959.

Following a review of the literature and his experiments with rabbits, the author concludes that meprobamate is not effective as a preventive of chronic Pb poisoning; however, he believes the drug to be useful as an adjuvant in the treatment of poisoning by Pb compounds.

- 2011** Georgia Medical College, Department of Medicine: CHRONIC LEAD POISONING. Medical Grand Rounds. *Journal of the Medical Association, Georgia* 48:468-73 (Sept.), 1959.

The case, presented by E.T. Avret, was that of a 36-yr-old Negro male, admitted with the chief complaint of pain of 3 mo duration in the abdomen, back, and legs, beginning with sudden blurring of vision and convulsions. The findings upon hospitalization are described in detail, and include Pb gum line, Hb 9.5 g/100 ml, 10,200 white count, presence of stippled red cells. Spinal fluid gave a positive Pandy test, but showed no cells. Urine Pb was at first 80 µg/24 hr and 6 days later, 408 µg. Urinary porphyrin test was strongly positive. EKG showed left ventricular hypertrophy, EEG was normal; skull X rays demonstrated an old depressed fracture; iv pyelogram showed depression of renal function bilaterally. After treatment with  $\text{CaNa}_2\text{EDTA}$  abdominal pain disappeared; at discharge, the patient was completely asymptomatic and the Pb line had faded considerably. The neurologic aspects and metabolism of Pb of the case are discussed at length. Since

occupational exposure was excluded, the source of Pb was thought by the patient's local physician to be illicit whiskey, for this was implicated in the death of another man in the community recently.

- 2012** Gimbert de Fallois, A.: Manifestations digestives atypiques de l'intoxication saturnine non professionnelle. Résultats du traitement par les chélateurs. (ATYPICAL DIGESTIVE MANIFESTATIONS OF NON-OCCUPATIONAL LEAD POISONING. THE RESULTS OF TREATMENT BY CHELATORS.) *Ouest Med.* 12, No. 8:264-7, 1959.

Poisoning originating in a fountain due to bad plumbing was reported. The patients were treated successfully with  $\text{CaNa}_2\text{EDTA}$ . (*Excerpta Medica*, Sect. 17, 6:Abstr. No. 1002, 1960)

- 2013** Giraud, G., Latour, H., Lévy, A., Puech, P., Olivier, G., and Hertault, J.: Expressions diverses d'une intoxication familiale par le plomb tetra-ethyl. (SEVERAL MANIFESTATIONS OF TETRAETHYLLEAD POISONING IN A FAMILY.) *Montpellier Médical* 55:120-1 (Jan.), 1959.

TEL intoxication due to exhaust gases from an outboard motor and from spilling a fuel can was observed in 3 members of a household. The symptoms varied in these subjects, 1 showed digestive troubles, 1 developed cardiac symptoms and the 3rd person became psychopathic. Treatment with a chelating agent was successful in all 3 cases.

- 2014** Giraud, G., Latour, H., Lévy, A., Puech, P., and Hertault, J. (Soc. Med. Biol. Sci., Montpellier, France): Action du calcitétracémate disodique dans une intoxication saturnine aiguë. (EFFECT OF CALCITETRACEMATE DISODIUM IN ACUTE LEAD POISONING.) *Montpellier Médical* 55:122-4 (Jan.), 1959.

A 44-yr-old worker in an accumulator factory developed symptoms of Pb intoxication after 2 mo on the job. A clinical examination showed 3,300,000 red blood cells, 180 stippled cells/100 leukocytes, a blood and urinary Pb content of 818 and 285 µg/l, respectively, and 2.5 mg/l coproporphyrin. EDTA was administered in 2 daily doses of 0.5 g (in a 250 ml glucose solution, each in 2 series of 5 days each, separated by an interval of 5 days of rest. Its effect on blood and urine is presented in a graph.

The rapid development of poisoning could be explained by the fact that at work the man was in direct contact with the plates and neglected to wear gloves, which in part caused a marked atrophy of the skin of the finger.

- 2015** Granati, A., Lenzi, R., and Angeleri, F.: Considerazioni su due casi di encefalopatia saturnina. (CONSIDERATIONS ABOUT TWO CASES OF LEAD ENCEPHALOPATHY.) *Folia Medica (Naples)* 42:1441-8 (Dec.), 1959.

Neuropsychic alterations and electroencephalographic anomalies indicating pathologic focal activity of irritative character were observed in 2 men >60 yr of age who for a long period had worked as decorators in the ceramics industry. In

spite of absence of case history data, and the fact that laboratory tests characteristic of Pb intoxication were negative, the authors made a diagnosis of chronic Pb encephalopathy. (From *Medicina del Lavoro* 51:493 (Abstracts), 1960)

- 2016** Great Britain Ministry of Labour and National Service: ANNUAL REPORT OF THE CHIEF INSPECTOR OF FACTORIES ON INDUSTRIAL HEALTH. London, Her Majesty's Stationery Office, 1959, 61 pp.

Reported cases of industrial Pb poisoning in 15 different industries employing Pb are tabulated for the years 1910-1958 (table 3, p 12). In Chapter 2, pp 13-8, cases of Pb poisoning reported during 1958 in the smelting of metals, ship-breaking, other contact with molten metal, white and red Pb workers, electric accumulator works, paint and color works and other industries are discussed in some detail. On p 31 a fatal poisoning by TEL is described.

A 26-yr-old male laboratory technician, soon after swallowing an unknown quantity of TEL, complained of "lack of air" and developed diarrhea, followed within 1 hr by a burning sensation in eyes, mouth and throat. When he presented himself at the hospital 1.5 hr later, he was in an excited state, complaining of nausea, slight pains in the joints, coldness of the extremities, diarrhea and headache. Oral administration of Mg sulfate did not change his condition. He began to vomit, 4 hr later he was unconscious and convulsed, and 11 hr after ingestion of TEL he died. Autopsy showed congestion and small hemorrhages in several organs, notably lungs and brain; the presence of Pb in his organs and fluids was demonstrated.

- 2017** Great Britain Ministry of Labour and National Service: INDUSTRIAL HEALTH. A SURVEY OF THE POTTERY INDUSTRY IN STOKE-ON-TRENT. A report by H.M. Factory Inspectorate. London, Her Majesty's Stationery Office, 1959, 78 pp.

Chapter 9(pp 49-52) is on Pb risks in the industry. Due to the replacement, in the making of glazes, of soluble Pb oxides by Pb compounds relatively insoluble in the body fluids, no case of Pb poisoning has been reported from an English pottery since 1952. Pb processes in the pottery industry, causation, diagnosis and protective measures against poisoning were reviewed. Routine medical examinations and special investigations carried out on Pb workers were described. Blood tests of glaze workers handling a low-solubility and a Pb-less glaze, respectively, showed no evidence of Pb absorption or any other difference between either group. A study of 17 color workers (9 men, 8 women) who had been employed in the pottery for an average of 15 yr, showed that none of the men had a level of punctate basophilia >300/million red blood cells while 2 of the women had 750 punctate basophils/million RBC and a hemoglobin value of 70%.

- 2018** Green, W.J. (Southwest Clinic Assoc., Dallas, Texas): AN UNUSUAL ASPECT OF LEAD POISONING. *Texas State Journal of Medicine* 55:829-30 (Oct.), 1959.

A 48-yr-old man was working in a storage battery

company which involved minimal exposure to Pb. He had been treated with EDTA for Pb poisoning 16 times over a period of 9 yr and convalescence was complete. After the 6th occurrence he was transferred permanently to essentially Pb-free work. Two years later he consulted the author with the complaint of swelling in his knees and general tightness in the joints. Intravenous EDTA was given daily for 5 days (1.0 g in 250 ml saline solution twice/day) and he became asymptomatic. Blood and urine specimens demonstrated Pb discharge from his body stores. (Urinary excretion tapered off from 1.4 mg/100 ml after the 1st injection.) Nine mo later he still felt well and had no recurrence of symptoms.

- 2019** Grossdorfer, K. (Graz, Austria): Grenz-fälle der gewerblichen Bleivergiftung. (BORDER CASES OF OCCUPATIONAL LEAD POISONING.) *Zentralblatt für Arbeitsmedizin und Arbeitsschutz* 9:108-14 (May), 1959.

The difficulties of making a definite diagnosis of Pb poisoning in occupational exposure are reviewed and it is pointed out that significant increases of urinary porphyrins and of the Pb concentration in blood and urine present the most indicative findings for the presence of Pb poisoning. Nine cases of past years, most of them fatal, of long-term exposure in Pb smelters were reported in detail. Signs and symptoms and pathological findings were described but in some cases the findings have been interpreted as not indicative of Pb poisoning and death was attributed to chronic peritonitis or chronic nephritis. A 10th case described was that of a worker who by mistake had swallowed an unknown quantity of fuel while filling a barrel from a tank by means of a rubber hose. He developed nausea, dizziness and vomiting within 2 hr and died after 10 hr from circulatory collapse. Necropsy showed hemorrhagic swelling of brain, lungs, blood vessels and gastric and intestinal mucosa; no metals were detected in the organs. Although a diagnosis of gasoline poisoning was made, the author considers an intoxication by TEL as another possibility.

- 2020** Gruenagel, H.H., and Niesel, P. (Univ. Bonn, Germany): Beitrag zur Frage des Krankheitsbildes der chronischen Bleiintoxikation. (SYNDROME OF CHRONIC LEAD INTOXICATION.) *Ärztliche Wochenschrift* 14:433-6 (June 5), 1959.

Symptoms and pathogenesis of chronic Pb poisoning are reviewed and the case of a 34-yr-old glass painter is reported. The man had been working with Pb-containing paints for 3 yr when he developed headache, amnesia, restlessness, dizziness, impaired vision in the right eye and weakness in the left extremities. He showed a Pb line, but no stippled cells nor porphyrinuria. Pb content in blood and urine before and after administration of mosatil was, respectively: 37 and 54 µg%, urine 40 and 9000 µg/1000 cc. Ophthalmological tests showed changes in the fundus. The case is considered as an example for a Pb poisoning associated with a vascular disorder, the etiology of which cannot be attributed definitively to the effects of Pb.

- 2021** Guerdjikoff, C. (Caisse Nat. Suisse d'Assur., Genève, Switzerland): De quelques risques saturnins peu connus du corps médical. (SOME HAZARDS OF LEAD POISONING NOT WELL KNOWN AMONG DOCTORS.) Z. Prav. Med. 4, No. 9:292-6, 1959.

The article emphasizes the difficulties in the diagnosis of occupational Pb poisoning. Some well-known forms of Pb poisoning are mentioned, drawing attention to the necessity for adequate legislation. (From Excerpta Medica, Sect. 17, 6:Abstr. No. 3348, 1960)

- 2022** Hadengue, A. (Univ. Paris, France): Le saturnisme. (LEAD POISONING.) Concours Médical 81:5619-24 (Dec. 19), 1959.

This is a general discussion of Pb poisoning. The author points out the fact that most cases of Pb poisoning are accidental, due to the improved working conditions. He discusses some of the clinical signs of Pb poisoning (digestive troubles, constipation, hypertension, neurologic syndrome, Burton line, high blood pressure) and some biological signs (basophilic stippling/leukocytes, blood and urine Pb contents, urinary coproporphyrin). He also points out possible causes, both occupational and those of alimentary origin, and possible treatments, such as BAL, cortisone, chlorpromazine, CaEDTA, CaNa<sub>2</sub> versenate, di-Na calcitetracemate. The chelates were found to be best.

- 2023** Hadengue, A., and Lamberton, J.N. (France): Saturnisme ou présaturnisme accidentels. (PLUMBISM OR ACCIDENTAL PREPLUMBISM.) Proceedings of the Society of Industrial Medicine and Hygiene, Paris. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 20:87-9 (Jan.-Feb.), 1959.

Three cases of accidental Pb poisoning were discovered by a check of stippled cell counts recorded at the previous routine examination. The accidental massive exposure occurred in a storage battery plant during mixing operations. The importance of semiannual tests for basophilic stippling is stressed and the preventive use of chelating agents in the presence of an increased count without other clinical signs of poisoning is recommended.

- 2024** Higuera Rojas, J., Salvatierra Ríos, D., Sillero, J., and Aguado, F. (Coll. Med., Granada, Spain): Ocho casos de intoxicación saturnina familiar. (EIGHT CASES OF LEAD POISONING IN A FAMILY.) Revista Clínica Española 72:338-40 (March 15), 1959.

The 8 cases of acute Pb poisoning occurred from the ingestion of bread made from flour that had been ground on a millstone repaired by using Pb. Analysis of the urine (sic, (orina) perhaps misprint for flour (harina?)) showed Pb content of 1 g/kg, and visually, Pb particles in the flour. The quantity ingested differed as to the various members of the family as did the intensity of the poisoning. Two cases, both male, 61 (or 66?) and 25 yr old, are described. They are also included in a tabulation of the findings. The others were 59, 30, 24, 21, 19, and 18 yr old (sex not indicated).

Among the findings, the most frequent were colic, black stool, constipation, vague pains, Pb line, pallor, hypertension, dark urine, asthenia, renal pain; liver enlargement was found in 2(++) in the 25-yr-old, and + in the 21-yr-old). Treatment differed according to the severity of symptoms, and included iv administration of Ca gluconate, Na citrate, chlorpromazine for colic, liver extracts and vitamin B<sub>12</sub>, hydrazine phthalazine and cortisone for those who exhibited hypertension, and EDTA infusions in 2 of the cases. The authors found chlorpromazine to be most effective in relieving colic.

- 2025** Horiuchi, K., Horiguchi, S., and Suekane, M.: STUDIES ON THE INDUSTRIAL LEAD POISONING. I. ABSORPTION, TRANSPORTATION, DEPOSITION AND EXCRETION OF LEAD. 6. THE LEAD CONTENTS IN ORGAN-TISSUES OF THE NORMAL JAPANESE. Osaka City Medical Journal 5:41-70 (March), 1959. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School. Vol. 1, April 1949-March 1959, pp. 248-77.

Tissues obtained from autopsy and post-operative specimens of adults who had not been overexposed to Pb, and from aborted or stillborn fetuses, >5 mo old, were analyzed for Pb by a modified dithizone mixed color method. The following adult organs were analyzed, with arithmetic mean µg/100 g shown in parentheses: Cerebrum (18); cerebellum (14); thyroid gland (20); lungs (30); heart (22); liver (190); pancreas (32); stomach (40); spleen (54); kidneys (140); large intestines (70); small intestines (29); muscle (25); skin (27); femur (1194); rib (739); vertebra (528); humerus (976); skull (840); scapula (769); bone marrow (1377); fatty tissue (0); uterus (21); ovary (0); bladder (1); placenta (57); spinal fluid (23); umbilical blood (55); human milk (9); teeth (3396). In tissues from adults highest concentrations (µg/100 g) were found in teeth (av 3396), bone marrow (1377) and bones, particularly the femur, (1194). In fetal tissues a maximum of 156 µg/100 g was found in bone; placental tissue 120, umbilical blood 90. The Pb level in soft tissues was not related to age, while it increased with age in bones: the yearly increase in the femur was ~37 µg/100 g.

Frequency distribution curves for the various organs were studied. Total body Pb of Japanese (54 kg average normal adult) was calculated at 78 mg in adolescence and 131 mg in old age. (Americans, 100-400 g for adults.) Results indicate that Pb passes from the mother through the placenta to the fetus which, in cases of long-term exposure of the mother, could lead to toxic effects in the fetus. However, since the Pb content of bone increases with the development of the fetus at the expense of the Pb content in blood, bone tissue may have a protective function. (43 references)

- 2026** Horiuchi, K., and Sugiyama, H.: OUR STANDPOINT IN EPIDEMIOLOGICAL RESEARCHES. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 1,

April 1949-March 1959, pp. 232-43.  
The authors review the epidemiologic investigations of their Department and the methods used for statistical evaluation. Control in occupational diseases included industrial Pb poisoning for which the contents of Pb in blood, urine and feces had to be determined in the healthy Japanese urban population. The frequency distribution curves of Pb content in blood (244 specimens) and urine (78) showed the log-normal type. The upper tolerance limits were: blood, 31  $\mu\text{g}/100\text{ g}$ ; urine, 159  $\mu\text{g}/\text{day}$ ; the arithmetic mean of Pb in feces (31 specimens) was 240  $\mu\text{g}/\text{day}$ .

**2027** Hsüeh, H.L.: (CaEDTA IN TREATMENT OF CHRONIC LEAD POISONING.) Chinese Journal of Internal Medicine 7:212-9 (Mar.), 1959.

**2028** Hunold, G.A.: Über die Bedeutung der maximalen Arbeitsplatzkonzentrationen (MAK-Werte) gesundheitsschädlicher Arbeitsstoffe und ihre analytische Erfassung. (SIGNIFICANCE OF MAXIMUM PERMISSIBLE CONCENTRATIONS OF TOXIC SUBSTANCES IN INDUSTRIAL ENVIRONMENT AND THEIR ANALYTICAL DETERMINATION.) Pracovní Lékařství 11:168-70 (Apr.), 1959.

Author discusses the significance of maximum permissible concentrations of toxic substances in industrial environment and their analytical determination. The methods should be specific for the particular substance, easily carried out, furnish consistent results and should not require expensive equipment. In some cases, additional clinical chemical tests should be made. Thus, determination of porphyrin and Pb blood levels should be used for diagnostic purposes in Pb poisoning.

**2029** Ippen, H. (Med. Acad., Düsseldorf, Germany): Porphyria cutanea tarda und Beruf. (PORPHYRIA CUTANEA TARDA AND OCCUPATION.) Berufsdermatosen 7:256-66 (Oct.), 1959.

The increasing incidence of cutaneous porphyria in later life has aroused the suspicion that exogenous as well as congenital factors are involved. A case of porphyria cutanea tarda is described in a 65-yr-old electric welder who had been exposed to Pb fumes for 14 yr. He had no clinical symptoms of Pb poisoning, but a higher than normal excretion of copro- and uroporphyrin. The bone marrow showed increased erythropoiesis and there was a hemosiderotic fatty cirrhosis in the liver. A survey by occupation of 168 cases of cutanea tarda patients indicated a possible etiology of alcohol, exposure to light and to Pb in 80%. Among the Pb group the most important single class of workers (11.9%) were automobile drivers. Author states that porphyria cutanea tarda seldom causes an incapacity for work of >30%, but in rare cases lesions resembling sclerodactyly may follow. (85 references)

**2030** Johnstone, R.T. (Los Angeles, Calif.): COMMON ERRORS IN THE DIAGNOSIS OF PLUMBISM. Industrial Medicine and Surgery 28:126-7; discussion, 127-33, 1959.

The author points out that Pb poisoning should not be referred to as a "protean" disease, for factors which once permitted months or years of exposure to hazardous concentrations of Pb dust or fumes no

longer exist. Any physician now sees extremely rarely an industrially induced case, characterized by the neuromuscular syndrome or encephalitis. Therefore, it is erroneous to attribute the bizarre findings perpetuated in the literature to Pb poisoning. Errors in the diagnosis of Pb poisoning arise out of an inadequate history, insufficient knowledge of the occupational environment and reliance upon laboratories whose experience and efficiency are not known. A common source of error arises out of faulty collection of materials as well as the interpretation of reports submitted by the laboratory. The figures presented by the report must be evaluated in relation to the history of exposure and the clinical picture. Pb poisoning is not difficult to diagnose if these common errors are avoided.

**2031** Kehoe, R.A. (Univ. Cincinnati, O.): RESPONSES OF HUMAN SUBJECTS TO LEAD COMPOUNDS. PROGRESS REPORT ON AN EXPERIMENTAL INVESTIGATION OF FACTORS WHICH INFLUENCE THE RESPONSES OF HUMAN SUBJECTS TO FINELY DIVIDED LEAD COMPOUNDS IN THE ATMOSPHERE. Industrial Medicine and Surgery 28:156-9; discussion, 159-61 (Mar.), 1959.

A preliminary report is presented on 6 experiments with 4 subjects, 2 of which have been duplicated. The experimental subject is placed in a respiratory chamber which is equipped as an office where he can carry out his day's work on 5 days of each wk for 7.5 hr/day. This procedure simulates the conditions of industry. Pb sesquioxide produced by combustion of TEL in a stream of propane is fed into the atmosphere of the chamber at a known concentration and known particle size. The experimental subject is requested to collect precise duplicate samples of everything he eats and drinks and to collect all urine and feces. This regimen applies to the whole period of observations including an introductory period of not <6 mo. The duration of the 6 experiments was 5-1/6, 4-1/3, 2-1/2, 2-7/12, and 2 yr, respectively, with the last experiment still in progress. When the respiratory exposure is discontinuous, ie, 5 days/wk rather than 7 days, the individual reaches within 6-8 mo a plateau with respect to urinary excretion and concentration of Pb in blood, whereas at daily oral ingestion 7 days/wk the Pb concentration in the urine and body tissues goes up at a steady rate throughout the whole period of exposure for as long as 5 yr. A change of the particle size from 0.5  $\mu$ -1  $\mu$  leads to an increase of pulmonary Pb retention from 35-40% to 40-50%. For a more complete report, see Abstract No. 2287.

**2032** Kiryakov, K. (Sofia, Bulgaria): Za khronichnite nevointoksikatsii s tetraetilolovo v usloviyata na aviotransporta. (ON CHRONIC NEURO-INTOXICATION WITH TETRAETHYL LEAD IN COMMERCIAL AVIATION.) Suvremenna Meditsina (Sofia) 10, No. 8:42-8, 1959.

A study on 35 workers in civil aviation, 21-40 yr old, employed for 1-10 yr, is presented. I: 5 men working in the mixing of ethyl fluid with gasoline; II: 12 repair men from the motor and aircraft shop; III: 18 men employed in current maintenance and cleaning of the motors. Air samples from the

working areas contained 0.000018-0.000024 mg TEL/l, or 6-8 times the allowable concentration. Signs of intoxication were most pronounced in Group I and least in Group III; subjective complaints were continuous or occasional headache, sleeplessness, paresthesia, agitation, excessive perspiration, impairment of memory, stomach disorders, etc. The objective signs included tremors, disturbances in coordination, impeded speech, Romberg's sign, etc. A typical asthenic condition was observed in 3 cases with bradycardia, hypotonia and hypothermia as well as increased perspiration and salivation. Pulse rate, blood pressure and body temperature as well as results from blood and urine analyses are tabulated. Tests involving higher nerve responses before and after work period demonstrated the presence of neurotoxic effects. The author emphasizes the need for prevention of hazards and education of personnel.

- 2033** Lachnit, V. (Med. Univ. Clinic, Vienna, Austria): Die Therapie der Bleiintoxikation. (THERAPY IN LEAD INTOXICATION.) Wiener Z. Inn. Med. 40:321, 1959.

Based on the literature, therapy with chelates, mainly CaEDTA, and damages due to this treatment are discussed. Intravenous administration of 1 g CaEDTA twice/day for 5 days, and repeated after a 2 day interval, is considered as harmless. In oral therapy the same dose is tolerated over a longer period of time. (Zentralblatt für Arbeitsmedizin und Arbeitsschutz 10:97, 1960)

- 2034** Lange, J., Pickardt, E., and Weinig, E. (Univ. Bonn; Univ. Erlangen, Germany): Zur Diagnostik und Therapie von Bleischäden mit Komplexbildnern. (DIAGNOSIS AND THERAPY OF LEAD INJURY BY COMPLEX FORMERS.) Ärztliche Wochenschrift 14: 105-11 (Feb.), 1959.

Methods for the mobilization of Pb are reviewed. Results of treatment with  $\text{CaNa}_2\text{EDTA}$  (Mosatil "Bayer") in 2 cases of occupational poisoning are described in detail. Data are also presented for 4 workers exposed to Pb and 6 patients not so exposed who were given EDTA. The authors conclude that Mosatil also mobilizes older Pb deposits and that determinations of urinary and blood Pb before and after treatment are helpful in diagnosing late damage by Pb. They consider iv treatment to be more effective than the oral and that a dosage of 25-30 mg/kg is just as effective as the recommended 50 mg dose. (52 references)

- 2035** Merville, R., Dequidt, J., and Fontaine, G. (Med. and Pharm. Coll., Lille, France): Le traitement ambulatoire du saturnisme professionnel par l'éthylène diamino-tétracétate de calcium et de sodium. (AMBULATORY TREATMENT OF OCCUPATIONAL LEAD POISONING BY CALCIUM DISODIUM EDETIC ACID.) Lille Med. 4, No. 5:291-3, 1959.

Twenty-eight cases of chronic Pb poisoning are discussed, including that of 1 patient with a polyneuritic form involving both upper limbs. Oral administration of  $\text{CaNa}_2\text{EDTA}$  (60 mg/kg) for 7 days caused diminution of the gingival line, general improvement, and normalization of blood values. Short treatment with EDTA (for 7 days) 3-4

times a year is recommended for prevention of major Pb poisoning accidents. (From Excerpta Medica, Sect. 17, 7:Abstr. No. 859, 1961)

- 2036** Michigan Department of Health: EFFECTIVE MEDICAL CONTROL OF LEAD. Michigan's Occupational Health 5:1-5 (Fall), 1959.

The following recommendations have been made for an effective Pb control program: (1) urine sampling every 1-3 mo; (2) blood sampling of all workers whose urine samples indicate critical Pb excretion; (3) removal of workers from Pb exposure when blood samples show critical Pb levels; (4) medical examination of all workers exposed to excessive Pb absorption; (5) correcting source of high Pb exposure. Diagnostic tests of excessive Pb absorption include stipple cell count of blood samples, quantitative or semiquantitative determination of urinary coproporphyrin III and of Pb in urine or blood. Urinary Pb determinations are considered as superior to stipple cell counts or coproporphyrin analyses. It is emphasized that EDTA is not a substitute for adequate control of Pb within the plant.

- 2037** Mikosha, A.: (TRACE ELEMENTS IN HUMAN EMBRYOS.) Naukovi Zapiski Stanislavs'k Medical Institute 1959, No. 3:85-9.

Embryos of 3.5 mo were found to contain the following trace elements: Mn, Ni, Al, Ti, Pb, Cr, Ag, and Cu. The concentrations of these elements increased between 4.5 and 6 mo and at 8 mo of intrauterine life showed a 2nd period of maximum concentrations; during the 7th mo, only Cr increased. The concentrations of Mn, Ni, Pb, Ti, Ag, Al, and Cr dropped sharply at the time of delivery while Cu increased in the embryo liver through the entire period of intrauterine life. (From Chemical Abstracts 59:7969, 1963)

- 2038** Miller, L.H. (Univ. Cincinnati, O.): EDTA THERAPY IN PERSONS WITH EXCESSIVE LEAD ABSORPTION FROM INDUSTRIAL EXPOSURE. Industrial Medicine and Surgery 28:144-7; discussion, 151-5 (Mar.), 1959.

The mechanism of the pharmacologic action of EDTA in Pb and TEL poisoning is discussed. The dosage and conditions under which administration is continued are presented. At present, it is believed that EDTA is most useful in the treatment of the acute phase of the illness. The routine, frequent, or infrequent use of it, or other present or future drugs, as prophylaxis against the absorption of excessive quantities of Pb cannot be condoned. Prophylaxis can be achieved safely only by controlling the sources of exposure by proper hygienic measures. (17 references)

- 2039** Moreo, L. (Univ. Milan, Italy): Su una sorgente poco nota di saturnismo: la fabbricazione di virole per lampadine elettriche. (A LITTLE KNOWN SOURCE OF LEAD POISONING: THE MANUFACTURE OF METALLIC PARTS FOR ELECTRIC LIGHT BULBS.) Medicina del Lavoro 50:673-8 (Nov.), 1959.

Two workers employed in the manufacture of electric

light bulbs were hospitalized due to abdominal cramps and anemia characteristic of Pb poisoning. One had signs of kidney lesions. When vitrite which is used in the bulbs as insulating material (Pb content of 0.35-6%) is melted during manufacture at 800°C, Pb vapors are produced which contain 0.15% of the Pb present in the vitrite. Cases of Pb poisoning may occur whenever a vitrite with a high Pb content is used.

- 2040** Nago, Y.: A STUDY ON THE PROTEIN METABOLISM IN LEAD POISONING. REPORT 1. A NEW APPARATUS FOR CONTINUOUS PAPER ELECTROPHORESIS. REPORT 2. LEAD CONTENT OF SERUM PROTEIN FRACTIONS. Journal of Osaka City Medical Center 8:499-509 (Apr.), 1959. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 2, April 1959-March 1961, pp. 51-4; 55-7.

1. The apparatus devised is briefly described and diagrams illustrating it and tracings of the results are presented.

2. Blood was obtained from patients with acute industrial Pb poisoning, individuals of suspected latent poisoning, Pb workers, and normal persons without exposure to Pb. Electrophoresis of proteins was performed by use of the above apparatus. After drying, the drip point of the phoresis paper was cut off and sprayed with a 0.1% dithizone chloroform solution. Clear coloration of dithizone-Pb was found at the position of albumin and  $\alpha_1$ -globulin. The density of the dithizone-Pb was then estimated by an automatically controlled densitometer connected with a recorder. The values obtained were compared with the standard curve prepared earlier. The results showed that Pb in the serum protein fraction was found mostly at the position of albumin and  $\alpha_1$ -globulin, with a trend to increase as the concentration of Pb in whole blood or serum protein increased. In the group with blood Pb >60  $\mu\text{g}/100\text{ g}$ , 85-99% of total Pb in the protein fraction was in the above fractions. In the group with blood Pb <60  $\mu\text{g}/100\text{ g}$ , the amount of Pb in whole blood was in proportion to the amount of Pb in albumin and  $\alpha_1$ -globulin. In the 1st group (>60  $\mu\text{g Pb}$ ), however, there was no significant correlation between Pb in whole blood and that in albumin and  $\alpha_1$ -globulin.

- 2041** Nasel'skii, N.B.: (EFFECT OF AGE ON THE TRACE-ELEMENT COMPOSITION OF HUMAN SKIN.) Naukovi Zapiski Stanislav's'k Medical Institute 1959, No. 3:90-7.

The composition of 63 skin samples from persons up to 72 yr age was studied. The concentration of Cu in the skin of embryos and children up to 9 yr of age was insignificant; it began to rise at the age 33-37 yr, then decreased at 52-54 yr of age. The Mg content was not affected by age. Maximum Si concentration was noted in the skin of embryos and newborn; it was low between the ages of 9-51 yr and then rose again. The Al and Ti values were highest in embryos and remained relatively constant during maturity and old age. The concentration of Pb was highest in the embryo skin, fell to lower

levels at birth, and reached a minimum at 18 mo of age. It was insignificant from age 20-25 yr, but then reached a new maximum at 72 yr. The same was true for Ag. Cr content reached a maximum during the embryonic stage, fell to a minimum at 18 yr, rose again at 25 yr, dropped to a low level at maturity and again rose during old age. (From Chemical Abstracts 59:14372, 1963)

- 2042** Nunziante Cesàro, A. (Univ. Messina, Italy): (HEMATOLOGICAL HISTOCHEMISTRY IN PROFESSIONAL PATHOLOGY.) Minerva med. 50:1383-90, 1959.

The histochemical changes in silicosis, silico-tuberculosis and chronic poisoning by Pb, benzene, CO, C disulfide, tetrachloride, methanol, acetic acid, hexane and Zn are discussed. In all cases of poisoning, cellular deoxyribonucleic acid was below normal. (From Chemical Abstracts 54:588 1960)

- 2043** Odaglia, G., and Sacchitelli, F. (Univ. Genoa, Italy): Sul comportamento del potere plasmalipidico nel saturnismo. (BEHAVIOR OF THE BLOOD LIPASE ACTIVITY IN SATURNISM.) Folia Medica (Naples) 42:508-13 (Apr.), 1959.

The plasma lipase was decreased in patients with Pb poisoning (22 cases were studied). This was most evident in acute and severe cases. With the regression of the symptoms of poisoning the plasma lipase returned to normal values.

- 2044** Oltramare, M.: La valeur des examens médicaux périodiques pour la prévention du saturnisme dans une fonderie. Essai de classification des sujets suivant le degré d'impregnation par le plomb. (THE VALUE OF PERIODIC MEDICAL EXAMINATIONS IN THE PREVENTION OF LEAD POISONING IN A FOUNDRY. AN ATTEMPT TO CLASSIFY THE SUBJECTS ACCORDING TO THE DEGREE OF LEAD ABSORPTION.) Z. Präventivmed. (Zürich) 4:302-9 (Sept.), 1959.

Periodic medical examinations, including basophil granular counts as the main criterion, were undertaken in a brass foundry in Geneva, as some of the measures designed to assess and control the Pb hazard when several cases of Pb poisoning had suddenly occurred. Production at higher temperatures had been increased, though the same bronze alloy containing 25% of Pb had been made for 25 yr. Atmospheric concentrations of Pb are shown; they were well above the MAC and near the furnace reached 12  $\text{mg}/\text{m}^3$ . Additional and improved ventilation hoods were installed, a partition was built and the workers were provided with masks to be worn during certain processes. No new cases of poisoning developed. A table of the criteria and of the results during the following year shows the improvement of health in the workers. The basophil granular picture permitted the detection of men with marked absorption before symptoms appeared. A graph shows the correlation between basophil granulation and Pb exposure in a worker after he had returned to work following recovery from

severe poisoning. The whole examination is performed at the factory and the result discussed with the individual, and if positive with the management. (From Bulletin of Hygiene 35:230, 1960)

- 2045 Oltramare, M., Lang, R., and Le Coultre, J.: Sur la numération des hématies à granulations basophiles dans le examens périodiques des ouvriers exposés au plomb. (ENUMERATION OF PUNCTATE BASOPHIL CELLS IN PERIODICAL EXAMINATIONS OF WORKERS EXPOSED TO LEAD.) Z. Unfallmed. u. Berufs-krankh. 52:235-42 (Sept. 15), 1959.

The authors classify basophil granulations according to size as large, medium and fine and consider punctate cells specific for Pb absorption when they number from 1-10/1000 erythrocytes. They use alkaline methylene blue for staining and work preferably in direct light. Among 50 Pb workers, those with no symptoms showed almost entirely fine or medium granulations; in those with slight symptoms of nervousness, constipation, occasional abdominal pain and a hemoglobin (Hb) level not <80%, some cells contained large granulations; with overt intoxication (anemia, colic and renal symptoms) the punctate count was never <8/1000, and coarse granulations were always present. It is concluded therefore that an increase in the number of punctate cells practically always precedes the appearance of manifest clinical symptoms and that the special value of this enumeration lies in the prevention of the passage of those showing fine and medium granulations to those with coarse. A typical case is quoted of a workman who felt well and had a Hb level of 85%, but who showed 10.6/1000 punctate basophils, of which 2% had coarse granulations. He was therefore removed immediately from all contact with Pb. In order to reduce the time necessary for counting 10,000 cells, a mathematical calculation of the statistical variation of blood samples has been evolved which it is claimed allows a sufficiently exact estimation for periodical examinations when 4000 cells are minutely examined; this takes ~1/2 hr, as opposed to >1-1/2 hr for the generally accepted minimum number of 10,000. (From Bulletin of Hygiene 35:229, 1960)

- 2046 Oshima, M.: (STUDIES ON LEAD POISONING. PART 1. ON THE DAILY VARIATION OF LEAD QUANTITY IN URINE. PART 2. ON THE RELATION BETWEEN COPROPORPHYRIN IN URINE AND LEAD CONTENT OF URINE AND OF BLOOD. Shikoku Acta Med. 14:855-60 (May); 25-34 (June), 1959.

1. Urine was collected from a worker of a battery factory for 2-4 successive days 3 times/day several times during the warm (July-Sept.) and the cold seasons (Jan.-March). Specific gravity, quantity of Pb, Pb concentrations were determined. The author points out that (1) the absolute quantity of urinary Pb excretion is more important than urinary Pb concentration which depends on the volume of urine. (2) Due to the wide daily variation of urinary Pb excretion, spot urine samples should be analyzed. (3) Large quantities of Pb were found in urine collected at night.

(4) Urinary Pb concentration varies more in the warm season than in the colder months. (5) The following correlation coefficients were found: volume/specific gravity (spg) of urine, -0.733; volume/Pb content, +0.667; spg/Pb content, -0.479; spg/Pb concentration, +0.348.

2. A study of 178 Pb workers did not reveal a close correlation between urinary CP and Pb content of urine and blood, but the mean value of Pb concentration in urine and blood showed a certain degree of relationship to the CP in urine. Many workers after <1 yr exposure showed a positive reaction of urinary CP which suggests that the CP test is helpful in the diagnosis of early or latent Pb poisoning. The specific gravity of whole blood was <1.049 in 12 of 158 men and the Hb value was <12.9 g/100 ml in 10 of 114 workers. Positive reaction to urinary CP was found in 121 of 178 subjects and intensive positive reaction in 43. Only 4 workers of 146 had <11 basophilic stipples/10,000 red blood cells; all of these subjects showed positive reaction to urinary CP and 3 of them showed an intense positive reaction. (From Bulletin of Hygiene 34:1265, 1959; 35:113, 1960)

- 2047 Paoletti, G. (Natl. Inst. Health Insurance, Arezzo Prov., Italy): Contributo allo studio della diagnosi precoce del saturnismo professionale. (CONTRIBUTION TO THE STUDY OF EARLY DIAGNOSIS OF OCCUPATIONAL LEAD POISONING.) Rassegna di Medicina Industriale 28:386-99 (Sept.-Oct.), 1959.

Three cases of Pb poisoning recently observed in a pottery, 1 in an early stage and 2 in a more advanced stage, are discussed with particular emphasis of old and new diagnostic methods. The increase in blood protoporphyrin is recognized as an early, constant and specific symptom of Pb intoxication. (From author's summary) (15 references)

- 2048 Pedinelli, M., and Stringari, M. (SOLI, Trento, Italy): Osservazioni sul trattamento "per os" con chelanti in lavoratori addetti alla produzione del piombo tetraetile. (OBSERVATIONS ON THE TREATMENT "PER OS" WITH CHELATING AGENTS IN TETRAETHYL LEAD PRODUCTION WORKERS.) Rassegna di Medicina Industriale 28:514-25 (Nov.-Dec.), 1959.

The principal stages of TEL production and the occupational hazards of each stage are described. EDTA in the form of 0.25 g tablets was given to 10 TEL production workers in daily doses of 1.0-1.5 g for 8-12 consecutive days. All these subjects had a urinary Pb concentration of ~200 µg/l. One of the men was successively treated with cysteamine and an 11th man was given only cysteamine treatment. Graphs illustrating the urinary Pb excretion for each man during treatment show that the Pb excretion increases considerably to the 3rd-5th day of treatment with EDTA and returns to low values by the 10-12th day. The increase is largest in workers who had been exposed to metallic Pb in addition to TEL. Similar though less pronounced results were obtained with cysteamine. Both drugs were well tolerated in the doses administered.



- 2049** Pernis, B., and Bairati, A., Jr. (Univ. Milan, Italy): Il midollo osseo nel saturnismo al microscopio elettronico. (STUDY OF THE BONE MARROW WITH THE ELECTRON MICROSCOPE IN LEAD POISONING.) *Medicina del Lavoro* 50:447-57 (Nov.), 1959. Ultrathin sections of bone marrow of 2 patients with Pb poisoning were studied with the electron microscope. In both cases the same submicroscopic alterations were found in many erythrocytes and erythroblasts which had been noted previously in guinea pigs experimentally poisoned with Pb. (Pernis, et al (1959)). These alterations are thought to be due to Pb-induced disturbances of heme synthesis which to a large extent takes place in the mitochondria.
- 2050** Perry, H.M., Jr., and Perry, E.F. (Washington Univ. School Med., St. Louis, Mo.): NORMAL CONCENTRATIONS OF SOME TRACE METALS IN HUMAN URINE: CHANGES PRODUCED BY ETHYLENEDIAMINETETRAACETATE. *Journal of Clinical Investigation* 38:1452-63 (Aug.), 1959. Mean urinary concentrations of Zn, Cd, Mn, Pb, V, Mo, Ni, Ag and Sn were determined for 24 normal American adults; day-to-day variations were measured for 1 normal adult. The urinary excretion of these metals was compared for healthy Americans and hospitalized Africans. Metal content in consecutive 24-hr urines from hypercholesterolemic patients before, during and after iv administration of  $\text{CaNa}_2\text{EDTA}$ , which had been observed to lower the level of cholesterol in human plasma, was also determined. A spectrographic method was used. The mean urinary Pb content of the 24 adults was 120  $\mu\text{g/l}$  of 24-hr specimens; the mean of 12 specimens from 1 normal adult, 24 yr old, was 91.1, and single specimens from 12 hospitalized African patients gave a mean of 38.9  $\mu\text{g/l}$ . The hypercholesterolemic patients excreted 208  $\mu\text{g Pb/l}$  before, 120-625 during, and 270 after EDTA.
- 2051** Pettinari, L., Rasetti, L., and Rubino, G. (Univ. Turin, Italy): Intossicazione da naftanato di piombo contenuto negli olii lubrificanti per sistemi idropneumatici. (INTOXICATION WITH LEAD NAPHTHATE IN LUBRICATING OILS FOR HYDROPNEUMATIC SYSTEMS.) *Rassegna di Medicina Industriale* 28:379-85 (Sept.-Oct.), 1959. A study of 4 men working with hydropneumatic hoists revealed signs of Pb exposure in 3 of them although only one of them developed the typical syndrome of Pb intoxication. The pathological picture in 2 of the patients included an intermittent hydrarthrosis which responded to EDTA treatment. One of the men showed slight anemia. Analysis of the lubricating oil used gave a Pb concentration of 260 mg%.
- 2052** Pinizzotto, G. (Univ. Messina, Italy): A proposito di un caso di atropatia saturnina. (ABOUT A CASE OF ARTHROPATHY DUE TO LEAD POISONING.) *Rassegna di Medicina Industriale* 28:1-10 (Jan.-Feb.), 1959. The case of a 47-yr-old varnisher and decorator was described. The man had been working continuously for 36 yr in the ceramic industry, using materials which contained Pb compounds. The man reported that 3 of his co-workers had died from occupational Pb poisoning. His first symptoms were vertigo, dyspeptic trouble, pain along the colon and in the back, fatigue, asthenia. The Burton line was evident. Laboratory tests revealed marked traces of urinary albumin, porphyrinuria 3+, red blood cells 4 million, Hb 75%, etc. X-ray pictures of his hands showed pathologic changes in the joints. The author points out that in some regions of Italy where the workers consider themselves as artisans, no hygienic or prophylactic measurements are observed, and calls attention to the necessity of stricter hygienic controls. (12 references)
- 2053** Pott, R. (North German Refinery, Hamburg): Ist die Prophylaxe der Bleikrankheit mit  $\text{Ca-EDTA}$  möglich? (IS PROPHYLAXIS OF LEAD POISONING WITH EDTA POSSIBLE?) *Archiv für Gewerbepathologie und Gewerbehygiene* 17, No. 4:354-64, 1959. A statistical study is presented covering 95 workers of a Cu-Pb mine who showed definite signs of Pb poisoning (20 stippled cells/50 fields, strong porphyrinuria, starting anemia) and were treated orally with 3 g EDTA/day for 4 wk while remaining on the job. Urinary Pb concentrations on the 6th and 20th day of treatment in ranges from <400- >4000  $\mu\text{g/l}$  are tabulated. The treatment appeared to be successful in 66 of the workers tested. However, the following sequelae raised doubts about the effectiveness of EDTA as prophylactic in Pb poisoning: (1) Signs of Pb intoxication reoccurred in 29 out of these 66 subjects within 2-3 mo after treatment; (2) 14 out of the 66 men had to be temporarily removed from Pb exposure within 3 mo and 2 others were given a 2nd treatment; (3) 38 developed gastric complaints within 7 mo. Differences between iv and oral administration of EDTA are reviewed and presented in a diagram. A continuous oral treatment with daily doses of 0.5-1.0 g EDTA during the period of Pb exposure is proposed and experiments in this direction are suggested. (25 references)
- 2054** Radošević, Z., Radonić, M., and Horvat, Z. (Med. Coll., Zagreb, Yugoslavia): Klinička zapazanja o "endemskoj nefropatiji" u Hrvatskoj. (CLINICAL ASPECTS OF "ENDEMIC NEPHROPATHY" IN CROATIA.) *Lifec-nicki Vjesnik* 81:445-56 (July-Aug.), 1959. The clinical findings in 48 patients with endemic kidney disease in the region of Salvonski Brod are described. This disease occurs in >5% of the inhabitants. The authors' opinion is that this nephropathy is a primary chronic interstitial nephritis. Renal biopsies performed on 8 patients and autopsy studies in 1 favored this diagnosis. The main characteristics of the disease are described. The functional and histological pattern of the early stage could not be identified. A group of 11 young patients with some slight pathologic findings in the urine was examined. Since neither function tests nor biopsy revealed any ab-

normalities, initial focal lesions were suspected. The authors point out that the etiology of this endemic disease is still unsolved; many sources have been considered, but chronic Pb poisoning, claimed by Danilović et al could not be accepted by them on the basis of blood Pb findings, stippled cells and coproporphyrin in urine in 36 patients. They call attention to the facts that the illness becomes manifest only in the 3rd decade of life; women are affected twice as much as men; family incidence is obvious; the basis of this nephropathy is a primary chronic interstitial nephritis; the causal agent shows also affinity to the hemopoietic system. (19 references)

- 2055** Reinl, W. (State Ind. Physician, Nordrhein, Düsseldorf, Germany): Zur gewerblichen Bleivergiftung. (OCCUPATIONAL LEAD POISONING.) Deutsche Medizinische Wochenschrift 84:1748-9, 1959.

Referring to Albach's publication (1958) the author points out that hypertonia and nephritis are not indicative of Pb poisoning and that damage to the nervous system is rare. However, constipation, colic, basophilia, and porphyrinuria are definite signs of Pb poisoning. A dietetic treatment preceding the diagnosis, as recommended by A., does not appear feasible to R. (From Zentralblatt für Arbeitsmedizin und Arbeitsschutz 10:17 (Abstracts), 1960)

- 2056** Rubino, G.F., Prato, V., and Fiorina, L. (Univ. Turin, Italy): L'anemia da piombo: sua natura e patogenesi. (ANEMIA PRODUCED BY LEAD POISONING. ITS NATURE AND PATHOGENESIS.) Folia Medica (Naples) 42: 1-20 (Jan.), 1959.

Erythrocyte survival in 10 persons with Pb poisoning was determined by the differential agglutination technique, by  $^{51}\text{Cr}$ , and the reticulocyte method. The daily hemoglobin destruction and erythrocyte regeneration were evaluated. Pb causes hyperhemolysis even in absence of anemia. In some instances the daily hemoglobin destruction obtained values as high as 4 times normal. Evidently, Pb is permanently attached to the erythrocytes and causes changes which lead to hemolysis even if they have been removed to a normal medium. The erythropoietic activity of the bone marrow was not damaged. (From Chemical Abstracts 53:15359, 1959)

- 2057** Sadokierski, W.: Ołowica w województwie białostockim. (LEAD POISONING IN THE DISTRICT OF BIALYSTOK.) Med. Pracy 10, No. 6:393-7, 1959.

Among 3 groups of a total of 130 workers from tile, graphic, and electric industries, the 1st group was exposed to Pb poisoning, and the morbidity rate was 42% in this group, of which women were most affected (no data). Safety measures are suggested. (From Excerpta Medica, Sect. 17, 6: Abstr. No. 3347, 1960)

- 2058** Saita, G. (Univ. Milan, Italy): Il dosaggio della protoporfirinemia e dell'eliminazione

del piombo dopo versamento di calcio nella diagnosi di saturnismo pregresso. (DETERMINATION OF PROTOPORPHYRINEMIA AND LEAD EXCRETION AFTER CALCIUM VERSENATE IN THE DIAGNOSIS OF PREVIOUS LEAD POISONING.)

Medicina del Lavoro 50:659-72 (Nov.), 1959.

The diagnosis of previous Pb poisoning is difficult in cases where the worker has been removed from exposure for a long time. The diagnosis is facilitated by the determination of urinary Pb and blood protoporphyrin (PP) after iv injection of 2g CaEDTA. Thirty-three subjects hospitalized for suspected Pb poisoning who had left hazardous exposure for variable periods of time were studied. In 6 cases, treated with EDTA 1-7 mo after the occurrence of acute poisoning, the urinary Pb was 2-3 mg/24 hr and the PP level in the red blood cells was 250-430 ml%, while the Pb level in blood, stippled cell count and urinary Pb and porphyrin level were normal. In 6 other workers removed from Pb exposure for 2-8 yr, increased PP in the blood (>100 µg%) and urinary Pb excretion of >1 mg/24 hr following EDTA administration were the only signs of chronic Pb poisoning. In 12 of the 33 workers PP in the blood was normal but urinary Pb excretion was increased. In 2 of these who had been removed from Pb exposure for 9-11 yr, Pb poisoning was recognized, while in the remaining 10 who had been removed from Pb exposure for 15 days-4 yr, the diagnosis of Pb poisoning was not confirmed. Increased PP in the blood with normal urinary Pb excretion following EDTA is not indicative of Pb poisoning. (20 references)

- 2059** Saita, G., and Moreo, L. (Univ. Milan, Italy): Talassemia ed emopatie professionali. Nota II - Talassemia e saturnismo cronico. (THALASSEMIA AND OCCUPATIONAL BLOOD DISORDERS. II. THALASSEMIA AND CHRONIC LEAD POISONING.) Medicina del Lavoro 50:37-44 (Jan.), 1959.

Three cases of Pb poisoning in subjects with thalassemic manifestations were reported. The men showed typical signs of Pb poisoning such as colics and anemia a few weeks after having been exposed to the hazardous work. The hypochromic anemia along with microcytosis, severe poikilocytosis and increased osmotic globular resistance suggested the simultaneous occurrence of thalassemia, which was confirmed by comparisons with other family members and by determination of the alkali-resistant hemoglobin. Pb poisoning was manifested by a high level of urinary coproporphyrin and blood protoporphyrin. The presence of stippled cells, increased serum Fe and indirect hyperbilirubinemia, being common to both syndromes, could not be used for a differential diagnosis. The course of the anemia was not much different from that seen in Pb poisoning and regression resulted after treatment with the usual detoxifying agents.

The authors point out that the occurrence of early and severe signs of Pb poisoning in these subjects indicates that men with constitutional blood disorders should not be exposed to occupational Pb hazards. (63 references)

- 2060** Šarić, M., and Hlebec, F. (Inst. Med. Res., Yugoslav Acad. Sci.; Central Inst. Hyg., Zagreb, Yugoslavia): Ispitivanja o moguć-

nosti pojave bubrenih bolesti kod seoskog stanovništva izloženog olovu. (STUDIES ON THE INCIDENCE OF KIDNEY DISEASES IN THE RURAL POPULATION EXPOSED TO LEAD.) Liječnički vjesnik 81:457-64 (July-Aug.), 1959.

The frequency rate of albuminuria and specific weight of the urine were determined in 496 inhabitants of the village Bedenec (43% of the whole population). In this village out of 120 households 45 are engaged in the making of Pb-glazed pottery, while all the households, without exception, use that kind of pottery for storing milk and fat, for milk fermentation, and other purposes. The analysis of stippled cells and reticulocytes showed increased absorption of Pb in part of the inhabitants. There was no difference in the frequency rate of albuminuria in the inhabitants of the village (though no catheter was used for the urine analysis in women) and the workers of an enterprise in Zagreb with no specific exposure to Pb. However, the percentage of the individuals in the village Bedenec with albumin in the urine was considerably lower than the percentage of albuminuria recorded in the inhabitants of certain villages in Serbia, Croatia, and Bosnia with a high number of diagnosed chronic nephropathies. There was also no greater deviation from normal in the specific gravity of urine in the inhabitants of Bedenec. The results obtained give no evidence of a significant incidence rate of chronic nephropathies in the inhabitants of the village Bedenec. Nor do they support the assumption that Pb plays the role of an etiologic factor in the incidence of endemic nephropathies in certain parts of this country. (From authors' summary; 21 references)

- 2061** Šarić, M., Kosoković, S., Zorica, M., Beritić, I. (Inst. Med. Res., Yugoslav Acad. Sci. and Arts and Internal Clinic, Zagreb, Yugoslavia): Profesionalni saturnizam u radnika zaposlenih na izgradnji "Mosta Slobode." (OCCUPATIONAL LEAD POISONING IN WORKERS EMPLOYED IN THE CONSTRUCTION OF THE "LIBERTY BRIDGE".) Liječnički vjesnik 91:803-9 (Nov.-Dec.), 1959.

Pb poisoning in riveters and electric welders is reported. The steel plates of the girders had been painted with red Pb paint and Pb fumes developed when the red-hot rivets were set. Two of the riveters showed manifest signs of Pb poisoning while laboratory signs were present in the majority of the rest of the workers. From the results of the examinations it became apparent that the riveters were considerably more exposed to Pb than the electric welders. The authors consider this case of interest because this source of occupational poisoning had not been recognized in Yugoslavia and because of future construction projects planned in their country.

- 2062** Savićević, M., Petrović, L., Stanković, M., and Djordjević, S. (Inst. Ind. Hyg., Belgrade, Yugoslavia): Unsere Erfahrungen mit  $\text{CaNa}_2\text{EDTA}$  (Mosatil-Bayer) bei chronischer Blei-Exposition. (EXPERIENCES WITH  $\text{CaNa}_2\text{EDTA}$  (MOSATIL BAYER) IN CHRONIC Pb EXPOSURE.) Zentralblatt für Arbeits-

medizin und Arbeitsschutz 9:6-12 (Jan.), 1959.

Thirty foundry workers with an exposure time of 5-16 yr (av 9.9 yr), were treated with  $\text{CaNa}_2\text{EDTA}$  for 7 days; 11 patients received iv 2.4 g/day, 5 a daily dose of 1.2 g; 7 men were given 1.2 g/day im and 7 others 3 g/day orally; 4 were left without therapy. Hemoglobin and erythrocyte values increased, punctate cells did not change significantly; reticulocytes tended to decrease slightly. Urinary Pb excretion was particularly high during the 1st day in the parenterally treated groups, less so in the orally treated men. Urinary coproporphyrins and urinary and blood Pb concentrations returned to normal during treatment. A decrease in the Pb line on the gums was noticed in all patients and finally disappeared in 26% of the cases, however, more rapidly so in those treated iv. Arthralgias disappeared in 30% and the pallor in 56%; in the control group, however, it did not change. EDTA had no clinically demonstrable toxic effect except possible diarrhea in 5 cases the origin of which was, however, uncertain.

- 2063** Savićević, M., Petrović, L., Stanković, M., and Djordjević, S. (Inst. Ind. Hyg., Belgrade, Yugoslavia): Prophylaktische orale Verabreichung von  $\text{Ca}_2\text{EDTA}$  (Mosatil-Bayer) bei Arbeitern, welche einer Vergiftung mit Blei ausgesetzt sind. I. Teil: Verabreichung von 2 g  $\text{Ca}_2\text{EDTA}$  pro Tag. (PROPHYLACTIC ORAL ADMINISTRATION OF  $\text{Ca}_2\text{EDTA}$  (MOSATIL-BAYER) TO WORKERS EXPOSED TO LEAD. I. ADMINISTRATION OF 2 G  $\text{Ca}_2\text{EDTA}$  PER DAY.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 9:180-5 (Aug.), 1959.

Nine men exposed to Pb were treated with 2 g  $\text{Ca}_2\text{EDTA}$ /day for 40 days. Urinary and blood Pb, coproporphyrin, stippled erythrocytes and clinical symptoms were compared with those in 8 controls. The treated subjects excreted in the urine an average of 13,960 mg/l of Pb during the 1st 10 days, 13,560 mg/l during the 2nd 10 days and 9180 mg/l during the 3rd 10 days. By the end of the treatment an av 46,760 mg/l was excreted, whereas the untreated were required 158.5 days to excrete the same amount. The decrease of the coproporphyrin was 3 times greater than in the control group, ie, 6070 mg/l and 16,320 mg/l respectively. The decrease in the number of stippled cells was greatest from the 10th-20th day of treatment. Authors conclude that oral administration of  $\text{Ca}_2\text{EDTA}$  is useful in prophylaxis of chronic saturnism. Research is suggested whether smaller amounts of  $\text{Ca}_2\text{EDTA}$  may not suffice. Furthermore, the balance of electrolytes should be tested.

- 2064** Savićević, M., Petrović, L., Stanković, M., and Poletti, D. (Inst. Ind. Hyg., Belgrade, Yugoslavia): Prophylaktische orale Verabreichung von Mosatil bei bleigefährdeten Arbeitern. II. Teil: Verabreichung mit 1- und 3-g- Mosatil Tabletten pro Tag. (PROPHYLACTIC ORAL ADMINISTRATION OF MOSATIL IN LEAD EXPOSED WORKERS. II. ADMINISTRATION OF 1- AND 3-G, MOSATIL TABLETS PER DAY.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 9:289-92 (Dec.), 1959.

Two groups of 8 Pb-exposed workers each were treated orally for 8 days with 1 and 3 mg Mosatil, respectively, while remaining at their regular work at an average atmospheric concentration of 0.637 mg Pb oxide/m<sup>3</sup>. Blood and urinary Pb levels, urinary coproporphyrin and stippled cells were determined every other day. The urinary Pb excretion in the 2 groups over 8 days amounted to 13.332 and 17.890 mg/l, respectively. These amounts are higher than those obtained in previous tests when the subjects were treated with the corresponding dosages in the hospital. However, the workers in the present test remained under the exposure of Pb while being treated which may account for part of the increased excretion. No untoward effects of the treatment were noted in any case. The authors emphasize, however, that clinical supervision during EDTA administration is required.

- 2065** Savičević, M., and Stanković, R.: (SATURNISM AND NEPHROPATHIA PROBLEMS.) Glas. hig. inst. Srbije 8:51-6, 1959.

The authors discuss the problem of the influence of toxic concentrations of Pb oxide aerosol on kidneys of 40 persons working under such conditions for a period of 3-23 yr. All these workers were medically investigated twice a year (systematic, medical and laboratory examinations) and subsequently taken to hospitals for clinical and laboratory examination. Neither nephropathia nor lesions of the vascular apparatus were noted as consequence of the chronic exposure to Pb poisoning. The authors conclude that the old concept of the great vulnerability of the kidneys and of the cardiovascular and renal system to Pb, should be reviewed by using more precise methods of testing for urea, creatinine, etc. (From *Excerpta Medica*, Sect. 17, 6:Abstr. No. 2647, 1960)

- 2066** Seignette, W.T.F., Haanen, C.A.M., Jansen, A.P., and Majoor, C.L.H. (Univ. Nijmegen, The Netherlands): De werkzaamheid van penicillamine en versenaat bij de behandeling van de ziekte van Wilson en van loodintoxicatie. (THE EFFECTS OF PENICILLAMINE AND VERSEDATE IN THE TREATMENT OF WILSON'S DISEASE AND LEAD POISONING.) *Folia Medica Neerlandica* 2:65-78 (June), 1959.

The effect of penicillamine, EDTA and some other drugs upon urinary excretion was studied in a Pb-poisoned patient. Pb excretion was more efficiently promoted by EDTA than by penicillamine. The advantage of penicillamine is the possibility of oral treatment. Therefore, further study of this drug for prophylactic treatment is suggested. (19 references)

- 2067** Shlopak, T.V.: (CONCENTRATIONS OF MACRO AND TRACE ELEMENTS IN THE CLEAR AND CATARACT-AFFECTED CRYSTALLINE LENSES OF MAN.) *Nauk. Zap. Stanislav'sk. Med. Inst.* 1959, No. 3:227-32.

Seventy-three cataract-affected and 23 clear crystalline human lenses were examined. Analyses showed the presence of high concentrations of Na, K, Ca and Mg and traces of Cu, Mn, Pb and Si. The Pb concentration increased as the cataract developed. (From *Ref. Zh., Biol. Khim.* 1963, Abstr. No. 8 F 1092; *Chemical Abstracts* 59:10618, 1963)

- 2068** Silvestri, U. (Univ. Bologna, Italy): Ricerche spettrografiche sulla composizione in elementi in tracce nelle emazie di individui sani e di ustionati. (SPECTROGRAPHIC STUDIES ON THE COMPOSITION OF TRACE ELEMENTS IN THE BLOOD OF HEALTHY INDIVIDUALS AND THOSE WITH BURNS.) *Bollettino della Società Italiana di Biologia Sperimentale* 35:1113-5, 1959.

In the red cells of 16 healthy subjects, Pb was among the elements occurring in moderate trace amounts and among those that showed most frequent and intense variations. In 11 burns patients, Pb followed the same pattern.

- 2069** Soos, G., Rozsahegyi, I., and Erdodi, Z.: (THERAPY OF LEAD POISONING BY HUNGARIAN-MADE CALCIUM DISODIUM ETHYLENEDIAMINE TETRAACETATE (CaEDTA) MARKED AS E. Gy. T. 1271.) *Orvosi Hetilap* 100:1081-4 (July 26), 1959. (I.M. 1:A-1205, 1960)

- 2070** Tada, O.: (ON THE LEAD CONTENT OF THE WHOLE BLOOD.) *J. Sci. of Labor* (Tokyo) 35:401-9 (May), 1959.

The Pb content in whole blood was studied for 1 mo in 11 healthy men and variations of the Pb level in blood were examined in 5 men, 20-30 yr of age, and 5 men, 30-40 yr old. An average Pb content of  $14 \pm 5$  µg/100 g blood was found; variations due to age were indistinct. On the basis of data from 33 subjects a normal range of 2-30 µg Pb/100 g blood (av 15 µg/100 g) was established; 60.6% of the subjects tested were in the range of 11-20 µg/100 g. Studies of Pb-exposed workers in various workshops over a period of 12 yr showed that operations yielding Pb dust raised remarkably the Pb concentration in air. On the other hand, operations generating Pb fumes raised the Pb level in the blood of workers although the atmospheric Pb concentration was not so high. Among 656 men exposed to Pb dust or fume, 35.9% had a Pb level of >30 µg/100 g blood and 6.3% showed >60 µg/100 g. (From *Bulletin of Hygiene* 34:1023, 1959)

- 2071** Teisinger, J. (Inst. Ind. Hyg. Occup. Diseases, Prague, Czechoslovakia): Tests biologiques d'exposition. (BIOLOGICAL TESTS FOR THE DETERMINATION OF EXPOSURE.) *Pracovní Lékařství* 11:153-61 (Apr.), 1959.

The importance of biological tests in toxicology is discussed in general and in reference to the following substances: Pb, As, Hg, Cd, CO, CS<sub>2</sub>, trichloroethylene, benzene, toluene, aniline and nitrobenzene. Exposure to Pb is determined mainly from the Pb levels in the urine and also in the blood. The average normal Pb content of the blood ranges from 0.020-0.040 mg% and most investigators consider 0.070 mg% as the threshold. This is in contrast to a statement from the USSR and from Japan according to which toxic symptoms have been noted at Pb concentrations of as low as 0.03 and 0.05 mg%, respectively. The relation between Pb concentrations in the air and in the blood and urine and the mobilization of Pb by chelating agents for diagnostic purposes is discussed. (87 references)

- 2072** Teisinger, J., and Srbová, J. (Clinic Occup. Dis.; Inst. Ind. Hyg. Occup. Dis., Prague, Czechoslovakia): THE VALUE OF MOBILIZATION OF LEAD BY CALCIUM ETHYLENE-DIAMINE-TETRA-ACETATE IN THE DIAGNOSIS OF LEAD POISONING. *British Journal of Industrial Medicine* 16:148-52 (Apr.), 1959.

In a control group of 50 patients who had never been exposed to Pb, the average urinary excretion in 24 hr was 0.031-0.043 mg, with a maximum of 0.100 mg. After iv injection of EDTA Pb in urine rose considerably but the maximum excretion of Pb did not exceed 0.350 mg/24 hr (av 0.143-0.153 mg/24 hr). In a group of 47 individuals who had formerly worked with Pb or were still engaged in work with Pb, with none of them showing symptoms of Pb poisoning, the urinary Pb excretion before and after EDTA averaged 0.067-0.082 mg/24 hr (maximum 0.268 mg) and 0.612-0.629 mg/24 hr (maximum 3.212 mg), respectively. Studies of 20 patients with chronic Pb poisoning showed that the degree of severity of Pb poisoning is proportional to the urinary Pb level after injection of EDTA; however, this rule is not without exception. It is concluded that mobilization of Pb may be of considerable value in the diagnosis of atypical cases of chronic Pb poisoning. However, the question whether the mobilization test is of greater significance for the hygienist than biological tests cannot be answered at present. (17 references)

- 2073** Timár, M. (Natl. Ind. Hyg. Inst., Budapest, Hungary): Vorschläge zur Bestimmung der biologischen Grenzkonzentration einiger Stoffe. (PROPOSED BIOLOGICAL DETERMINATION OF MAXIMUM PERMISSIBLE CONCENTRATIONS OF CERTAIN SUBSTANCES.) *Pracovní Lékarství* 11:167-8 (Apr.), 1959.

See Abstr. No. 2341

- 2074** Vallee, B.L., Stein, E.A., Sumerwell, W.N., and Fischer, E.H. (Harvard Med. School; Peter Bent Brigham Hosp., Boston, Mass.; Univ. Washington, Seattle): METAL CONTENT OF  $\alpha$ -AMYLASES OF VARIOUS ORIGINS. *Journal of Biological Chemistry* 234:2901-5 (Nov.), 1959.

Spectrographic analyses of  $\alpha$ -amylases from human saliva, hog pancreas, *Bacillus subtilis* and *Aspergillus oryzae* showed the presence of insignificant quantities of Mn while Pb could not be detected. (42 references)

- 2075** Verbanck, M., Toussaint, C., Toppet, N., Bastenier, H., Deslypère, P., and Degraef-Millet (Found. Queen-Elizabeth; Univ. Brussels, Belgium): Étude métabolique des effets de l'E.T.D.A. calcique dans le saturnisme latent. (METABOLIC STUDY OF THE EFFECTS OF CaEDTA ON LATENT PLUMBISM.) *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 20:21-33 (Jan.-Feb.), 1959.

Latent plumbism often occurs in workers who have been exposed to Pb over an extended period of time. After the signs of acute Pb poisoning have disappeared a moderate number of basophil cells persist and the urine contains 100-400  $\mu$ g Pb/day.

Six patients, aged 27-63 yr, with latent plumbism, were maintained on a non-milk diet and treated with CaEDTA by im and iv injections. Study of blood and urine samples led to the following conclusions: While, on the basis of the limited number of subjects, it could not be said that, in the latent course, Pb exposure necessarily causes diminution of glomerular filtration, still this specific finding in 2 of the 6 patients indicated Pb to have been the cause of decreased kidney function. EDTA in the doses applied (1.2 g/day im, 2.4 g/day iv) did not appear to be nephrotoxic. An increased P excretion which was noted in 2 patients was probably due to Pb since the same anomaly was observed during acute plumbism.

It is suggested that EDTA depresses P excretion (by 20%) and thereby decreases the activity of the parathyroid. Since the parathyroid stimulates bone destruction, a reduction of its activity immobilizes Ca in the bones and decreases liberation of Pb from the bones of the Pb-poisoned patients. As to the metabolism of other ions, K elimination was decreased by EDTA by 10-30% while Mg excretion remained unchanged. Urinary Pb excretion before administration of EDTA was found to be 117  $\mu$ g/day (av); on the 1st day of treatment it rose to 383  $\mu$ g and then dropped to 166 and 140  $\mu$ g, respectively, on the 2nd and 3rd day. (32 references)

- 2076** Vigliani, E.C. (Univ. Milan, Italy): Criteri di orientamento sulle cosiddette "massime concentrazioni biologiche tollerabili." (INFORMATIVE CRITERIA ON THE SO-CALLED "MAXIMUM ALLOWABLE BIOLOGICAL CONCENTRATIONS.") *Medicina del Lavoro* 50: 323-7 (May), 1959.

Some industrial poisons or their metabolites are found in the blood and/or urine of workers during and/or after exposure. Their determination is important because it indicates the degree of absorption and storage of the poison in the body and permits correlation of the clinical symptoms with the amount of toxic substance or its metabolites in blood and urine. The determination of toxic substance in the body fluids permits the evaluation of occupational hazards sometimes better than a measurement of concentrations in the air. Maximum allowable biological concentrations, as adopted by the Institute of Industrial Hygiene in Milan, are listed for a number of substances. The following data are given for Pb and TEL, respectively in Pb/l: urine 0.15 and 0.12; blood 0.08 and 0.07; coproporphyrin in urine 0.10.

- 2077** Vinogradova, L.M.: (CONTENTS OF LEAD, COPPER, MANGANESE, TITANIUM, ALUMINUM, AND SILICON IN THE BLOOD OF WORKERS IN CONSTANT CONTACT WITH LEAD AND ITS COMPOUNDS.) *Nauk. Zap. Stanislavsk. Med. Inst.* 1959, No. 3:242-8.

Examination of 305 workers showed that the Pb content in the blood of all workers in contact with Pb was 30-40 times higher than in normal individuals. It depended on the form in which Pb enters the organism and on adaptation to the effects of Pb. Cu, Si, and Mn contents were also elevated. Ti did not exceed the norm. (From Ref. Zh. Khim. 1963, Abstr. No. 51303; Chemical Abstracts 59: 15845, 1963)

- 2078** Waldman, R.K., and Borman, E.K. (Connecticut State Dept. Health, Hartford): A NOTE ON SERUM TRANSAMINASE ACTIVITY AFTER LEAD ABSORPTION. *A.M.A. Archives of Industrial Health* 19:431-3 (Apr.), 1959.

Examination of 25 persons industrially exposed to Pb showed that the serum glutamic oxalacetic transaminase (GOT) activity was >40 units in all except one whose blood Pb level was 0.02 mg/100 g. Blood Pb levels in the 24 others ranged from 0.045-0.14 mg/100 g. The subjects showed no symptoms of Pb poisoning. The authors conclude that wider use of the GOT test be made to study correlation with other findings.

- 2079** Warren, H.V. (Univ. British Columbia, Canada): GEOLOGY AND MULTIPLE SCLEROSIS. *Nature* 184:561 (Aug.), 1959.

A high prevalence of multiple sclerosis was noted in the areas having the following rock formations: Eocambrian sediments in Norway and Sweden; some granites in Telemark, Norway; the Old Red Sandstones of Northern Scotland; and many of the limestones of Southern Quebec, Ontario, and Central Nova Scotia. In these geological formations, higher than normal quantities of Pb are known to occur.

- 2080** Wu, H.W., Lu, S.H., and Chang, M.C. (Dept. Med., Hunan Med. Coll., Changsha, China): LEAD POISONING. TREATMENT OF 8 CASES WITH VITAMIN C AND MAGNESIUM SULFATE. *Chinese Journal of Internal Medicine* 7:143-5; 13 (Mar.), 1959.

The authors treated 8 cases of Pb poisoning with vitamin C and Mg sulfate. Vitamin C was given by iv drip, 1-2 g/daily in 500 ml of 5% glucose solution. Mg sulfate was given by im injection, 25% solution 5-10 ml every 8 hr. Three to four wk made up a course of treatment. In cases of severe abdominal pain, renal capsule block with procaine was done. All the cases were given ferrous sulfate for anemia.

Clinical observations showed that abdominal colicky pain was generally alleviated 2 days after treatment. In some cases of severe colicky pain, the pain was relieved by renal capsule block. All other symptoms such as nausea, vomiting, loss of appetite, dizziness, headache and fatigue improved after 1 or 2 days of treatment, and generally disappeared after 3 or 4 days. Symptoms of pain in the extremities and ache in the bones receded less rapidly. In 4 cases with hypertension, the symptoms disappeared in 2-14 days. In 6 cases there was a Pb line over the gums. After 3 wk of treatment, the condition disappeared in 2 cases, improved in 2 cases, and was unimproved in 2 cases. There was hepatomegaly in 2 cases. After treatment, the liver was nonpalpable in 1 case and diminished in size in the other. There was neuritis in 1 case, which improved after treatment. After 10 days of treatment, anemia improved in 6 cases; the stippled red cells decreased after a few days, and disappeared in around 2 wk. Coproporphyrinuria was positive in all cases on admission; at the end of treatment it was still positive, but to a much lesser extent. The body weight was increased in 6 cases at the end of treatment.

The authors carried out Pb poisoning experiments

in 20 white mice (10 as controls). The results showed that Mg sulfate only retarded the weight decrease in the animals, and did not exert any other protective effect. The 10 animals all died. (From authors' English summary)

- 2081** Yaverbaum, P.M. (Regional Hosp., Irkutsk, USSR): (BIOCHEMICAL AND HEMATOLOGICAL STUDIES OF PERSONS IN OCCUPATIONAL CONTACT WITH TETRAETHYL LEAD.) *Sbornik Nauchnykh Rabot Irkutskoi Oblasti Klinicheskoi Bol'nitsy* 1:177-85, 1959.

The author presents the results of a study on a number of biochemical factors in persons in contact with TEL and metallic Pb. Blood glutathione (reduced form) was examined in 59, the residual N in 34; hematologic tests were carried out on 50 and included erythrocyte sedimentation rate (ESR), red and white cell counts and Hb determination. There was a slight increase in glutathione in 69.5% (30.6-49 mg%; normal, 20-30) and normal levels in 30.5%. On the basis of the observed increase, it was inferred that liver function was intensified. In 11 out of 34 persons some tendency to an increase in residual N was observed (up to 47.4 mg%). No relationships could be established between high residual N and an increase in reduced glutathione. The ESR was lower in 50% of the cases and Hb was found to be slightly down in 72%. In 74% moderate erythropenia (anemia) was noted. Only 16% showed a reduction in the number of leukocytes, and if the lower limit as indicated by Chernov is observed (5500/mm<sup>3</sup>), 14 persons (28%) showed some degree of leukopenia. In 27 out of 50 (54%) an increase in the number of monocytes was observed, 18 were normal and 4 had a slightly lower figure. Assuming 1-50% being the normal number, only 3 showed a slight increase in the number of eosinophils. But eosinophilic granulocytes and lymphocytes were within the normal range. No correlation was found between length of contact with TEL and biochemical and hematologic changes.

- 2082** Zambrano, A., Rozera, G., and Biondi, S. (Univ. Naples, Italy): (LEAD POISONING AND ITS PREVENTION IN THE MANUFACTURE OF STORAGE BATTERIES.) *Folia med. (Naples)* 42:1168-93 (Oct.), 1959.

While workers in the manufacture of storage batteries failed to show any clinical signs of Pb poisoning, the hazard was considerable. Pb concentrations reached levels as high as 1.5, 2.5, and 3.9 mg/m<sup>3</sup>. Increased urine and blood Pb, urinary coproporphyrin, and stippled red blood cells were found in ~50% of the workers. Prevention measures are discussed. (From Chemical Abstracts 54:Abstract No. 11769, 1960)

- 2083** Zielhuis, R.L.: De Industriële Loodintoxicatie in Nederland. Beschouwingen en onderzoeken. (INDUSTRIAL LEAD INTOXICATION IN THE NETHERLANDS. DISCUSSIONS AND STUDIES.) *Nederlands Instituut voor Praeventieve Geneeskunde, Report* 46, 1959, 271 pp.

In chapters 1-6 the author evaluates the concept of Pb poisoning, the factors determining it, the signs and symptoms and the possible preventive measures. It is useful to distinguish 3 separate definitions

of intoxication: pharmacologic, clinical and compensational intoxications. The criteria to be used by the technical-hygienist are determined by the definition. The determining factors are presented schematically. The signs and symptoms in man are extensively discussed, and the Pb effect on hematopoiesis reviewed. Chapter 7 discusses the results of investigations of 233 Pb poisoning cases in 1953 and 1954, 16% of which the author concludes should be regarded as not conclusive, and of the remaining 84% most were among those occupied in storage battery and pigment plants. Methods of counting stippled erythrocytes and reticulocytes are evaluated. From a study of 117 nonexposed men the normal values for hemoglobin, stippled cells, reticulocytes and coproporphyrin was established: 12.8 g%, 0.5/1000, 9.0/1000 and 3.5(200 µg/l) respectively.

Hematologic studies were made in 43 workers from 3 different Pb processing plants over an 18 mo period; absence of increased number of stippled erythrocytes (SE) (>0.5/1000) and/or increased coproporphyrinuria (CP) ( $\geq 3$ ) argues against a relation between signs and increased Pb intake; generally, if the number of SE stays below a maximum limit of 1-1.5/1000, no anemia or other functional disturbances will occur; an increase in reticulocytes occurs before increased SE, and while CP is an early sign, it does not give a good idea of the extent of Pb intake; the product of intensity and exposure time does not give an adequate impression of the reaction of the organism to be expected; the anemia level is clearly dependent on the intensity of exposure but little on the duration. In chapter 12 the relation between degree and duration of exposure was investigated in 161 men from 2 pigment factories. The findings were that the MAC of Pb in air should not be >0.15 mg Pb/m<sup>3</sup> but rather set at ~0.10 mg Pb/m<sup>3</sup>. In chapter 13 the effect of industrial Pb exposure on the health of 513 workers in 23 factories is discussed. In pigment industries, in storage battery plants and in a shipyard decrease in hemoglobin was frequently observed. The results of this study, analyzed in chapter 14, confirmed the author's conclusions in earlier chapters. In chapter 15 an investigation is described on the possibility of improvement of hematopoiesis by administering 30 µg Vitamin B<sub>12</sub> for 4 wk daily orally but no effects were noticed. In chapter 16 experiments with rabbits are described which were to simulate Pb poisoning in man. The 3 groups of animals were given sc 1/8, 1/2 and 1 mg Pb chloride/kg weight daily. Based on these results, guiding rules for preventive medical examination are given in the last chapter. (400 references) (From English summary)

- 2084** Zielhuis, R.L.: THE MAXIMUM ALLOWABLE LIMITS FOR BIOLOGICAL DATA IN THE PREVENTION OF INDUSTRIAL INORGANIC LEAD INTOXICATION. *Pracovní Lékařství* 11:164-5 (Apr.), 1959.

See Abstract No. 2355.

- 2085** Zorina, L.A., and Vanshtein, I.A. (Inst. Ind. Hyg. Occup. Dis., Acad. Med. Sci., USSR): K voprosu o terapevticheskom znachenii kompleksionov pri khronicheskoi intoksikatsii svintsom. (THERAPEUTIC

VALUE OF COMPLEXING COMPOUNDS IN CHRONIC LEAD POISONING.) *Gigiena Truda i Professional'nye Zaboлевaniya* 3, No. 1:7-11, 1959.

In 32 patients, iv treatment with 20 ml of 10% CaNa<sub>2</sub>EDTA twice daily for 3 days, repeated 2-3 times at 4-5-day intervals, raised Pb excretion in urine 33-100-fold. General weakness and pain, headaches, stomach disorders, etc, during the first days of treatment were indications of its effectiveness. They disappeared at the end of the treatment. In 13 other patients receiving 2 g EDTA/day orally for 20 days, the urinary Pb increase was 8-20-fold with no side effects. With both compounds blood analyses showed unfavorable results during the first days of treatment. EDTA is advocated as an effective therapeutic in Pb poisoning, and its parenteral administration is recommended. (13 references)

1960

- 2086** Albahary, C. (France): Saturnisme et troubles de l'hémoglobino-génèse. (LEAD POISONING AND HEMOGLOBINOGENESIS.) Proceedings of the Society of Industrial Medicine and Hygiene. *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 21:352-6 (June), 1960.

On the basis of 4 case reports, blood findings indicative of thalassemia and Pb poisoning are discussed and it is pointed out that the same rate of increase of stippled red cells may be found in minor and minimal thalassemia as in Pb exposure. Concerning the physiopathological mechanism, only the globin is involved in thalassemia while in Pb poisoning Pb seems to act as an antienzymatic substance. Thus, the stippled cells may not be the result of an alteration of the mature blood corpuscles by the poison but may rather represent basophil complexes due to a disturbance in hemoglobin formation at the stage of erythroblasts.

- 2087** Albahary, C., Truhaut, R., Boudene, C., and Desoille, H. (Paris, France): Diagnostic et prevention du saturnisme par le versenate de calcium disodique. (DIAGNOSIS AND PREVENTION OF LEAD POISONING BY DISODIUM CALCIUM VERSENATE.) In Proceedings 13th International Congress on Occupational Health, New York, July 25-29, 1960 (published 1961), pp. 209-14.

See Abstract No. 2223.

- 2088** Aldanazarov, A.T., and Archabarov, B.A. (Kazakh Akad. Sciences, USSR): Uroven svintsa i gematoporfirina v moche u rabochikh svintsovykh zavodov v zavisimosti ot stepeni otravleniya. (LEAD AND HEMATOPORPHYRIN LEVELS IN THE URINE OF LEAD PLANT WORKERS AS A FUNCTION OF THE SEVERITY OF LEAD POISONING.) *Trudy Instituta Kraevoi Patologii, Akademiya Nauk Kazakhskoi SSR* 8:151-8, 1960.

Levels of Pb and hematoporphyrin were tested in the urine of 248 Pb plant workers. The group included apparently healthy subjects, subjects without symptoms but suspected of Pb intoxication, cases

of intoxication of varying degree of severity and patients with residual symptoms after an acute attack of Pb intoxication. Pb levels of 0.05 mg/l or higher, and hematoporphyrin levels of 6 units or higher were considered pathological. Increased levels were found in ~50% of apparently healthy workers, and of suspected Pb intoxication cases. With the appearance of symptoms and with increasing severity of Pb intoxication, the incidence of pathological urinary Pb levels increased to a high of 80%. The absolute levels of Pb and hematoporphyrin increased to a maximum of 0.24 mg/l and 10 units, respectively. In most cases, increased levels of hematoporphyrin were accompanied by reduced blood hemoglobin levels. Generally, hematoporphyrinuria preceded the appearance of stippled basophilic erythrocytes. Although increased urine levels of Pb and hematoporphyrin are indicative of exposure to or intoxication by Pb, normal values do not exclude Pb intoxication. (16 references)

**2089** Asano, I.: HAEMATOLOGICAL STUDIES ON LEAD ADMINISTRATION THROUGH THE RESPIRATORY TRACT IN HUMAN BEINGS. *Journal Osaka City Medical Center* 9:2101-18 (June), 1960.

This article is listed by title only in the Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School. Vol. 2, April 1959-March 1961, p. 26.

Pb acetate solution was experimentally administered through the respiratory tract to 2 healthy Japanese adults, using a new inhalation apparatus. The experiment covered a period of 238 days, from August to the following March. It was divided into the following 5 stages: In the 1st, 1 mg/day of Pb acetate (0.546 mg Pb) was administered by inhalation every day for 61 days; in the 2nd, 2 mg/day for 31 days; in the 3rd, 4 mg/day for 50 days; in the 4th, no Pb for 42 days; and in the 5th stage of 54 days, thiotic acid and CaEDTA were administered for the purpose of treatment. The results obtained were as follows: At first the amount of Pb in the blood increased with an abnormal increase in urinary coproporphyrin excretion and in the reticulocyte count. These increases diminished ~15 mo after discontinuation of the Pb intake. Stippled cells showed an increase followed by the development of anemia. Red cells and hemoglobin content decreased following the Pb administration almost in the same ratio. An increase in white cells and relative neutrophilia, with slight lymphopenia, was observed in the Pb-exposed, but these phenomena did not seem influenced by Pb. In the myelogram of subject A, the number of erythroblasts increased at the early stage of Pb absorption. Basophilic and polychromatic macroblasts increased also in both A and B during the Pb absorption period, while normochromatic normoblasts decreased in the last stage of Pb absorption. Thrombocyte count of subjects increased in the early stage of Pb absorption. (From APCA Abstracts 8, Abstr. No. 4696, 1962)

**2090** Aub, J.C. (Harvard Med. School, Boston, Mass.): THE COMPARISON OF ORGANIC AND INORGANIC LEAD POISONING. In California State Department of Public Health: The Fourth Air Pollution Medical Research Con-

ference, Dec. 7, 8, and 9, 1960. Berkeley, Calif., 1960, Proceedings of the third day, pp. 52-61.

Although Pb poisoning has been well investigated, some factors of absorption and treatment remain important to study in a comparison of inorganic Pb with organic Pb (TEL) intoxication. The latter is seen very rarely, since organic Pb in Pb-gasoline is transformed into inorganic Pb before it appears in auto exhausts. The author discusses briefly the 2 types of poisoning, then in greater detail, the metabolism of Pb as learned in laboratory animals and man, chiefly from the point of view of absorption via the respiratory tract. He then mentions Kaye and Reznikoff's analysis of New York City street dust before the use of TEL (1924) and in 1934, in which an almost 50% increase of Pb was found. Storage of Pb in bone is then discussed at some length with mention of the author's work (with G. Wislocki) on the Ca content in antlers of deer. This tissue undergoes very rapid growth and would be ideal for an evaluation of Pb storage in contaminated areas.

**2091** Baader, E.W. (Hanover, Westphalia, Germany): Die Porphyria cutanea tarda ist keine Berufskrankheit. (PORPHYRIA CUTANEA TARDA IS NOT AN OCCUPATIONAL DISEASE.) *Berufsdermatosen* 8:132-5 (June), 1960.

The author does not agree with Ippen's opinion that porphyria cutanea tarda is a chronic "subclinical" Pb intoxication and as such represents an occupational disease that requires to be reported and compensated. The 65-yr-old welder who had been exposed to Pb and later developed skin porphyria with corresponding urinary porphyrin excretion, did not show the typical history and clinical signs of Pb poisoning as Ippen maintains. Pb exposure does not simultaneously infer Pb poisoning. Furthermore, truck driving cannot be classified in the group of "Pb occupations" merely because many of Ippen's dermatologic patients were truck drivers. The author points out that for 120 yr it has been known that Pb does not affect 2 organs: the lung and the skin. In his own 35-yr-long practice he has seen no case with skin lesions due to Pb.

**2092** Baader, E.W. (Univ. Münster, Westphalia, Germany): SELF-POISONING WITH LEAD. *Industrial Medicine and Surgery* 29:1-7 (Jan.), 1960.

Deceitful cases of self-poisoning by eating Pb in order to prolong compensation and means to detect such cases are discussed. Five points are listed as possible signs of attempted deceit: (1) severe so-called relapses occurring after extended removal from exposure; (2) the presence of >4 mg Pb/100 g feces at 4 wk after stopping work; (3) the proportion of urinary (mg/l) to fecal Pb (mg/100 g) (normally 1:3); (4) the discovery of other metals than Pb in the feces (in printers, Sb and Sn were often found along with Pb just as they occur in the alloy of the type); (5) X-ray findings of the empty intestines.

**2093** Baker, J.B.E. (Charing Cross Hosp. Med. School, London, England): THE EFFECTS OF DRUGS ON THE FOETUS. *Pharmacological Reviews* 12:37-90 (Mar.), 1960.



The literature concerning the effect of Pb on the mother and the fetus is reviewed on pp 78-9. The conclusion is drawn that too high a concentration of maternal Pb early in pregnancy may cause fetal death by trophoblastic necrosis or by hemorrhages in the early placenta. Surviving fetuses or those not poisoned until later may show a specific picture of underdevelopment of unknown mechanism. (354 references)

- 2094** Bartolozzi, O., and Zurlo, N. (Univ. Milan, Italy): Effetti della profilassi con versenato di calcio negli operai esposti al piombo (EFFECTS OF THE PREVENTIVE TREATMENT WITH CALCIUM VERSENATE IN WORKERS EXPOSED TO LEAD.) *Medicina del Lavoro* 51:607-11 (Oct.), 1960.

From Aug. 1955 on, 400 workers of a battery plant have been treated preventively with 2 g/day of CaEDTA twice for 10 days/yr. No untoward reactions developed and brought considerable improvement in respect to Pb poisoning. Although the subjects remained exposed to Pb, the urinary porphyrin remained normal for 1 yr after the treatment so that a determination of the porphyrin content in urine was no criterion for Pb poisoning. In spite of high urinary Pb levels in many workers no signs of poisoning were seen. When removed from work the urinary level dropped to 50% within 1 mo. Morbidity at this plant dropped since 1955 to 3.5%, compared with 4.5% for other industries. From 1950-1955 there were 9 cases of Pb poisoning and from 1955-1959 only 1.

- 2095** Belknap, E.L.: REVIEW OF TEN YEARS OF PUBLISHED EXPERIENCES OF TREATMENT OF INORGANIC LEAD ABSORPTION IN THE ADULT WITH EDATHAMIL OR CALCIUM SODIUM EDTA. In Proceedings 13th International Congress on Occupational Health, New York, July 25-29, 1960 (published 1961), pp. 217-26.

A review of 10 yr of published experience involving treatment of Pb absorption with edathamil, or  $\text{CaNa}_2\text{EDTA}$ , is presented. This includes the indication for its use, the most effective technique of administration (iv or oral), and a discussion of its potential dangers as well as procedures which may be undertaken to determine whether its administration has been adequate.

- 2096** Bellini, F., and Finulli, M. (Univ. Milan, Italy): Gastroduodenite ed ulcera peptica nel saturnismo. (GASTRODUODENITIS AND PEPTIC ULCER IN LEAD POISONING.) *Medicina del Lavoro* 51:369-75 (May), 1960.

A study of 457 patients with Pb poisoning showed gastritis and duodenitis in 62 men (13.5%), and peptic ulcer in 18 (3.9%). The authors conclude that in subjects with definite Pb poisoning, particularly when repeated abdominal colics have occurred, Pb can be held responsible for a gastroduodenitis and probably also for peptic ulcer. Possible mechanism of action of Pb in the production of the lesion is discussed. (33 references)

- 2097** Boersma, M.J., and Beyer, T.: Tijdelijke nierbeschadiging gedurende behandeling met calcium-EDTA wegens loodvergiftiging. (TEMPORARY RENAL IMPAIRMENT DURING TREAT-

MENT WITH CA-EDTA FOR LEAD POISONING.) *Nederl. Tijdschr. v. Geneesk.* 104:1152-4 (June 11), 1960.

Renal dysfunction of a transient nature was caused in a patient, aged 29, by treatment with CaEDTA for Pb poisoning. Functional impairment was seen in the glomeruli as well as in the tubuli. (From *Bulletin of Hygiene* 35:969, 1960)

- 2098** Boogaardt, C.A., and De Mooij, H. (N.V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands): AIR POLLUTION FROM SOLDERING FUMES. *Industrial Medicine and Surgery* 29:36-8 (Jan.), 1960.

Examination of 42 female employees engaged in soldering did not reveal any facts pointing to Pb poisoning. The coproporphyrin level was  $<200 \mu\text{g/l}$  in 38 of the subjects, stippled cells  $<0.25\%$  in 39. The Pb concentration in the 4 soldering departments ranged from  $18-166 \mu\text{g/m}^3$  (av  $28-150$ ) at nose height, and from  $40-123 \mu\text{g}/100 \text{ m}^3$  (av  $67-104$ ) in the 2 fume areas of the soldering rooms. Investigations concerning possible additional absorption of Pb through the mouth by contact with Pb alloys are in process.

- 2099** Boyadzhiev, V. (Dept. Health, Ind. Hyg., Clin. Occup. Dis., Bulgaria): Vliyanie na kraveto mlyako i maslo vurkhu vuznikvaneto i protichaneto na olovnoto otravyane mezhdu akumulatorni rabotnitsi. (EFFECT OF MILK AND BUTTER ON THE APPEARANCE AND COURSE OF LEAD POISONING AMONG BATTERY WORKERS.) *Nauchni Trudove na Visshiya Meditsinski Institut, Sofia* 39, No. 3:143-70, 1960.

Investigations were done on 2 groups of workers in storage battery manufacturing plants; one received daily 1 l. fresh milk/person, the other, 100 g butter. The working and living conditions of the workers were also investigated in order to determine other possibilities for the appearance of Pb poisoning. Changes in the hematologic criteria and other cardinal symptoms were followed over a 10-mo period (6 experimental and 4 control months). It was established that both work and home conditions were about the same, showing that the observed changes in the criteria were due to the  $\sim 30$  times higher concentrations than normal at work. Under the influence of the experimental rations, almost the same changes appeared in the number of erythrocytes, leukocytes, polymorphonuclear cells and lymphocytes as well as in Pb pal-lor, etc. The author concludes that neither milk nor butter prevent the appearance of Pb poisoning. Some indicators decreased in the group given butter (hemoglobin, leukocytes). With discontinuance of butter rations some improved (erythrocytes, hemoglobin, color index, etc). Therefore, butter had a negative effect on the criteria studied. In confirmation of the opinion expressed in the literature, the author recommends for workers exposed to Pb, a diet rich in proteins and poor in fats. (From author's English summary; 20 references)

- 2100** Brieger, H. (Jefferson Med. Coll. Philadelphia, Pa.): CHELATING AGENTS IN THE PREVENTION AND TREATMENT OF OCCUPATIONAL DISEASES. *Archives of Environmental*

Health 1:271-7 (Sept.), 1960.

The review begins with the application of the principle of chelation in the treatment of Pb poisoning with the use of Na citrate by Kety and Letonoff in 1941, followed by the introduction of BAL, primarily for As poisoning (Peters et al), in 1945. These were followed in turn by the use of the Ca and  $\text{CaNa}_2$  salts of ethylenediaminetetraacetic acid (EDTA), penicillamine and DTPA. Experience in Be disease, poisoning with Mn, Cd, Te, Tl, and other metals is then briefly reviewed. The author summarizes his survey, first pointing out the questionable value of several clinical reports, by stating that the mechanism of action of BAL in As poisoning has been studied so perfectly that the recommended clinical application has met with results that correspond to theoretical predictions, but that this is not yet fully true of the interaction between other chelating agents and metals. However, results obtained in human beings correlate rather well with the results of animal experiments, and, in spite of theoretical gaps and practical limitations, the introduction of EDTA for the treatment of Pb poisoning has been an important advance. (60 references)

- 2101** Brieger, H.: THE USE OF CHELATING AGENTS IN OCCUPATIONAL MEDICINE. In Seven, M.J., and Johnson, L.A., ed.: Metal-Binding in Medicine. Philadelphia, Lippincott, 1960, pp. 200-4.

The use of chelates in chronic Pb, Hg, Be, Mn, Cd, Te, Tl, Sb, As, and radioactive metal poisonings is discussed. The author concludes as follows, taking into account the questionable value of several clinical reports: The action mechanism of BAL in As poisoning has been studied so completely that the recommended clinical application has met with results that correspond to theoretical predictions. Although this is not yet fully true in regard to other chelates and metals, the results obtained in humans correlate rather well with those of animal experiments. In spite of theoretical gaps and practical limitations, the introduction of  $\text{CaNa}_2\text{EDTA}$  for the treatment of Pb poisoning has been an important advance. (50 references)

- 2102** Brudevold, F. (Forsyth Dent. Infirmary, Boston, Mass.), Steadman, L.T. and Smith, F.A. (Univ. Rochester, N.Y.): INORGANIC AND ORGANIC COMPONENTS OF TOOTH STRUCTURE. Annals of the New York Academy of Sciences 85, Art. 1:110-32 (Mar. 29), 1960.

Pooled layer samples of enamel from teeth of known ages, collected at different geographic areas, were microradiographically analyzed for trace elements. Results showed that certain elements, including F, Zn, Pb, and to a lesser extent Fe, Ag, Mn, Si and Sn normally occur in greater concentrations in surface than in subsurface enamel. The Pb concentration in 6 successive layers, in ppm (dry weight), decreased from 210-47 in unerupted teeth, 350-35 (latter in 5th layer) in erupted teeth <20 yr, 360-54 at 20-29 yr, 520-200 (4th layer) at 30-49 yr, and 550-152 at >50 yr. The data demonstrate that the increase of Pb with age is also more marked in the external than internal portion of the enamel. Tooth enamel of primitive

people from 2 Pacific Islands and from Greenland contained smaller concentrations of Pb than enamel from the US. Certain constituents including carbonate, Na and Mg occurred in lower concentrations in surface than subsurface enamel, while others such as Cu, Sr, Al and K were evenly distributed. Pb concentrations in surface and body enamel of intact teeth from different geographical regions were 2.6-0.4 and 1.1-0.1  $\mu\text{M/g}$ , respectively. The distribution of Pb and Zn in crown dentin and roots was also studied. In crown dentin of teeth >50 yr age Pb content was  $\sim 300$  ppm, Zn >1200 ppm; in the roots of unerupted teeth, Pb was  $\sim 350$  ppm and Zn >1000.

- 2103** Bruno, L. (Health Dept., Alfa Romeo Soc., Italy): Il rischio di saturnismo tra i lavoratori addetti alle scocche di automobili. (THE HAZARD OF LEAD POISONING IN WORKERS OF A CAR BODY PLANT.) Medicina del Lavoro 51:225-31 (Mar.), 1960.

A study was made of 39 workers engaged in the soldering and polishing of car bodies which exposed them to the inhalation of large amounts of Pb-containing dust. Atmospheric samples at various operations showed concentrations of Pb from 1.137-6.385  $\text{mg/m}^3$ ; dusts contained up to 2120  $\text{mg/m}^3$ . The average Pb content in blood was 89  $\mu\text{g}/100$  ml, urinary coproporphyrins 26  $\mu\text{g}/100$  ml, stippled erythrocytes 700/million. When hand filing was introduced in place of machine filing and precautionary measures were set up, control tests after 1 yr gave the following results: blood Pb 68  $\mu\text{g}/100$  ml, urinary coproporphyrins 7.7  $\mu\text{g}/100$  ml, stippled cells 62/million.

- 2104** Bugyi, B. (City Hosp., Csepel/Budapest, Hungary): Röntgenologische Reihenuntersuchung zur Früherfassung der Knochen- und Gelenkerkrankungen beruflicher Genese. (ROENTGENOGRAPHIC SERIAL EXAMINATION FOR THE EARLY DETECTION OF BONE AND JOINT DISEASES OF OCCUPATIONAL ORIGIN.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 10:104-9 (May), 1960.

Systematic X-ray examination of the long tubular bones, especially in the metaphysical areas of the shank bone, is recommended for Pb workers. (29 references)

- 2105** Burger, G.C.E., and Frant, R. (TNO Inst. Ind. San. Eng., Netherlands): OCCUPATIONAL HEALTH IN NETHERLANDS. Annals of Occupational Hygiene 2:280-2 (Nov.), 1960.

The recent literature on industrial exposure to Pb is reviewed with special emphasis on some conflicting views between the findings of Dutch and American investigators. Various methods for coproporphyrin determination, and MAC-values for Pb in industrial exposure and food toxicology are discussed.

- 2106** Butt, E.M. (Univ. S. California, Los Angeles): TRACE METAL PATTERNS IN HEALTH AND DISEASE. In California State Department of Public Health: The Fourth Air Pollution Medical Research Conference, Dec. 7, 8, and 9, 1960. Berkeley, Calif., 1960, Proceedings of the third day, pp.

19-38.

Since the author was unable to present preliminary studies of Pb in tissues, he reported on some of the results of analyses of 12 elements in 10 tissues obtained at autopsy in the Los Angeles County Hospital. The work was carried out, with the exception for Hg, with an emission spectrochemical method, the accuracy of which was first determined. The elements examined were Pb, Fe, Mn, Cu, Zn, Mo, Ca, Al, Co, Ag, Cr and Cd, and the organs, liver, kidney, heart, brain, lung, spleen, pancreas, adrenal, thyroid and jejunum. The detailed data for all elements and tissues are shown in 4 tables. In premature and full-term infants, Cu, Zn, and Fe in liver were higher than in adults. The mean Pb contents in premature infants' liver was (mg/100 g dry tissue) 0.31; in full-term, 0.35; in 3 mo-1 yr, 0.28; in adult controls, 0.79. Pb values in the lung and liver had a tendency to show maxima in the middle age groups, but not so or less obviously in other organs. In a tabulation of mean Pb concentrations in liver, lung, spleen and brain, at ages from 0-1, 1-20, 21-30, etc up to 100 showed ranges as follows, in mg/100 g dry tissue, respectively: 0.42-95, with the highest in the ages 31-70; 0.48-1.10 highest at 41-50, decreasing to 0.50 at 81-100 yr; 0.27-0.69; 0.26-0.38. Since very high quantities of Pb in liver had been found in a New York case of Mediterranean anemia with excessive Fe storage, J. Ellis of Cornell University School of Medicine sent tissues from 53 autopsies (cancer, heart, etc diseases). In general, differences of metal values were not great, but Pb values for liver, brain and spleen were ~2 times the values for the LA Hospital cases. Comparisons of Pb in liver, pancreas and jejunum with Fe were also made in Bantu siderosis, hemochromatosis, Cooley's anemia and pulmonary siderosis.

The author concludes as follows: It is quite evident that Pb accumulates, particularly in the liver, in response to excessive Fe storage. The converse was true in a few proved instances of exposure to Pb. Therefore, elevated hepatic Pb levels cannot be interpreted as *prima facie* evidence of Pb intoxication. The question arises whether Pb in response to Fe storage has an insidious or latent effect on hepatic cells, affecting their abilities to excrete Fe. If not, then the body must have enormous powers of metal-binding, since clinical findings of Pb intoxication, such as anemia, red cell stippling and urinary excretion of coproporphyrins were not present in the cases of hemochromatosis, aregenerative anemias and other Fe-storage diseases. Hemosiderin, a combination of protein and Fe, may act as a binding agent not only for Fe but for excess Pb, Ca, Cu, Zn and Mo. Special stains revealed that Cu and Fe were present in pigment granules of giant cells in certain forms of hepatic cirrhosis.

- 2107** Butt, E.M., Nusbaum, R.E., Gilmour, T.C., and DiDio, S.L.: TRACE METAL PATTERNS IN DISEASE STATES: HEMOCHROMATOSIS, BANTU SIDEROSIS AND IRON STORAGE IN LAENNEC'S CIRRHOSIS AND ALCOHOLISM. In Seven, M.J., and Johnson, L.A., ed.: *Metal-Binding in Medicine*. Philadelphia, Lippincott, 1960, pp. 43-9.

See preceding abstract.

- 2108** Candura, F., Villa, T., Candura, M., and Czechieli, S. (Univ. Pavia, Italy): IRON METABOLISM OF SUBJECTS TREATED WITH  $\text{CaNa}_2\text{EDTA}$ . *Lavoro Umano* 12:369-81, 1960. EDTA was administered iv to normal and Pb-poisoned individuals and the urinary and fecal excretion of Fe was determined colorimetrically. EDTA did not remove Fe from transferrin to any significant degree. Urinary Fe levels were not significantly elevated during chelation therapy except for a rise during the 1st 24 hr, which subsequently returned to normal. Fecal Fe levels were not materially changed. (From Chemical Abstracts 58:6113, 1963)

- 2109** Casula, D., Cherchi, P., and Spinazzola, A. (Univ. Cagliari, Italy): Sul comportamento di alcune prove di funzionalità epatica in soggetti esposti al rischio saturnino. (THE BEHAVIOR OF CERTAIN LIVER FUNCTION TESTS IN SUBJECTS EXPOSED TO LEAD.) *Rassegna Italiana di Gastro-Enterologia* 6:639-54 (Dec.), 1960.

Liver function tests were performed on 31 workers exposed to Pb as founders or typographers for 12-30 yr. Ten of these men showed signs of chronic Pb intoxication, 9 showed increased Pb absorption and 12 were free of clinical and laboratory signs of Pb poisoning. A number of subjects, most frequently those with chronic Pb poisoning, showed a slight deficiency of liver function as manifested by the glycemic curve and a small reduction of the level of serum pseudocholinesterase.

- 2110** Casula, D., Cherchi, P., and Spinazzola, A. (Univ. Cagliari, Italy): Sul comportamento dei fattori del complesso protrombinico in soggetti esposti al rischio saturnino. (BEHAVIOR OF PROTHROMBIN COMPLEX FACTORS IN SUBJECTS EXPOSED TO LEAD POISONING RISK.) *Rassegna Medica Sarda* 62:703-11 (Sept.-Oct.), 1960.

The activity of the prothrombin complex, proconvertin, proaccelerin, prothrombin alone, prothrombin + proconvertin, was studied in 62 subjects exposed to Pb. All subjects were divided into the following 3 groups: (1) all subjects showing clinical and chemical signs of Pb chronic intoxication (19 cases); (2) subjects without clinical signs of intoxication but with physiologic signs of Pb absorption: >70% Pb in blood, >200  $\mu\text{g}$  in 24 hr urine, >100  $\mu\text{g}$  coproporphyrin in urine, increase in stippled erythrocytes (14 cases); (3) subjects without clinical or physiologic signs but with a long-term (10-30 yr) exposure to Pb (29 cases). Reduction in the values of prothrombin and proconvertin was observed frequently. Proaccelerin, on the other hand, did not show any variations. This reduction in activity did not reach beyond 70% of the normal value. No essential difference was found in the behavior of the prothrombin complex between group 1 and 2, in which ~35% decrease in prothrombin complex value was observed; 15% of the subjects in group 3 showed subnormal value. Administration of vitamin K (30 mg, daily, for 4 consecutive days), to all cases with prothrombin and proconvertin values <80% of the normal value,

did not seem to exert a significant influence. Only in 3 cases did the values return to normal. It is concluded that the reduction in the prothrombin complex activity observed, might be due to a decrease in the production of these factors by the liver.

- 2111** Cermeño y Cermeño, F. (Avila Prov. Inst. Health, Spain): Epidemiologia de la intoxicación por plomo en la provincia de Avila. (EPIDEMIOLOGY OF LEAD POISONING IN THE PROVINCE OF AVILA.) Revista de Sanidad e Higiene Publica 1960:85-100 (Jan.-Feb.).

The province of Avila represents a poverty region of Spain with substandard living and housing conditions, lack of hygiene, malnutrition, and related problems. The geography, population distribution, topography and climate are described. People and livestock drink the same water from open wells. However, the cause of epidemics of Pb intoxication in this region has been discovered to be in the consumption of wine, after a survey had excluded occupational source. Analysis of a sample suspected to have caused poisoning gave 100 mg/l by the colorimetric method. Search for the origin of this Pb disclosed solubility from a glaze which covers the inside of the earthenware jars and kettles. Three further samples from various receptacles had Pb contents ranging from 60-450 mg% (?). The main factors causing high Pb content in wine were (1) storage in glazed containers, (2) the presence of acids in the wine, such as is the case during fermentation, and (3) a duration of contact of wine with the glaze sufficiently long to dissolve the Pb. The etiology and symptomatology of acute and chronic Pb intoxication are briefly given. Measures for the elimination of the hazard included an investigation for the identification of the wine barrel vendors. From 1956-1958, 62 cases of Pb intoxication were found of which 32 were women and 30 men.

- 2112** Cervetti, S., and Casucci, G. (Univ. Genoa, Italy): Osservazioni sul comportamento elettroforetico delle siero-proteine nella intossicazione florida da piombo. (OBSERVATIONS ON THE ELECTROPHORETIC BEHAVIOR OF SERUM PROTEINS IN SEVERE LEAD POISONING.) Lavoro Umano 12, No. 10:452-62, 1960.

The electrophoretic pattern of serum proteins in 57 subjects with severe Pb poisoning showed a decrease of the total proteins in 18 cases, of the albumins in 23 cases, a reduced value of albumin to globulin ratio in 15 cases, an increase of  $\alpha$ -globulins in 8 cases, of the  $\beta$ -globulins in 10 and of the  $\gamma$ -globulins in 19. These findings were considered to be due to a mild functional liver impairment provoked by Pb poisoning. Almost all the colloidal tests gave normal results.

- 2113** Cherchi, P., and Spinazzola, A. (Univ. Cagliari, Italy): Sul comportamento delle prove omogeniche in soggetti esposti al rischio saturnino. (STUDY OF THE COAGULABILITY OF THE BLOOD AND CAPILLARY RESISTANCE IN PERSONS EXPOSED TO LEAD.) Archivio Italiano di Scienze Mediche

Tropicali e di Parassitologia 41:655-62 (Dec.), 1960.

In a study on 28 workers from a Pb foundry and the printing industry, the subjects were placed into 3 groups, showing: (1) clinical and biological signs of chronic Pb poisoning, 14; (2) no obvious clinical evidence of Pb poisoning but clear biologic signs of Pb absorption, 7; (3) no Pb-effects even though duration of exposure had been 10-30 yr, 7. In addition to the usual tests, the following hematological tests were undertaken: the tourniquet, Hecht's test, bleeding time, coagulation time, Howell's recalcification time, platelet counts, clot retraction, Quick test, fibrinogen level. The protocols of all the 28 subjects investigated are presented in a table giving the results of the tests in detail. More than half the workers with clinical signs of Pb intoxication, and 1/3 of those with signs of increased Pb absorption, gave results in the tourniquet and Hecht tests, 10-15% above the normal level. The changes in fragility of the blood vessels are generally proportional to the degree of Pb absorption and the duration of exposure. (14 references).

- 2114** Chernavina, L.F.: (USE OF ULTRAVIOLET IR-RADIATION FOR CORRECTION OF SOME DISTURBANCES OF METABOLIC PROCESSES IN WORKERS IN DANGEROUS OCCUPATIONS.) Ul'trafioletrovoe Izluchenie 1960, No. 3:154-7.

Increased blood alkaline phosphatase was found in 58% of 1275 workers of the Sevkabel factory, Leningrad, with no apparent dependence on season. From 78-88% of workers in dangerous occupations had increased alkaline phosphatase, compared with 48% of those in nondangerous occupations and 47% of those in service positions. Persons in the dangerous jobs were likely to be exposed to heat, Co, H sulfide, and benzene, or to Pb. Values of alkaline phosphatase >10 units were considered elevated. At the Sevkabel factory a procedure was organized for exposure of selected groups to natural and artificial ultraviolet. Such exposures tended to restore alkaline phosphatase levels to normal. (From Chemical Abstracts 56:5075, 1962)

- 2115** Chiesura, P. and Micheli, F. (Univ. Padua, Italy): Osservazione clinico-statistiche sulla distribuzione professionale del saturnismo. (CLINICO-STATISTICAL OBSERVATIONS ON THE OCCUPATIONAL DISTRIBUTION OF LEAD INTOXICATION.) Folia Medica (Naples) 43:1017-29, 1960.

A group of 156 individuals who received INAIL benefits for permanent disability caused by Pb intoxication and another group of 142 subjects, suspected of Pb intoxication were studied over a 3-yr period. Data are tabulated for the 1st group on the incidence of Pb poisoning in various occupations and regions, the degree of disability in the various occupations, and the principal toxic manifestations at various degrees of disability. Data tabulated for the 2nd group show the proportion of non-poisoned and poisoned subjects in the various occupations and the degree of their intoxication. The results of the study are discussed. (16 references).

- 2116** Cimasoni, G., and Oltramare, M. (Dental and Stomatol. Polyclinic; Med. Polyclinic, Geneva, Switzerland): Plomb et parodontolyse. (LEAD AND PYORRHEA.) Schweiz-erische Monatsschrift für Zahnheilkunde 70:903-11 (Oct.), 1960.

A 39-yr-old Italian man employed for less than a year in the manufacture of bronze containing 25% Pb showed, besides the usual signs of Pb poisoning, a distinct gingival Pb line with loosening and loss of several teeth for which he claimed additional compensation. A review of the literature and own studies on workers with and without Pb exposure failed to establish Pb poisoning as a cause of pyorrhea even though parodontal disorders frequently appear in Pb poisoning cases.

- 2117** Corsi, G.C. (Univ. Padua, Italy): La diagnosi nell'intossicazione professionale da arseniato di piombo. (DIAGNOSIS IN OCCUPATIONAL INTOXICATION BY LEAD ARSENATE.) Rivista degli Infortuni e delle Malattie Professionali 47:169-77 (Jan.-Feb.), 1960.

Problems encountered in the diagnosis of intoxication with Pb arsenate are discussed. In the acute form which is generally caused by ingestion of Pb arsenate, gastrointestinal symptoms characteristic of As intoxication prevail. In the chronic form which is usually caused by inhalation of Pb arsenate, the symptomatology varies. In most cases the aspect of Pb intoxication predominates but in some cases a mixed syndrome of As and Pb intoxication results. A picture of pure As poisoning is rare. Since the clinical findings are inconclusive, special laboratory tests, such as determination of As and Pb in blood and urine, urinary coproporphyrin and protoporphyrin in the blood, are required. In the chronic form, As and Pb deposits should be first mobilized by BAL and EDTA. Urinary concentrations of As and Pb >300 and 500 µg/l, respectively, and protoporphyrin values in the blood 100-150 µg/100 ml are indicative of intoxication. (15 references)

- 2118** Cumings, J.N. (Inst. Neurol. Natl. Hosp., London, Eng.): COPPER, IRON AND LEAD METABOLISM AND THE BRAIN. In: Bowman, P.W., and Mautner, H.V., ed.: Mental Retardation. Proceedings of the First International Medical Conference at Portland, Maine, New York, Grune and Stratton, 1960, pp. 288-301.

The author introduces his review on the title subject (74 references) by stating that various metals when deposited in the brain or in other organs, may affect the metabolic processes by a number of different actions. They may cause the destruction of cells by a toxic action, modify the function of cells by altering the essential enzyme systems, or affect cells so that, although function is preserved, it is so altered as to give secondary features. Cu metabolism is discussed in some detail, as relatively much is known about it. The review of Pb is limited to a section on encephalopathy and its associated chemical features. This condition is most common in children, the cause being inorganic Pb. Organic Pb, because exposure is at work, gives rise to cerebral lesions only in

adults. There is considerable variation in data for urinary Pb excretion in Pb encephalopathy compared with normal subjects. Some workers have found normal values but a large number of records show a raised Pb content. Pb levels determined by 27 groups of workers in blood, urine, cerebrospinal fluid, brain, liver and long bones in Pb encephalopathy are tabulated. Such enzyme studies as have been done have given negative results. A Pb line in the long bones has been seen only in young children and not in adults. Mental sequelae may occur in up to 30% of cases. No correlation between Pb levels in the body fluids and the occurrence of mental symptoms has been observed.

- 2119** Del Valle, R., and Gamo Herranz, A. (Provincial Hosp., Guadalajara, Spain): Saturnismo crónico. (CHRONIC LEAD POISONING.) Revista Clínica Española 76:120-3 (Jan. 31), 1960.

To the increased and diversified use of Pb in industry as a major cause of Pb intoxication must be added the exposure to Pb in the general environment, dangerous because of its ease of pulmonary, cutaneous and oral absorption. The latter causes include drinking water from Pb pipes, food packed in Pb containing materials and accidental ingestion of Pb such as occur in the infant. Two cases of Pb poisoning, in a 52 and a 66-yr-old women, with colic, stippled erythrocytes and other typical signs and Pb in urine (no value given) due to the use of a glazed earthenware jar in which vinegar was kept are described. An investigation of the cooking habits in patients' vicinity revealed a similar condition in the daughter of one of the patients. The authors uncovered 2 further cases in a married couple who had been using Pb glazed dishes.

Treatment in these cases was with  $\text{CaNa}_2\text{EDTA}$  and symptomatic treatment with antispasmodic drugs and vitamins.

The authors state in closing that the identification and removal of causes of Pb intoxication are more important than cure.

- 2120** Dinischiotu, G.T., Nestorescu, B., Radulescu, I.C., Ionescu, C., Preda, N., and Ilutza, G. (Colentina Hosp., Bucharest, Romania): STUDIES ON THE CHEMICAL FORMS OF URINARY LEAD. British Journal of Industrial Medicine 17:141-5 (Apr.), 1960.

Pb in urine has been determined by a wet-ashing technique to give total Pb (Bessman et al, 1955) and by a standard coprecipitation technique to give precipitable Pb (Cholak et al, 1948). In 44 normal subjects, with an exposure to Pb not greater than that of normal living conditions, values obtained by both methods were the same (43.0 and 42.6 µg/l). In 72 subjects heavily exposed to Pb in their work (increased absorption); of whom 15 showed no clinical or laboratory signs of Pb poisoning (group 1) and 57 had clinical Pb poisoning (group 2) the precipitable Pb was significantly less than the total Pb: 95.5 and 130.4 µg/l respectively for group 1 and 150.04 and 256.9 µg/l group 2. Thus, as much as 40% of urinary Pb can escape determination by the coprecipitation methods of estimation. Preliminary findings suggest that the nonprecipitable Pb may be present as a

natural chelate.

The significance of these observations is discussed as follows: In normal subjects where the amount of Pb absorbed equals that which is excreted, the urinary Pb is eliminated entirely as precipitable Pb, but where there is increased absorption with or without Pb poisoning the urinary Pb appears in 2 forms. The nonprecipitable Pb found only in urine of persons exposed to Pb appears thus to distinguish them from those with only a physiological absorption. The level of nonprecipitable urinary Pb increases with the total Pb excretion and is highest in those suffering from Pb poisoning. The principal condition governing the excretion of this nonprecipitable Pb fraction is the degree of Pb accumulation which may be found equally in those not suffering from clinical Pb poisoning rather than the clinical state of those suffering from Pb poisoning. The danger is stressed that cases of threatened Pb intoxication may be overlooked if only coprecipitation methods of estimation Pb in urine are used.

- 2121** Dłużniewska, K., and Górczyńska, K. (Inst. Hyg., Acad. Med., Kraków, Poland): Stopień narażenia na zatrucie ołowiem robotników zatrudnionych w hutach ołowiu i cynku oraz w zakładach graficznych. (THE DEGREE OF EXPOSURE TO LEAD POISONING OF WORKERS IN LEAD AND ZINC FOUNDRIES AND PRINTING WORKS.) *Przegląd Lekarski* 16, No. 6:190-5, 204, 1960.

In 1955-57, the authors examined the conditions of environment and health of workers in a Zn and Pb foundry (275 males) and a printing works (229 males), in order to estimate the degree and real frequency of Pb poisoning in the 2 kinds of works. Investigation of the environment showed that the conditions in both the foundry and the printing works were unsuitable. The concentration of Pb in the air of the Zn-Pb factory was especially high, 20-600 times higher than the Soviet standard permitted concentration of 0.01 mg/m<sup>3</sup>; this was also exceeded in the printing works (3-10 times as high). Medical examination of the workers showed subjective and objective symptoms characteristic of Pb poisoning. Headache, loss of appetite, loss of muscular strength, a metallic taste in the mouth and nausea were frequent complaints. Among the objective symptoms the most characteristic were hypochromic anemia (average erythrocyte count 3,860,000, Hb 12.17 g/100 ml, index 0.93 for workers in the Pb-Zn foundry; for those in the printing works the erythrocyte count was 4,200,000, Hb 13.2 g/100 ml and index 0.95), the excretion of coproporphyrin III in the urine (56.7% of foundry workers and 11.7% of printing works employees), and the concentration of stippled erythrocytes (32% of foundry workers and 9.6% of printing works employees). In the Zn and Pb foundry, 40% of workers and in the printing works, 4.8% were found to have Pb poisoning. The authors conclude that the known principles of health protection for those in contact with Pb are not carried out and that constant control and examination of the conditions of work and health is still necessary. (From *Excerpta Medica*, Sect. 17, 7:Abstr. No. 2596, 1961)

- 2122** Dmitriev, V.F., Gazarkh, L.A., and Shipitsyn, S.A. (Med. Inst., Irkutsk, USSR): CONTENTS OF MANGANESE, NICKEL, LEAD, CALCIUM, AND MAGNESIUM IN PROTEINS OF THE BRAIN. *Mikroelementy v Pochvakh. Vodakh i Organizmakh Vost. Sibiri i Dal'nego Vostoka i ikh Rol v Zhizni Rast., Zhivotnykh i Cheloveka*, Akad. Nauk SSSR, Sibirsk. Otd., Tr. Pervoi Konf., Ulan-Ude 1960:99-104 (published 1961).

Spectrographic analyses of brain proteins showed the presence of 0.013-0.048% Pb (av 0.022%) in animal brain proteins and 0.012-0.020% (av 0.015%) in human brain proteins. (From *Chemical Abstracts* 59:6780, 1963)

- 2123** Dominici, L.M., Micheloni, F., and Bigotto, M.R.: Le intossicazioni da piombo nell'industria ceramica della Repubblica di San Marino. (LEAD POISONING IN THE CERAMIC INDUSTRY OF SAN MARINO.) *Igiene e Sanità Pubblica* 16:13-22 (Jan.-Feb.), 1960.

The Republic of San Marino has a long history of work with ceramics, chiefly glass, but cases of Pb poisoning have only rarely been reported though 300 persons out of a total population of the republic of 15,000 are employed in such work. Two large establishments employ 145 and 85 persons respectively; the remainder work in small workshops where the hygienic conditions leave a good deal to be desired.

In the manufacture of the so-called "lead glass" PbO and red Pb are used in considerable amounts as fluxes to make the colors adhere to the matrix and to make them more brilliant, the amounts of PbO varying from 3-40%. The authors examined all 300 workers clinically and selected basophilia as the simplest index of early Pb absorption and though not even those longest in the industry showed evidence of overt Pb poisoning, in some the history of digestive disturbances, etc., was suggestive. However, 30% showed evidence of Pb "impregnation" which was not necessarily related to age, sex, type, or length of work, suggesting some contingent condition which the authors consider was essentially neglect of the rules, particular reference being made to the neglect of personal cleanliness, especially of the hands, as a potent accessory factor.

Nevertheless, 30 persons, 14 male and 16 female, were found to have a basophil rate of 1:300. Their ages ranged from 12-67 yr (only 2 were >40 yr) and the length of time they were exposed to risk varied from 25 days to 50 yr though only 4 had done such work for >10 yr. The authors consider that regular medical inspections at brief intervals together with the examination of blood films for basophilia is essential for prevention, together with education of the operatives as to the possible risk. Six of the 30 with high basophilia had done such work for a maximum of 8 mo, and only 1 of these was >20. (From *Bulletin of Hygiene* 35: 760, 1960)

- 2124** Dymshits, Ya.M., and Misharin, A.P. (Med. Inst., Irkutsk, USSR): TRACE ELEMENTS IN LYMPH-ADENOID TISSUES. *Mikroelementy v Pochvakh. Vodakh i Organizmakh Vost. Sibiri i Dal'nego Vostoka i ikh Rol v Zhizni*

Rast., Zhivotnykh i Cheloveka, Akad. Nauk SSSR Sibirsk. Otd., Tr. Pervoi Konf., Ulan-Ude 1960:105-9 (Published 1961).

Spectrographic analyses of Si, Ni, Mn, and Pb showed the following Pb contents in mg%; normal tonsils from 47 autopsies 0.006-15 (av 1.4); pathologic tonsils from 154 tonsillectomies 0.001-34.0 (av 1.15); normal appendixes from 56 autopsies 0.017-2.90 (av 0.471); pathologic appendixes from 71 appendectomies 0.003-1.23 (av 0.26); adenoids removed from 8 children 0.168. The results indicated that the minimum and average amounts of trace elements studied were higher in normal than in pathological lymphadenoid tissues. This may be a result of the adaptation reaction of the diseased organism. (From Chemical Abstracts 59:9151, 1963)

**2125** Eisler, L., and Bartoušek, V. (Div. Occup. Dis., Neurol. Div., KUNZ, Ostrava, Czechoslovakia): Neurologické a psychiatrické poruchy při otravě olovem. (NEUROLOGICAL AND PSYCHIATRIC DISORDERS IN LEAD POISONING.) Pracovní Lékařství 12:362-5 (Sept.), 1960.

The authors present a case of encephalopathy due to Pb poisoning in a 37-yr-old man, which developed after a brief exposure (5 mo) in a wire hardening shop. The extent of exposure was illustrated by the finding of up to 3.9% (0.17 g in 4.43 g) dust/m<sup>2</sup> deposited on the furnace. The intoxication manifested itself first by gastrointestinal symptoms; after these subsided, neurological symptoms appeared. These included, apart from a single epileptoid paroxysm, small focal disorders providing evidence of the affection of the brain stem of the diencephalon. The psychic symptomatology was marked by depression, temporary confusion and delirium. The patient was treated with CaNa<sub>2</sub>EDTA Spofa and in addition the preparation was used twice for mobilizing the Pb bound in the tissues. The laboratory results are shown in figures. Upon admission, Hb was 74%, stippled cells 54/10,000, Pb in blood 108 µg%, urinary porphyrin 3+. (13 references)

**2126** Emmerson, B.T., and Thiele, B.R. (Brisbane Hosp., Govt. Chem. Lab., Australia): CALCIUM VERSEINATE IN THE DIAGNOSIS OF CHRONIC LEAD NEPHROPATHY. Medical Journal of Australia 1:243-48 (Feb. 13), 1960.

The difficulty of deciding in a particular case of chronic renal disease whether the lesion was due to childhood Pb poisoning or to other factors is pointed out. Urinary Pb excretion was determined after intravenous (iv) injection of 1 g CaNa<sub>2</sub>EDTA to 9 patients with nephropathy (31-54 yr old, 6 of whom were known to have had Pb exposure in childhood, 1 had recent (7 mo before) acute Pb poisoning, and 2 none) and 1 subject (46 yr) who had had Pb poisoning in childhood but had no renal lesion. There were 6 normal control subjects. The results of the study were presented in tables and figures. Pb content in skull bone, determined in 4 of those exposed to Pb in childhood, ranged from 4.6-19.5 mg/100 g moist bone; in 2 controls, 1.4-2.7. Urinary Pb 6 days after EDTA ranged in the patients from 0.59-3.83 mg (cumulative) and from 0.02-0.61 mg in the controls in 4 days after EDTA. It was

found that increased and prolonged urinary Pb excretion followed after iv infusion of CaNa<sub>2</sub>EDTA in some patients with advanced renal disease due to childhood Pb poisoning though they had not had any appreciable Pb exposure for periods up to 40 yr.

**2127** Eolian, S.L., and Eramian, S.G.: Ob izmenenii vozбудimosti obonitel'nogo analizatora pri vozdeistvii nekotorykh proizvodstvennykh khimicheskikh venchestv. (ON CHANGES IN THE EXCITABILITY OF THE OLFACTORY ANALYZER DURING THE ACTION OF VARIOUS TOXIC SUBSTANCES.) Vest. Otorino-Laringol. (Moscow) 22:40-3 (Nov.-Dec.), 1960.

The excitability of the olfactory analyzer was studied by the Elsberg-Levi olfactometric method in 224 persons having contact with Pb. The olfactory analyzer excitability decreased in Pb intoxication. The authors concluded that olfactometry may facilitate the detection of early signs of Pb intoxication. (From APCA Abstracts 8: Abstr. No. 4673, 1962)

**2128** Fatzer, R. (Wädenswil, Switzerland): Ein Beitrag zum Bleibenzinproblem. (CONTRIBUTION TO THE PROBLEM OF LEADED GASOLINE.) Praxis 49:350-2 (Apr. 7), 1960.

The review on the hazards arising from the use of leaded gasoline is illustrated with the case of a truck driver who complained about insomnia, intestinal disturbances, pain in the joints, etc., and showed severe gingivitis. The author remarks that in his 20 yr of dental practice he had never seen such purulent gums. The patient complained that there was often an odor of gasoline in his cab. The gingivitis disappeared rapidly after treatment with CaEDTA (even after the 1st injection), and the patient remained in perfect health when he was allowed to use Pb-free gasoline in his truck. The author regards these facts sufficient to warrant a diagnosis of Pb poisoning. Although he discusses briefly the MAC in air and Pb levels in blood and urine, the latter were not determined in this case, for as he states, such values are only relative and subject to wide disagreement from author to author as to interpretation.

**2129** Fernández-Sánchez, F., and Santos-Ruiz, A. (Inst. Gregorio Rocasolano, Madrid, Spain): (TRACE ELEMENTS IN NORMAL AND PATHOLOGIC HUMAN TISSUES. VI. NORMAL AND MYOMATOUS UTERINE TISSUE. VII. UTERINE CARCINOMAS.) Rev. espan. fisiol. 16 (Supplement 3):201-9; 211-8, 1960.

Pb was found in 47 specimens of myomatous and normal uterus. Spectrographic analysis of 53 carcinomas showed the consistent presence of Pb. However, between normal and tumor tissue no difference was found in the concentration of Pb. (From Chemical Abstracts 55:4718, 1961)

**2130** Fischer, R.E.: Das Schrifttum über die Bleikrankheit aus den Jahren 1953-58. (THE LITERATURE ON DISEASES CAUSED BY LEAD EXPOSURE, 1953-58). Clausthal-Zellerfeld, Gesellschaft Deutscher Metallhütten-und Bergleute e. V., 1960, 137 pp.

An extensive review and an annotated bibliography of the 413 references of the literature from 1953-58 are presented. The material is arranged according to the following topics: Occurrence of diseases caused by Pb exposure; Pb in the air and dust of streets; pathways of Pb in the body; biological effects of Pb; diagnosis, therapy, and prophylactic measures in Pb intoxication; protective measures in industry; hazards due to TEL.

- 2131** Gaultier, M., Gajdos, A., Gajdos-Török, M., Fournier, E., and Gervais, P.: L'intérêt diagnostique et thérapeutique des dosages de porphyrines dans le saturnisme. (DIAGNOSTIC AND THERAPEUTIC IMPORTANCE OF DETERMINATIONS OF PORPHYRINS IN SATURNISM.) *Pathologie et Biologie* (Paris) 8:1993-2003 (Nov.), 1960.

An elevation of urinary porphyrin correlating with an increase of erythrocytic porphyrins is found constantly in evident clinical Pb intoxications. A normal level of erythrocytic protoporphyrin permits the dismissal of a diagnosis of Pb poisoning even in an individual who has been exposed to Pb, and other causes have to be investigated (liver disorders, other types of poisoning). On the other hand an increase of protoporphyrin with a normal coproporphyrin level can be present in an individual exposed to low risk of Pb poisoning although clinical indications are not yet evident. The Pb mobilization test, by iv infusion of  $\text{CaNa}_2\text{EDTA}$ , enables decision as to doubtful cases. Counts of stippled erythrocytes remain a sound practice, though other causes may provoke their appearance (thalassemia). The indicated treatment of Pb intoxication is infusion of EDTA twice daily for 6 days with a pause after which the treatment has to be repeated. The importance of the repetition of the treatment has been proved, for when the Pb level soon becomes normal, EDTA cannot mobilize any appreciable amount of Pb stored in the bones, which has not yet been mobilized.

The provocation test, after a few days' pause, is the best test toward recovery because the coproporphyrin level becomes normal well before detoxication is complete, while that of protoporphyrin remains elevated for some time. (From *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 23:179-80 (Abstracts), 1962)

- 2132** Gemke, G.R. (East.-Kazakh Reg. Div. Publ. Health, Ust'-Kamenogorsk, USSR): K voprosu o sostoyanii arterial'nogo tonusa pri vozdeistvii svintsia. (THE ARTERIAL TONE UNDER THE INFLUENCE OF LEAD.) *Gigiena Truda i Professional'nye Zabollevaniya* 2:49-53, 1960.

The blood pressure was studied in the brachial and temporal arteries of 345 men working in the agglomeration, crushing, charging, and dust-trapping shops of a Pb plant. Individuals up to 40 yr of age showed a rise in pressure in the brachial artery. Lowering of pressure occurred frequently at a higher age. In general, regional temporal hypotension was observed more often than hypertension. Other findings included asymmetry of the arterial pressure and arterial dystonia. (12 references)

- 2133** Gemke, G.R. (East-Kazakhstan Regional Dept. Health, USSR): Funktsional'noe sostoyanie limfaticheskikh sosudov pri saturnizme. (THE FUNCTIONAL STATE OF THE LYMPHATIC VESSELS IN SATURNISM.) *Klinicheskaya Meditsina* 41:111-4 (Jan.), 1960.

The author conducted dynamic investigations of the functional condition of lymphatic vessels in 40 patients with occupational Pb poisoning. The method of Primak-Herbst with intradermal introduction of adrenaline and measurement of the area of the white spot (lymphangiogram) was used. It was found that in Pb poisoning the lymphatic vessels undergo considerable functional changes. They consist of a diminution of the area of lymphangiogram in Pb colic attended by arterial hypertension, as compared with subjects suffering only from Pb anemia. Upon subsidence of clinical manifestations, there is seen a considerable increase of the area of the lymphangiogram, which is more pronounced in persons with an elevated arterial pressure who had suffered previously from Pb colic. (From author's summary)

- 2134** Gerarde, H.W. (Esso Res. Eng. Co., Linden, N.J.): CHEMICALS IN INDUSTRY. Federation Proceedings 19, Part II (Suppl. 4) 22-5 (Sept.), 1960.

In this discussion, the author emphasizes the "explosion" in the development of new chemicals in the past 20 yr, and the need of testing their toxicity for employee safety. In illustration of the need of detecting chemicals or metabolites in body fluids for precautionary measures, a table showing biological threshold limits, based on exposure tests, includes Pb and TEL, respectively, as follows (mg/l): blood 0.08, 0.07; urine 0.15 and 0.12.

- 2135** Gerin, C., Pollini, R.R., and Balbo, W. (Italy): CLINICOSTATISTICAL AND MEDICOLEGAL STUDIES CARRIED OUT ON 2,000 WORKMEN AT THE MEDICOLEGAL CENTER OF INDUSTRIAL TOXICOLOGY OF THE UNIVERSITY OF ROME. Abstracts of the 13th International Congress on Occupational Health, New York, July 25-29, 1960, No. 17-5.

Case material on 2000 workmen exposed to Pb and other poisons in air over a long period is presented. In a considerable percentage of cases, laboratory studies showed evidence of initial intoxication, although very few cases of "full-blown" disease resulted. Need for early diagnosis through periodic tests and medicolegal evaluation of damage to health is discussed.

- 2136** Goldwater, L.J. (Columbia Univ., New York, N.Y.): OCCUPATIONAL EXPOSURES AS ETIOLOGIC FACTORS IN HEART DISEASE. A.M.A. Archives of Industrial Health. 21:509-13 (June), 1960.

Pb is listed among chemicals reported to act on the heart, its alleged action being myocardial degeneration. (33 references)

- 2137** Granata, M.: (CASE HISTORIES OF SATURNISM IN CERAMICS WORKERS.) *Minerva medicolegale* 80:90-4 (Jan.-Apr.), 1960; Cumulated Index Medicus 1:A-488, 1960.



- 2138 Grandjean, E., and Wüthrich, M. (Inst. Hyg. and Ind. Physiol., Zürich, Switzerland): Untersuchungen über die Bleigefährdung von Splissern. (STUDY ON THE LEAD HAZARD OF SPLICERS.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 10:153-8 (July), 1960.

Fifty men of whom 42 were splicers of telephone cables, ranging from 25-50 yr old, so engaged from 6 mo-10 yr, and 8 solderers or installers were subjected to a medical examination. The following findings were made: In a test with 15 subjects the water in which the men washed their hands contained an average of 17-33 mg Pb per person. The majority of air analyses in the manholes ranged from 0.01-0.02 mg Pb/m<sup>3</sup> except during scraping and brushing of the couplings when for a short time values between 1 and 29 mg/m<sup>3</sup> were observed. Urinary Pb of the splicers ranged from 0-0.1 mg Pb/l, most of them were 0.01-0.06 mg/l. Case history and subjective complaints did not exceed those of a normal group. There were 3 cases of finger tremor, 1 case of anemia and 4 cases of increased stippled erythrocytes. However, since these were isolated cases, they could not be considered as symptoms of Pb damage. No relationships were noted between the frequency of complaints and the objective signs or the urinary Pb level. The frequency of digestive complaints was higher than normal which may have been caused by the fact that the splicers worked at night. The authors conclude that the favorable results of the investigations are due to proper training and personal hygiene combined with relatively good health conditions of the examined men.

- 2139 Grevisse, J. (Univ. Liège, Belgium): Applications thérapeutiques des sels de l'acide éthylène-diamino-tétra-acétique. (THERAPEUTIC APPLICATIONS OF THE SALTS OF ETHYLENE DIAMINOTETRAACETIC ACID.) Revue Médicale de Liège 15:125-32 (Feb. 15), 1960.

The chemistry, metabolism, toxicity and medical application of EDTA in Pb and other heavy metal poisonings is reviewed on the basis of 129 references.

- 2140 Grisler, R., and Finulli, M. (Univ. Milan, Italy): Utilita' della tecnica semplificata della clearance dell'acido para-aminoippurico nello studio delle nefropatie vascolari professionali. (USE OF SIMPLIFIED TECHNIQUE FOR p-AMINOHIPURIC ACID CLEARANCE IN STUDYING OCCUPATIONAL VASCULAR KIDNEY DISEASES.) Medicina del Lavoro 51:376-80 (May), 1960.

The technique used by the authors is that of Bettge and Simon (1955), which permits a reliable evaluation of renal plasma flow (RPF) by determining p-aminohippuric acid (PAH) clearance, as based on the decrease, vs time, of plasma concentrations of PAH after a single injection, without need of collecting the urine with a catheter. As determined on 15 normal subjects, an average of 620 (530-780) ml/min was obtained. In 20 patients with nonoccupational hypertension, the RPF in 13 was lower than normal; 6 of them showed an azotemia >50 mg% and in 7 renal damage was definitely

established. In 20 patients with Pb poisoning, 4 with acute colic (av 500 ml/min RPF) 3 showed decrease in RPF, with only 1 of them exhibiting arterial hypertension which regressed at the end of colic. In 5 with colic that had receded a short time before (av 560 ml/min RPF) reduction in RPF was observed in only 2; all had normal tension. In 3 with Pb anemia without colic present or past (av 760 ml/min RPF) RPF was normal; 1 was hypertensive. In 8 with chronic poisoning (av 457 ml/min RPF), RPF was reduced in 6 cases of whom 4 were hypertensive, and normal in 2, both normotensive.

The authors conclude that the technique gives results that are comparable to those reported by other authors employing more complicated methods for Na thiosulfate and PAH clearance, and recommend it for the study of subjects with occupational poisoning accompanied by possible vascular lesions, as it provides a picture of renal function. (17 references)

- 2141 Haeger-Aronsen, B. (Univ. Lund, Malmö, Sweden): STUDIES ON URINARY EXCRETION OF  $\delta$ -AMINOLAEVULIC ACID AND OTHER HAEM PRECURSORS IN LEAD WORKERS AND LEAD-INTOXICATED RABBITS. Scandinavian Journal of Clinical and Laboratory Investigation 12, Supplement 47:1-128, 1960.

The metabolism of trace quantities of Pb, Pb toxicology and the value of certain laboratory tests in the early detection of increased Pb absorption are reviewed in the 1st 2 chapters.

In Chapter 3, methods are described for determination of ALA, porphobilinogen (PBG), coproporphyrin + coproporphyrinogen ("CP") and Pb in the urine and ALA in serum as well as the number of basophilic stippled cells (BSC) in the blood. ALA was shown to be stable in urine of pH 4-7 but unstable at higher pH values, while PBG and "CP" were most stable in slightly alkaline urine. Therefore, if urine has to be stored before determination of ALA and PBG, it should be divided into 2 parts, 1 of which is adjusted to pH 4-7 and the other to pH 7-9.

Chapter 4 gives the normal ranges for the urinary concentration of ALA, PBG, "CP", Pb and creatinine as determined for humans and rabbits and shown in numerous tables. No differences were found with sex. The mean urinary excretion of ALA by 100 apparently healthy individuals was 0.29 mg/100 ml (SD = 0.14) or, in terms of weight/g of creatinine, 1.52 mg (SD = 0.59). In Chapter 5, findings are reported on urine and in certain cases blood from 307 individuals (135 Pb workers, 75 patients with different types of porphyria, 47 patients with miscellaneous diseases) and 85 rabbits. Earlier observations that many workers employed in Pb industries have an increased urinary excretion of ALA but, in most cases, a PBG excretion within the normal range, were confirmed. The urinary excretion of ALA was also markedly raised in Pb-poisoned rabbits. In contrast to what was found in the Pb workers, the urinary PBG was also increased.

Chapter 7 deals with observations on Pb-poisoned patients and rabbits treated by administration of EDTA or penicillamine. The urinary excretion of ALA decreased rapidly at the same time as the Pb

excretion increased. The pathologically high excretion of ALA in Pb-intoxication therefore seems to be correlated with the amount of ionized or easily available Pb in the organism.

In the remaining Chapters the application of certain physical and enzymatic methods is first described to the identity of the "ALA", excreted in increased amounts in Pb poisoning. Since Mauzerall and Granick (1956) questioned whether the substance estimated as ALA was identical with  $\delta$ -aminolevulinic acid or only a fraction of the total "ALA." Consideration of the results obtained suggests that the abnormally high excretion of ALA during Pb poisoning can be the result of both prerenal and renal damage. The prerenal disorders possibly responsible for the raised serum concentration of ALA are discussed.

In an attempt to ascertain whether determination of the urinary ALA might be of value in the routine medical control of Pb-workers, the increases in urinary ALA and "CP" and the number of BSC in the blood were compared. This showed that demonstration of an increase in urinary ALA is a more sensitive index of the presence in the body of excessive amounts of Pb and reflects the order of such an increase more accurately, besides which it is the earliest change detectable by these methods. Apart from Pb intoxication, acute intermittent porphyria cutanea tarda and some types of porphyria occurring in South Africa are the only diseases in which the urinary ALA is known to be raised. In these porphyrias the raised excretion of ALA is almost always accompanied by an increase in the excretion of PBG. Of the 47 patients with various diseases, mainly liver disease and hemolytic anemias, the urinary ALA was normal in all except 3, in whom it was only slightly raised. Intoxication of rabbits with Ca, Cu, Zn, As, Ag, Sn, Hg, Tl and Bi was not followed by any increase in the excretion of ALA.

Periodic examination of the urine from Pb workers in different departments of a storage battery industry showed that the increase in the urinary ALA varied directly with the degree of exposure to Pb. The results suggest that the workers occupied with plate finishing, assembling, pasting + oxide mixing and plate forming are exposed to the greatest risk of Pb intoxication, while work in the Pb storage, casting and charging departments appears to involve no appreciable hazards.

The author concludes that in the routine medical supervision of factory workers, determination of the urinary ALA should be a valuable test, giving an early and reliable indication of increased absorption of Pb.

- 2142** Harada, A., Orita, J., and Takahashi, S. (Yuasa Storage Battery Co. Ltd.; Clinic, Takatsuki, Osaka, Japan): (THE REACTIONS OF HEALTHY MEN FOLLOWING LEAD WORK.) *Ko-kumin Eisei* 29:65-78, 1960.

Seven healthy men with no previous Pb exposure were employed in work with Pb contact at various concentrations for 200 days. Pb showed no effect on leukocytes, but erythrocyte counts, Hb content and specific gravity of whole blood decreased and then were restored gradually. Higher concentrations of Pb produced more rapid onset, deeper effects, and slower recovery. The patterns observed

in the behavior of the basophilic stippled cells and reticulocytes, and the coproporphyrin in urine are described. The amount of Pb in blood and in urinary excretion increased to a constant level according to the extent of Pb exposure. Increase of urobilinogen in urine was observed only in 2 cases with high Pb exposure. (From *Chemical Abstracts* 55:4822, 1961)

- 2143** Hofmann, A.F., and Smiley, J.D. (Coll. of Physicians and Surgeons, Columbia Univ. and Presbyterian Hosp., New York, N.Y.): IDIOPATHIC HYPOPARATHYROIDISM PRESENTING WITH SEIZURES. A PATIENT EXHIBITING MOBILIZATION OF LEAD DURING TREATMENT. *American Journal of Medicine* 28:147-51 (Jan.), 1960.

A case of idiopathic hypoparathyroidism with a history of repeated grand mal seizures was reported. The patient, a 46-yr-old woman, exhibited periods of memory loss, papilledema and retinal hemorrhages despite normal cerebrospinal fluid. The fundal findings, unilateral neurologic signs and electroencephalographic abnormalities simulated a brain tumor, but cleared after treatment. The diagnosis of hypoparathyroidism was made after determination of serum P and Ca levels of 7.4 and 5.5 mg%. The patient was given a low P diet and a daily regimen of 3.75 mg dihydrotachysterol orally and 10 ml of 10% Ca gluconate iv. Pursuant to the previously considered diagnosis of Pb encephalopathy, blood and urine Pb determinations were obtained after 6 days of therapy, with the following results: blood 0.26 mg% (normal 0.07-0.12), urine 0.30 mg/l (normal 0.08 mg/24 hr). For the next 3 wk, the patient received orally daily 3.75-7.5 mg dihydrotachysterol and 7-10 g of Ca lactate. Vitamin D at a daily dose of 100,000-200,000 units was then substituted for the dihydrotachysterol. Four weeks after starting therapy, the blood and urine samples showed no detectable Pb. Smears of peripheral blood for stippling remained negative and random urine tests disclosed no coproporphyrin III. The other symptoms disappeared and the patient returned to good health. A blood test 2 yr after admission showed no Pb.

The authors conclude that Pb mobilization from skeletal stores occurred during therapy, and mechanisms involved in interrelationships between Pb, Ca and P metabolism are discussed. No history of increased Pb exposure in this patient could be determined. (40 references)

- 2144** Hofreuter, D.H. (US Pub. Health Serv., Cincinnati, O.): PRELIMINARY REPORT OF FIELD STUDIES OF LEAD AND CARBON MONOXIDE. In California State Department of Public Health: The Fourth Air Pollution Medical Research Conference, Dec. 7, 8, and 9, 1960. Berkeley, Calif., 1960, Proceedings of the third day, pp. 5b-18.

The data reported here on the blood and urinary levels of Pb among a cross-section of urban and rural populations are included in the final report published in 1961. (See Abstract No. 2269.)

- 2145** Holtzman, R.B.: SOME DETERMINATIONS OF THE RaD AND RaF CONCENTRATIONS IN HUMAN

BONE. US Atomic Energy Commission Document No. ANL-6199, 1960, pp. 94-106. Surgical bone and tooth specimens were analyzed for  $^{226}\text{Ra}$ ,  $^{210}\text{Pb}$ , and  $^{210}\text{Po}$ . Data are tabulated. An attempt was made to determine whether or not any correlation exists between  $^{210}\text{Pb}$  and  $^{226}\text{Ra}$  concentrations in various types of bone. (From Nuclear Science Abstracts 15:8475, 1961)

- 2146** Horiuchi, K., Horiguchi, S., Nagao, Y., Hashimoto, K., Asano, I., and Noma, H.: A SURVEY ON THE INFLUENCE OF LEAD EXPOSURE UPON NEW EMPLOYEES IN AN ELECTRIC BATTERY WORK. Osaka City Medical Journal 6, No. 1:71-7, 1960. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 2, April 1959- March 1961, pp. 31-7.

New employees, ~20 yr old, were examined. The average atmospheric Pb concentration in the work-shops was 0.05-1.8 mg/m<sup>3</sup>; the Pb in the air consisted mainly of Pb oxide dust of a particle size of 0.2-3.0  $\mu$  in diameter. Red blood cell counts showed a slight increase during the first 1-4 wk and then gradually stabilized at a lower level. The Hb content decreased for ~6-8 wk and stayed at the low level. Four weeks after exposure, stippled cells were found in all blood samples; the reticulocyte count was not influenced. Urinary and fecal Pb increased; the Pb concentration in the blood did not increase significantly until 6-12 mo after the start of exposure. There was a significant increase of urinary coproporphyrin (CP). Workers removed from Pb exposure showed decreased urinary Pb and CP, and increased Hb content.

- 2147** Huckvale, W.S. (Consolidated Mining and Smelting Co. Ltd., Trail, B.C.): THE CONTROL OF A LEAD HAZARD IN INDUSTRY. Occupational Health Review 11; No. 4:17-20, 1960.

Inorganic Pb compounds and TEL are discussed in relation to toxicity, sampling and standards, tests for Pb absorption, symptoms and signs of Pb poisoning, and facilities for small industries. In conclusion it is stated that a Pb hazard exists when there are  $\geq 2$  mg Pb/10 m<sup>3</sup> air in 8 hr and is most toxic when taken in through the respiratory tract. Well run medical and hygienic programs will eliminate acute Pb poisoning and reduce chronic Pb poisoning to a minimum.

- 2148** Humperdinck, K. (Ruhr Miners' Org., Bochum, Germany): Die Bleivergiftung. (LEAD POISONING.) Medizinische Klinik (Munich) 55:2125-7 (Nov. 18), 1960.

This is a review and discussion of the occurrence, symptoms and treatment of occupational Pb poisoning, based on 41 references.

- 2149** Hursh, J.B. (Univ. Rochester, N.Y.): NATURAL LEAD-210 CONTENT OF MAN. Science 132:1666-7 (Dec. 2), 1960.

Samples from the whole body ash of 18 cadavers (age at death 32-85 yr) were analyzed for  $^{210}\text{Po}$ , and the measurement, converted to disintegrations per unit time, gave the equivalent of  $^{210}\text{Pb}$  acti-

vity. The results gave an average content of 0.015 pCi/g wet bone (0.0053-0.032). The contribution of  $^{210}\text{Pb}$  to the radioactive dose from natural sources constituted ~1/5 that from internally deposited  $^{226}\text{Ra}$  and its daughters.

- 2150** Huzl, F., Joachimsthaler, J., Sýkora, J., and Syblík, J.: Otravy olovem v keramickém průmyslu. (LEAD POISONING IN THE POTTERY INDUSTRY.) Pracov. Lék. 12, No. 5:256-9, 1960.

Clinical observations on pottery workers are described, with special emphasis on the effect of Pb in pregnancy. The conclusion is drawn that, in pottery plants, Pb poisoning occurs through the digestive system. CaNa<sub>2</sub>EDTA is administered to outpatients with Pb exposure for the prophylaxis of Pb poisoning. Measures have been taken to improve conditions in the industry. (From Excerpta Medica, Sect. 17, 7:Abstr. No. 852, 1961)

- 2151** Ippen, H. (Med. Acad., Düsseldorf, Germany): Berufsbedingte Porphyria cutanea tarda. (OCCUPATIONAL PORPHYRIA CUTANEA TARDA.) Berufsdermatosen 8:135-9 (June), 1960.

Ippen replies to the various objections made by Baader and points out that these objections do not change his viewpoint. He suggests further study of cases of porphyria and their relationship.

- 2152** Ippen, H. (Med. Acad., Düsseldorf, Germany): Die subklinische Bleischädigung. (SUBCLINICAL LEAD POISONING.) Berufsdermatosen 8:139-50 (June), 1960.

The prolonged effect of small amounts of Pb can cause organic lesions in certain organs, particularly in the liver, which remain unrecognized for some time. This phenomenon is designated as "sub-clinical Pb poisoning." The condition may lead to a liver cirrhosis as demonstrated by porphyria cutanea tarda. There is a direct relationship between the skin lesions and the hepatosis, but only an indirect connection to Pb. In the absence of other influences causing possible hepatic lesions and in the presence of an extended Pb exposure the described liver pathology and the chronic hepatic porphyria should be recognized as an occupational disease. This is essentially a discussion of "latent" Pb poisoning; significance of Pb porphyrinuria; relationship of Pb to liver; Pb and porphyria. (94 references)

- 2153** Izar, G. (Siena, Italy): Come si visita.. un nefroarteriosclerotico da saturnismo cronico. (HOW TO EXAMINE...A PATIENT OF NEPHROARTERIOSCLEROSIS CAUSED BY CHRONIC LEAD POISONING.) Minerva Medica 51:1893-4 (May 19), 1960.

A 55-yr-old man, tinner since adolescence, had suffered from gastrointestinal disturbances for the past 20 yr. He was a light eater, heavy drinker, moderate smoker. The author was consulted subsequent to attacks of pain in the lumbar region, swelling of legs, scant urine. Upon finding albumin in the urine, the patient was prescribed proper diet and rest. Shortly before writing the report, the author saw the patient in a highly

aggravated condition. Complaints were dizziness, anorexia, anuria during the day, nocturia, dyspnea, dry cough accompanied by cyanosis. Among clinical and laboratory findings were yellowish pale facial color; inflamed, easily bleeding gums; grey blue line; missing or poor teeth, highly incrustated with tartar; blood pressure 210 maximum, 120 minimum, heart enlarged; superficial arteries serpiginous, rigid; liver slightly enlarged; albumin in urine; red cells 2,800,000; white, 2,500; no basophil stippling; eyes, no retinal or vascular lesions in fundus. The author based his diagnosis of nephroarterial sclerosis due to chronic Pb poisoning on the occupation of the patient ("saturnism is not rare in tanners," and "according to Devoto absorption of 1 mg Pb/day for 40 days suffices to produce saturnism"), the digestive disturbances, dental and gingival lesions, the peripheral abnormalities of heart and arteries, and hypochromic anemia.

- 2154** Kairkabaev, M.K.: (THE CARBOHYDRATE FUNCTION OF THE LIVER IN CHRONIC LEAD POISONING.) Trudy Inst. Kravoi Patol., Akad. Nauk Kazakh. SSR 8:178-86, 1960.

Disturbed carbohydrate metabolism was found in 83.2% of 98 patients with Pb poisoning. Disturbed liver carbohydrate metabolism ran parallel to the gravity of intoxication and was frequently expressed as a reduced and delayed rate of glycogen formation, and occasionally in the depletion of liver glycogen reserve. (From Referat. Zhur. Khim., Biol. Khim. 1961, Abstract No. 7S1493; Chemical Abstracts 55:20213, 1961)

- 2155** Kakhn, Kh.A.: THE EFFECT OF CALCIUM DI-SODIUM ETHYLENEDIAMINETETRAACETIC ACID ( $\text{CaNa}_2\text{EDTA}$ ) ON THE EXCRETION OF LEAD FROM THE ORGANISM. Tr. 1-oi (Pervoi) Biokhim. Konf. Pribaltiisk. Resp. i Belorussii, Biokhim. Obshchestvo, Tartu 1960:473-5 (published 1961).

Eleven patients suffering from chronic Pb intoxication received iv 20 ml of a 10% solution of  $\text{CaNa}_2\text{EDTA}$  daily for 3 days. After 3 days' interruption the same procedure was repeated. Pb concentration in the urine was highest after 2 days of treatment. The therapy normalized the erythrocyte and reticulocyte count; the porphyrinuria disappeared. (From Chemical Abstracts 58:8350, 1963.)

- 2156** Kapetanović, K., Radmić, S., and Soldatović, D. (Univ. Belgrade, Yugoslavia): Proteinske frakcije krvnog seruma kod osoba hronično trovanih olovom. (SERUM PROTEIN FRACTIONS IN PERSONS WITH CHRONIC LEAD POISONING.) Acta Pharmaceutica Yugoslavica 10, No. 3:125-9, 1960.

The Pb concentration in the blood and albumin,  $\alpha_1$ -,  $\alpha_2$ -,  $\beta$ - and  $\gamma$ -globulin in the blood serum was determined in 36 persons with chronic Pb poisoning and the average values obtained were compared with those of normal individuals. The Pb content in the blood of the Pb-poisoned subjects ranged from 39 to 142  $\mu\text{g}\%$ . The albumin fraction in their blood serum was decreased by an average of 20%, the  $\alpha_1$ -globulin in most cases was some-

what lower than in controls,  $\alpha_2$ - and  $\beta$ -globulin remained unchanged and  $\gamma$ -globulin was decreased by an average of 50%.

- 2157** Kaye, S. (State Health Dept., Richmond, Va.): LEAD POISONING. Virginia Medical Monthly 87:31-2 (Jan.), 1960.

The derivatives of Pb, the use and properties of the compounds are briefly reviewed. The MLD of soluble Pb salts is  $\sim 10$  g/150 lb weight and of TEL,  $\sim 100$  mg/150 lb weight. The symptoms, identification and treatment of Pb intoxication are listed and the author concludes with a brief discussion of  $\text{CaNa}_2\text{EDTA}$  in the treatment of acute and chronic cases in adults and children.

- 2158** Kehoe, R.A. (Univ. Cincinnati, O.): TETRAETHYL LEAD - THE DISPOSITION OF AN INTERNATIONAL CHEMICAL HAZARD. In Proceedings 13th International Congress on Occupational Health, New York, July 25-29, 1960 (published 1961), pp. 126-9.

This paper deals with hygienic policies and procedures instituted in 1926 in the TEL industry and subsequent modifications and improvements. Principles of industrial medicine and hygiene as applied in the manufacture and transport of TEL involved physiologic and toxicologic investigation and the design of commercial operations. Toxicological information obtained by conventional laboratory procedures was not sufficient for industrial hygiene purposes but had to be translated into technologic methods for quantitative measurement and into meaningful techniques for determining physiologic and clinical responses of exposed personnel, along with their significance. This involved experiments with animals. The feasibility of widespread hygienic control depended on limitation of exposure to as few sites and to as few personnel as possible, and therefore the development of a definite pattern of commercial operations had to be evolved, ie, the concentration of manufacturing activities at sites where expert technical and hygienic and medical facilities and personnel could be assembled. Transportation necessitated special containers, distinct labeling, special handling, and transport personnel. Mixing procedures were limited to a minimum number of sites; model mixing equipment was designed; safe, hygienic mixing instructions were issued; and proper technical and medical supervision was furnished.

Special situations took into consideration the following: proper cleaning and repairing methods of gasoline storage tanks in order to prevent hazardous exposures; operating manuals giving instructions for all operations along with safety and health instructions; consultations with and informing occupational health authorities in various countries where the product was to be introduced, of all hygienic facts brought to light by research and experience; advice and assistance in achieving the best results was given which in turn brought about a reasonably uniform international program of industrial medicine and hygiene; medical consultants in operating areas who act professionally for the TEL industry to see that the laws and practices of their country along with the requirements of the medical advisors of the industry

are complied with.

All this has led to the maintenance of an exceptionally adequate hygienic regimen for >30 yr.

- 2159** King, E., and Thompson, A.R. (London Hosp.; Vauxhall Motors Ltd., Luton, England): RELATIVE SIGNIFICANCE OF TESTS FOR INDUSTRIAL LEAD ABSORPTION AND POISONING DETERMINED BY FIELD SURVEYS. *Industrial Medicine and Surgery* 29:534-9 (Nov.), 1960.

See Abstract No. 2290.

- 2160** King, E., and Thompson, A.R. (London Hosp., London; Vauxhall Motors, Luton, England): A FIELD SURVEY TO DETERMINE THE RELATIVE SIGNIFICANCE OF TESTS FOR INDUSTRIAL LEAD ABSORPTION AND POISONING. In *Proceedings 13th International Congress on Occupational Health*, New York, July 25-29, 1960 (published 1961), pp. 301-11.

See Abstract No. 2290.

- 2161** Kissel, P., Colleson, L., Dureux, J.B., Rauber, G., and Anthoine, D.: Le mégadol-ichocôlon saturnin. (SATURNINE MEGADOL-ICHOCOLON.) *Presse Médicale* 68:1739-42 (Oct. 26), 1960.

The occurrence of Pb intoxication with abdominal colics in 2 men, aged 52 and 42 yr, respectively, was discussed. In the 1st case intoxication was due to the drinking water which contained 4 mg% Pb; in the 2nd case the patient had been exposed to work with minium for 18 mo. Laboratory tests showed Pb levels in the blood of 95 and 135 µg%, respectively, and basophilic erythrocytes. Radiological examinations revealed a segmentary enlargement of the colon in the 1st case and a total enlargement accompanied by megadolichocolon, in the 2nd. Evidence of the latter had also been obtained by clinical tests. The possibility of the occurrence of megacolon due to Pb intoxication was pointed out.

- 2162** Lewis, C.E. (Texas Eastman Co., Longview): THE TOXICOLOGY OF ORGANOMETALLIC COMPOUNDS - PART I. *Journal of Occupational Medicine* 2:183-7 (Apr.), 1960.

Chemical properties of TEL and the differences in the effects of inorganic and organic Pb compounds on the organism are described. The case of a worker who had been exposed to TEL while cleaning some storage tanks, is reported. He showed mild generalized muscle weakness, coarse tremors of the extremities, increased activity of the deep tendon reflexes and maniacal outbursts. Urine analysis, white blood cell and hemoglobin count and peripheral blood smear gave results within normal limits. The man recovered completely over a 3-mo period.

- 2163** Lyubomudrov, V.E.: (EARLY MANIFESTATIONS OF TETRAETHYLLEAD INTOXICATION.) *Vrachebnoe Delo* 1960, No. 2:175-8. Translation, US Office of Technical Services OTS:60-31, 485.

The arterial blood pressure was studied in 78 workers exposed to 0.001-0.0002 mg TEL/l air. Data obtained before employment were compared with those after employment of 3 mo, 3-6 mo, and >6 mo.

The maximum pressure in the temporal artery and in the brachial artery of the same side were both measured with the same sphygmomanometer but with different cuffs. The vegetative innervation was determined by symmetrical galvanometric and perspiration measurements of the skin with Mishchuk's apparatus. The frequency and degree of galvanic and perspiration asymmetry was markedly increased even though no signs of TEL poisoning (bradycardia, hypotension, loss of weight and sleep, etc) were observed. Only 8 of the 45 persons employed for 6 mo and 7 of the 13 employed for >6 mo complained of periodic headaches with characteristic localization. The brachial arterial blood pressure did not go down in workers employed <6 mo, but the maximum arterial blood pressure was decreased in 4 of the 16 persons employed for >6 mo, and the minimum was decreased in 9 of them. The trend of the arterial blood pressure values could not be determined in the >6 mo group because no preemployment data were available. A general decrease in the ratio temporal/brachial arterial blood pressure was observed. All 13 workers in the >6 mo group showed hypotension in brachial arterial pressure. The conclusion is drawn that vegetative asymmetry and a high degree of hypotension should be regarded as early manifestations of TEL intoxication.

- 2164** Micheli, F., Pera, S., Vecchioni, V. (Center for Study of Work Accidents, INAIL-ENPI, Florence, Italy): Aspetti medico-sociali del saturnismo. (MEDICAL-SOCIAL ASPECTS OF LEAD POISONING.) *Rivista degli Infortuni e delle Malattie Professionali* 47:998-1008 (Nov.-Dec.), 1960.

The authors discuss the various aspects of Pb intoxication which, because of the rising use of Pb and its compounds, now has become an important problem of diagnosis and prevention. Indeed, this industrial disease presents for the Insurance Board an increase of both sanitary assistance and social welfare which is reflected in changes made in industrial disease laws in 1952 which include Pb poisoning. The authors observe that the gravest form of the disease affects laborers in the prime of their work capacity and produces permanent disabilities in ~35%. They have also found that the greatest number of cases with residual disabilities occur among workers of the chemical and earthenware industries. The average duration of chronic Pb poisoning has been found to be 136 days and it has been established that the digestive system is the one to be most affected. In closing, the authors point to the economic losses caused by this technology and recommend efficient hygienic and preventive action to be carried out primarily by the industrial physician.

- 2165** Milošević, B. (Epidemiol. Inst., Coll. Med., Belgrade, Yugoslavia): O redim oblicima trovanja olovom s naročitim osvrtom na hronični nefrit. (ON RARE FORMS OF LEAD POISONING WITH A SPECIAL REVIEW OF CHRONIC NEPHRITIS.) *Medicinski Glasnik* 14:248-52 (May), 1960.

The review, based on 83 references, was prompted by the publication of Danilović et al (1957) on the occurrence of endemic nephritis.

- 2166** Miyake, S.: A STUDY ON THE NEW SIMPLE SYNTHETIC DIAGNOSTIC METHOD ON LATENT LEAD POISONING. *Journal of the Osaka City Medical Center* 9, No. 12:5023-39, 1960. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 2, April 1959-March 1961, p. 40.

A review on the basis of 47 references of the chelate mobilization test in relation to concentrations of Pb in blood and urine and coproporphyrin elimination.

- 2167** Morrill, E.E., Jr. (US Air Force, San Francisco, Calif.): TETRAETHYL LEAD POISONING INCIDENT WITH EIGHT DEATHS. *American Industrial Hygiene Association Journal* 21:515-7 (Dec.), 1960.

Twenty-three Japanese men had been employed in the cleaning of petroleum tanks at a US Army base in Japan for ~6 mo, when all of them became ill and 8 died within a few days. The latter had been handling sludge which was scraped wet from the bottom of the tank into drums and hoisted out of the manhole. The workmen had received safety instructions and protective clothing, face masks, etc, but had frequently removed their masks and had not avoided skin contact with the sludge. Nothing of value was revealed which would incriminate any possibility other than TEL poisoning.

- 2168** Mungo, A., and Sessa, G. (Univ. Naples, Italy): Quadro radiologico dell'apparato digerente nel saturnismo professionale. (RADIOLOGICAL PICTURE OF THE DIGESTIVE APPARATUS IN OCCUPATIONAL LEAD POISONING.) *Minerva Gastroenterologica* 6:163-71 (Oct.-Dec.), 1960.

Of 148 cases of Pb poisoning hospitalized from 1919-1958 (av 44 yr old (19-75), exposed to Pb 7 mo-60 yr), 118 were found upon radiology to have spastic colitis, 62 had gastroduodenitis, 43 typhloappendicitis, 13 gastroduodenal ulcer, and 8 dolichomegacolon; these conditions were present either alone or associated with other conditions. From their analysis of the cases, the authors conclude that there is a high frequency of changes involving all sections of the digestive system; changes on the part of the stomach and duodenum, although frequent, are generally mild; gastric and duodenal ulcers are encountered rarely; the most frequent disorders are the organic and functional involving the large intestine; a typhloappendicitis is frequently seen. They also call to attention the fact that disorders of the digestive system may be favored by certain chronic illnesses and predisposing factors such as syphilis, alcoholism, and excessive smoking. (24 references)

- 2169** Myślak, Z.: Leczenie przewlekłego zatrucia dowieun doustnym podawaniem werseniam wapnia. (TREATMENT OF CHRONIC SATURNISM BY ORAL ADMINISTRATION OF CALCIUM VERSENATE.) *Medycyna Pracy* 11:353-68, 1960.

Treatment of chronic Pb poisoning with 2-3 g of CaEDTA orally in 102 cases is described. Daily Pb elimination was 1.2-17.9 mg (av 7.3 in acute and 3.8 in chronic cases). (88 references) (From *Medicina del Lavoro* 52:312 (Reviews), 1961)

- 2170** Noma, H.: ABSORPTION AND EXCRETION OF LEAD ADMINISTERED BY INHALATION IN THE HUMAN BEING. *Journal of the Osaka City Medical Center* 9, No. 5:1651-64, 1960. In: Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 2, April 1959-March 1961, p. 26.

Nebulized Pb acetate was administered by inhalation with a new apparatus to 2 normal Japanese male adults, at doses of 31 mg for the 1st 61 days, 23 mg for the next 31 days and 60 mg for the last 50 days. The results obtained were as follows: Pb intake was recovered in the urine most rapidly, followed by feces and blood in that order. A cumulative excretion of Pb administered by inhalation was 40-50% and the rest was retained in the body. Excretion of Pb in urine is 12-20%. Excretion of urinary coproporphyrin showed a moderate increase during the Pb intake prior to the appearance of other manifest clinical symptoms. Several tests on liver function revealed that the amounts of Pb intake in this experiment have little effect on a normal liver function.

- 2171** Pecora, L. (Univ. Naples, Italy): PORPHYRINS AND LEAD POISONING. *Sang* 31:859-63, 1960.

Elevation of erythrocyte-free protoporphyrin appears frequently in Pb poisoning but it is not a specific sign. The increase in various porphyrins is due to augmented synthesis and thus differs from the effect of Pb in vitro. The increase in plasma Fe, often marked, is partly a result of Fe removal from the tissues on accumulation of Pb. Free protoporphyrin, like coproporphyrin, can complex with Pb and neutralize its toxic effect. (From *Chemical Abstracts* 55:12633, 1961)

- 2172** Perry, H.M., Jr., and Camel, G.H.: SOME EFFECTS OF CaNa<sub>2</sub>EDTA ON PLASMA CHOLESTEROL AND URINARY ZINC IN MAN. In Seven, M.J., and Johnson, L.A., ed.: *Metal-Binding in Medicine*. Philadelphia, Lippincott, 1960, pp. 209-15.

In a series of hypercholesteremic patients treated with parenteral CaNa<sub>2</sub>EDTA, all showed markedly increased Zn elimination. Smaller, but significant, increases in Cd, Pb, Mn, and V were observed, but none in Mo, Ni, Ag or Sn. The mean level of cholesterol fell ~100 mg/100 ml plasma.

- 2173** Peters, H.A.: CHELATION THERAPY IN ACUTE, CHRONIC AND MIXED PORPHYRIA. In Seven, M.J., and Johnson, L.A., ed.: *Metal-Binding in Medicine*. Philadelphia, Lippincott, 1960, pp. 190-9.

The author reviewed the multiple signs and symptoms in a large number of patients with hepatic porphyria, and proposed the term "paraporphyrin" for those who do not show elevated uroporphyrin or porphobilinogen in the urine, despite the clinical resemblance to the porphyric. In the "para" patients there is a rise in urinary ALA and Zn and/or Cu, with increased fecal protoporphyrin. He calls attention to the existence of a schizophrenic syndrome in porphyria. Therapy with BAL, Na<sub>2</sub>EDTA or CaNa<sub>2</sub>EDTA has seemed helpful in >2/3 of the hepatic porphyric cases, some of which were very

severe. In an addendum he cites Galambos and Peacock's case (1959) of an acute porphyric with a urine Pb level of 1.412 mg/l, in whom chelation therapy had an unfavorable effect. Two of the author's most severe cases also had elevated urinary Pb. He points to the similarity of acute porphyria symptoms to those of Pb poisoning, and suggests that other cations may be involved in the etiology of this process. (39 references)

- 2174** Petrović, Lj., and Stanković, M. (Inst. Hyg., Belgrade, Yugoslavia): Mogućnost trovanja olovom kod kopaca galenita. (LEAD POISONING IN GALENA MINERS.) Arhiv za Higijenu Rada i Toksikologiju 11, No. 1:35-44, 1960.

Results of clinical and laboratory studies on (1) 233 miners of galena containing 12% Pb are compared with those obtained from (2) 105 inhabitants of the city Belgrade and from (3) 106 residents of a rural village, as well as from (4) 69 persons living within 500 m of a Pb smelting plant, in an area showing several tens as high values as the normal Pb in the soil, an average of 0.117 mg Pb/m<sup>3</sup> air on days with winds blowing from the direction of the plant, and Pb values of 0.58-5.5 mg% in vegetables and 27.5-36 µg% in the blood of farm animals. Mean Pb values for the groups in numerical order, respectively, were: blood 0.0296, 0.0352, 0.0290, and 0.0498 mg%; urine 0.0358, 0.0413, 0.0313, 0.1385 mg/l; coproporphyrin 0.0384, 0.0297, 0.0360, and 0.0472 mg/l. (13 references)

- 2175** Petrović, Lj., Stanković, M., Savićević, M., and Poletić, D. (Inst. Hyg. FPR of Serbia, Ind. Med. Dept., Inst. Hyg. Med. Univ., Belgrade, Yugoslavia): AEROSOL INHALATION OF CaNa<sub>2</sub>EDTA (MOSATIL) BY WORKERS CONSTANTLY EXPOSED TO LEAD POISONING. British Journal of Industrial Medicine 17: 201-4 (July), 1960.

Solutions of CaNa<sub>2</sub>EDTA (mosatil) were given to 10 patients as an aerosol generated by a Draeger aerosol apparatus. The patients worked in a Pb smelter and had been exposed to Pb concentrations of 0.6-1.25 mg Pb/m<sup>3</sup>. Five men each inhaled 0.6 g CaNa<sub>2</sub>EDTA/day for 7 successive days and 2.4 g on the 9th day or a total of 6.6 g. Another group of 5 received 4 doses of 2.4 g each on alternate days or a total of 9.6 g. The 1st group excreted an average of 21.6 mg Pb during the treatment, the 2nd group 14.2 mg. Urinary coproporphyrin fell to normal in both groups. Aerosol administration of CaNa<sub>2</sub>EDTA may be useful as preventive treatment but further study is needed to learn if its long-term administration carries no risk.

- 2176** Petrović, Lj., Stanković, M., Savićević, M., and Poletić, D. (Yugoslavia): OUR EXPERIENCES WITH CALCIUM DISODIUM EDATHAMIL. In Proceedings 13th International Congress on Occupational Health, New York, July 25-29, 1960 (published 1961), pp 338-41.

The effect of CaNa<sub>2</sub>EDTA at various doses, the largest being 35 mg/kg body weight (23 mg), and various modes of administration was studied in 92 Pb smelters exposed to Pb inhalation (0.6-2.0 mg Pb/m<sup>3</sup> air). Urinary excretion of Pb was 1.2-73.4 mg/24 hr, a quantity normally excreted in 33-360

days without treatment. Other laboratory findings are also given.

- 2177** Pettinati, L., Capellaro, F., Rasetti, L., and Rubino, G.F. (Univ. Turin, Italy): Distribuzione del piombo ematico e suo meccanismo di filtrazione renale nell'intossicazione saturnina. (DISTRIBUTION OF BLOOD LEAD AND ITS MECHANISM OF RENAL FILTRATION IN LEAD POISONING.) Minerva Medica 51:38-41 (Jan. 6), 1960.

Blood values are tabulated for 7 workers, 22-62 yr old, who had been exposed to Pb for 6 mo-16 yr; 5 of the men were in the stage of chronic Pb intoxication with renal involvement, 2 were in an acute stage. Data are listed for red blood cells, hematocrit, reticulocytes, basophil stippled cells, protoporphyrin. Pb analyses of blood and urine were made 48 hr before and after iv administration of 2 g CaNa<sub>2</sub>EDTA.

The authors conclude that Pb in the blood is mainly deposited in the red cells to a varying extent, from 45-70%. During treatment with EDTA, a part of the Pb (from 2-10%) passes into the plasma causing an increase of concentration there. In plasma ultrafiltration tests, only a very low fraction, 2-3%, of the Pb was bound with the proteins. The clearance of Pb was extremely low: av 0.4 ml/min (0.17-0.74 ml). After administration of EDTA clearance rose sharply. The slight but constant increase in glomerular filtration appeared to be connected with a contemporaneous increase in renal plasma flux which in 1 case rose from 325 ml/min before to 430 after administration of EDTA. (14 references)

- 2178** Pommé, B., Girard, J., Plagne, R., and Chabannes, J. (France): Les polynévrites saturnines. (SATURNINE POLYNEURITIS.) Gazette Médicale de France (Paris) 67: 1811-5 (Sept. 25), 1960.

Pb-induced polyneuritis mainly involves a motor and trophic injury to the extensor of the hand and fingers as well as the forearm, representing a late stage of Pb poisoning. The Pb preferentially attacks those muscles with a high chronaxy. Paralysis is very gradual, sometimes preceded by cramps, tingling and pain along the nerve trunks, and usually occurs in a segmental, localized form. Less typical effects are sometimes found (1) in the upper limbs, manifested by a Duchenne-Erb or Aran-Duchenne paralysis; (2) in the lower limbs, calling to mind alcoholic polyneuritis (very rare); (3) in the cranial nerves (also very rare). Generalized forms by a Guillain-Barré syndrome, poliomyelitis or another extensive polyneuritis. all 4 limbs. Two clinical aspects of it are (1) Landry paralysis and (2) diffuse peripheral paralysis with associated Pb encephalopathy. Other diagnostic aids are Burton line, parotid hypertrophy, hypertension, chronic albuminuria and azotemic nephritis, polyarthritides (gout), Pb colic, encephalopathic manifestations, anemia, basophilic stippling, hyperazotemia, high contents of coproporphyrin I and III in urine (>100 µg), Pb in blood >70-100 µg, Pb in urine >100 µg. Aran-Duchenne paralysis is shown by cervical myelopathies and radicular lesions, injury to the lower limb by alcoholic polyneuritis and encephalopathy, and gen-

eralized forms by a Guillain-Barré syndrome, poliomyelitis or another extensive polyneuritis. The most frequent etiology of Pb polyneuritis is occupational intoxications; today these are well-known and detected early. Accidental intoxications are more advanced when detected and thus cause more trouble. They are caused by using Pb objects (toys, eating utensils), but mainly by drinking water contaminated with Pb. Treatment is mainly with vitamins, adenosinetriphosphate and glycocholl, as well as with physical therapy. Three cases are described in which Pb polyneuritis was caused by drinking water with  $>2$  mg Pb/l. (17 references)

- 2179** Preda, N., Dinischiotu, G.T., Rădulescu, I.C., and Georgescu, A.M. (Clinic Occup. Dis. Med. Pharmaceut. Inst.; Colentina Hosp., Bucharest, Romania): CLINICAL CATEGORIES OF INDUSTRIAL PLUMBISM AND OTHER OCCUPATIONAL POISONINGS. In Proceedings 13th International Congress on Occupational Health, New York, July 25-29, 1960 (published 1961), pp. 343-5.

Based on long-term observation of  $>2000$  workers with occupational Pb or Hg exposure, the course of intoxication was divided into the following stages: (1) physiological absorption, (2) increased occupational absorption, (3) suspected intoxication, (4) intoxication proper, (5) toxic carrier state, and (6) recovery. Tests used in the study were quantitative variations of erythrocytes with basophilic granulations and of coproporphyrinuria. Both tests showed progressive increases from the stage of increased absorption through intoxication proper, with values low during the toxic carrier period. Clinical symptoms of a reactive nature are also discussed.

- 2180** Questions and Answers: LEAD POISONING. Journal of the American Medical Association 174:334 (Sept. 17), 1960.

In answer to a question for the best, simplest, most accurate, and most quantitative screening tests the following procedure for the determination of urinary porphyrins is described by Dr. C. P. McCord: glacial-acetic acid,  $H_2O_2$  and ether are added to a 10 cc urine sample and the reading under the Wood's lamp is made after 10-15 min. The observable fluorescence is arbitrarily divided into 4 classifications from normal porphyrin concentration to a very marked increase. The method may be made more quantitative by using a colorimeter. Significant results in  $>10\%$  out of a group of Pb workers indicates that Pb exposure has occurred.

- 2181** Radino, G. (Univ. Milan, Italy): SPECTRO-CHEMISTRY OF THIRTY MINERAL ELEMENTS DETECTED IN THE HUMAN HEART, IDENTIFICATION OF Ti, Li, Bi, Ni, Ba, Ag, Cs, Va, Cd, Si, Co, As. Arch. sci. med. 109:326-41, 1960. Pb was also detected in the ash of myocardial muscles by spectral analysis. (From Chemical Abstracts 54:15599, 1960)

- 2182** Rasetti, L., Pettinati, L., and Scansetti, G. (Univ. Turin, Italy): CHRONIC LEAD NAPHTHENATE POISONING - TRANSCUTANEOUS AB-

SORPTION OF THE COMPOUND. In Proceedings 13th International Congress on Occupational Health, New York, July 25-29, 1960 (published 1961), pp. 348-9.

The danger of Pb absorption by persons handling Pb naphthenate exists during saponification as well as in all procedures connected with the filling, operation and serving of lifts, carrier belts, etc, in which the substance is usually used as an additive to the mineral oil contained in the system. Of 14 cases reported by the authors, signs of massive Pb absorption were found in at least 5, signs of abnormal absorption in 4, and essentially normal findings in 5 cases. Blood Pb levels ranged from 35-98  $\mu g\%$ , urinary Pb from 65-900  $\mu g/24$  hr before EDTA (including all patients) and from 320-9750  $\mu g/24$  hr after EDTA (6 patients not included), urinary coproporphrin from 74-1640  $\mu g/24$  hr, and Hb 76-94. The majority of patients were not examined for basophilic stippled cells. As borne out by tests on volunteers, the manner of Pb saturation is by percutaneous absorption.

- 2183** Rathus, E.M.: REPORT ON AN INVESTIGATION INTO THE HAZARDS OF MINING FOR LEAD AT MOUNT ISA MINES AT THE REQUEST OF THE INDUSTRIAL COURT QUEENSLAND. Queensland Government Gazette 204:1765-88 (Aug. 1), 1960.

This first report encompasses inspection and description of mine workings, underground ventilation, and the Pb hazard at blast furnace and Cu smelter, current protective measures, and medical facilities before going into the details of the investigation and findings. About 350 men were examined, 270 from the Pb smelter and its environs, the rest came from volunteers from underground workings and other places. Aside from clinical examination, hematology and routine urinalyses were performed, Pb in urine and in blood, urinary porphyrins and blood urea and uric acid were determined. In addition, the records of accepted cases of Pb poisoning by the Lead Board since 1954 were examined, and special groups of the Operative Painters' and Decorators' Union were examined for comparison.

Environmental survey showed Pb concentrations in air in the Pb smelter to range from 0.07-8.52  $mg/m^3$ ; a single value of 600  $mg$  is shown for a deliberately created "blow back" as an example of what may occur in normal blast furnace emergencies. In the underground workings, 0.37 and 0.98  $mg$  Pb sulfide/ $m^3$  were found. Dust counts, temperature and ventilation were also examined and findings are tabulated. Graphs and tables show the clinical and laboratory findings, particularly on long-term employees and selected cases. In describing the findings, the author had gained the impression that a number of men complained of nausea and aches and pains in joints, although there were no direct signs of Pb intoxication. Several men had had symptoms of sufficient severity for transfer; others who had no symptoms had been transferred because of blood findings and routine testing. About 30 had had symptoms in the past which could be attributed to Pb. A few of these cases are described. Among the laboratory results, urinary Pb from 0.00-0.20  $mg/l$  was found in 47% smelters; only 19% were in the nor-



mal range <0.08, and 24% showed 0.21 mg/l and more. In the other workers (underground and surface), 76% were in the normal range and 20% from 0.11-0.20 mg/l. Of 56 men classified as boiler-makers, riggers, etc., only 16 were <0.1 mg/l. As to coproporphyrin excretion, the majority gave negative results; 22 showed >400 µg/l, indicating a minimum of 10% showing significant exposure. Positive urinary albumin was found in 15, with 8 showing a trace only, the others could be explained readily and could not be attributed to working conditions. Stippled cell (SC) counts of 2600-5000 were found in only 8; 41% of the smelters and 73% of the underground and surface workers did not show any SC. Hemoglobin from 14-16 g was found in 60%, from 12-14 g in 24%, and >16 g in 15%.

The author's conclusions are that the environmental exposure in the smelter is considerable and the cases of Pb poisoning would occur under the conditions found during the investigation. The report concludes with a list of recommendations as to overtime work, the need of a full-time industrial hygienist, monitoring of air at frequent intervals, and various types of protective measures. In an Appendix, environmental investigations performed by B.R. Tiele are reported in detail.

- 2184** Reinl, W. (State Ind. Med. Supervisory Distr. Nordrhein, Düsseldorf, Germany): Die moderne Therapie der Bleivergiftung. (MODERN THERAPY OF LEAD INTOXICATION.) Regensburger Jahrbuch für Ärztliche Fortbildung 8, 1959/60 (8 pp).

The author points to the fact that in Germany there have been but few reports of Pb poisoning from causes other than occupational, in contrast to other countries. He reviews the incidence of Pb poisoning in Nordrhein from 1926-58, exposure of such victims from 1945-58, as published by him and Goertz, the frequency of symptoms, erythrocyte counts, etc. The discussion of treatment of Pb poisoning is summarized as follows: Injection of CaEDTA at 1.2 g (in 10 ml)/day for 2-3 days, possibly every other day, followed by 2-3 wk treatment with orally administered doses of 1 g 3 times/day. If side effects appear, parenteral administration should be discontinued. Treatment of Pb colic is by use of modern spasmolytics and application of moist heat. Treatment of constipation is important. Generally anemia regresses under general treatment. Where pronounced anemia is present, treatment with liver preparations and vitamin B<sub>6</sub> and 12 is appropriate. Residue-rich and Ca-rich diet is recommendable. The same treatment is recommended for the neuritic patients, in encephalopathy, sedatives and at times lumbar puncture must be considered.

- 2185** Rieders, F.: CURRENT CONCEPTS IN THE THERAPY OF LEAD POISONING. In Seven, M.J., and Johnson, L.A., ed.: Metal-Binding in Medicine. Philadelphia, Lip-pincott, 1960, pp. 143-5.

In the author's experience, the administration of a single dose of 1 g CaNa<sub>2</sub>EDTA, given slowly iv, and followed by >1 mg Pb/24 hr urine confirms an excessive Pb burden, and together with clinical

observation of abnormalities is valuable in the diagnosis of Pb poisoning. He emphasizes that acute Pb poisoning is a clinical syndrome and not a laboratory diagnosis. He has not yet encountered anyone who has not been exposed to excessive Pb with a 24-hr urinary Pb elimination >1 mg after EDTA; mostly it has been <0.5 mg. Maximum Pb elimination occurs within ~1-2 1/2 hr after EDTA. Therefore it could be an office procedure, by collecting urine for only a few hours. Next, he recommends in the therapy of the "silent," or chronic, phase and acute exacerbation he recommends a series of 1 infusion/wk for several weeks until a large series have been given. Finally, he warns against the oral administration of EDTA, for combination of Pb with it occurs in the intestine, where it is absorbed as the Pb chelate, to be excreted in the urine. Some of the chelate breaks down on the way to the urine, so that there is an increased Pb burden to the soft tissue. Although slight depletion in kidney Pb occurs, an increase of Pb in the liver and occasionally in the brain takes place, leading to a possible encephalopathy.

- 2186** Roche, L., Badinand, A., and Lejeune, E. (Path. Toxicol. Center, Lyon, France): Les chélateurs dans le saturnisme. (CHE-LATING AGENTS IN LEAD POISONING.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 21:1-12 (Jan.-Feb.), 1960.

Twenty-nine subjects (8 with obvious, 21 with doubtful Pb poisoning) were subjected to infusions with Na<sub>2</sub>CaEDTA, starting with a daily dose of 0.50 g and increasing to 2 daily doses of 0.50-1.0 g each. For diagnostic purposes the administration was extended over 2-4 days, for therapy over 7-10 days. Detailed results were reported for both groups. In the 8 men with obvious Pb poisoning a more or less distinct improvement of the clinical manifestations (colic, anemia, Burton's line) was noted. Urinary Pb excretion ranged from 3000-27,000 µg/24 hr which is 7-30 times the amount of spontaneous excretion; the number of basophil stippled cells decreased appreciably after the 1st day of treatment and disappeared usually within 1-2 wk; coproporphyrinuria (CP) reached a normal range within 5-7 days. In the group with doubtful poisoning, urinary Pb excretion increased from >2000 to 2650-11,500 µg/24 hr in 8 subjects who had previously been exposed to Pb but did not show any change in stippled cells or CP. In the remaining 13, urinary Pb excretion ranged from 800-2000 µg/24 hr in 9 and <800 µg/24 hr in 4.

In remarking on the effectiveness of EDTA, the authors suggest that treatment should not be discontinued with the disappearance of signs and symptoms but should be continued for a week up to 1 or several months. This they base on finding in a Pb-induced polyneuritis a total theoretical elimination of Pb through 3 EDTA courses of 55,201 µg, and a theoretically derived total quantity of Pb in the body upon death 3 mo later, as found in the kidney, liver, muscles, bones, and renal calculi of 136,310 µg. On the other hand, more experience is needed before chelating agents can be recommended for preventive treatment. The value of chelating agents in the diagnosis of Pb poisoning is summarized as follows: maximum urinary Pb

excretion >2000 µg/day is indicative of high absorption of Pb; a maximum of 800-2000 µg/day shows moderate absorption which often is in the tolerated range; excretion of <800 µg/day is not in the pathologic range and is observed in persons without known Pb exposure.

- 2187** Roche, L., Lejeune, E., Tolot, F., Mouriquand, C., Baron, Coineau, and Soubrier. (Pathol. Toxicol. Center Ed. Herrist Hosp.; Consult Occup. Dis., Lyon, France): Saturnisme et Thalassémie. (LEAD POISONING AND THALASSEMIA.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 21:329-33 (June), 1960.

Although the syndromes of Pb poisoning and thalassemia vary greatly in severe cases, the differences between these 2 afflictions are less distinct in mild or latent cases. In both conditions, increased numbers of stippled erythrocytes appear, hypochromic anemia with anisocytosis, schistocytosis, and target cells. However, thalassemia is characterized by an enlarged spleen and, aside from family history, by hemoglobin A<sub>2</sub> and a high level of alkaline resistant hemoglobin, as well as an increased osmotic resistance. Pb poisoning is diagnosed by an increased level of urinary coproporphyrin and by urinary and blood Pb analyses following the administration of chelates. Clinical data are discussed for 2 patients suffering from thalassemia and 2 subjects with Pb poisoning. It appears that thalassemia patients exposed to Pb are more susceptible to Pb poisoning than are normal subjects.

- 2188** Ross, C.R., Windish, J.P., Dubois, L., Monkman, J.L. and de Villiers, A.J. (Dept. Natl. Health and Welfare, Ottawa, Canada): SURVEY OF LEAD HAZARD IN INDOOR FIRING RANGES. American Industrial Hygiene Association Journal 21:256-60 (June), 1960.

Pb poisoning was discovered in 2 instructors at firing ranges; urine samples contained 1000 and 200 µg Pb/l, respectively; coproporphyrin tests were strongly positive. Air samples collected at this range, located in the sub-basement of a large office building, contained 0.11-4.2 mg Pb/m<sup>3</sup> at the firing point, 0.09-4.7 mg Pb/m<sup>3</sup> at the target line, and 6.9 mg/m<sup>3</sup> at the center of the range; at a desk in the corridor, 0.85 mg/m<sup>3</sup> was found. Dust samples contained 12.5-25% Pb. Other series of tests at 6 different ranges again showed very substantial Pb concentrations during and after firing. Urinalysis surveys showed average Pb levels of 29-42 µg/l for men exposed up to 30 hr/mo. A good ventilation system is recommended in order to avoid hazards.

- 2189** Rubino, G.F., Rasetti, L., and Teso, G.A. (Univ. Turin, Italy): THE METABOLIC PORPHYRIN PRECURSOR IN LEAD POISONING. In Proceedings 13th International Congress on Occupational Health, New York, July 25-29, 1960 (published 1961), pp. 359-61.

Studies on the uroporphyrin (UP), coproporphyrin (CP), δ-aminolevulinic acid (ALA) and porphobilinogen (PPG) excretion in 13 controls and 11 patients with Pb poisoning led to the conclusion that abnormalities of the porphyrin metabolism in Pb poisoning were due to a blocking effect of Pb

on the enzymatic system regulating heme synthesis. In the patients with Pb poisoning, a considerable increase in urinary ALA and CP excretions was demonstrated, with a lesser increase in PBG and UP excretion. In regard to blood, increases were noted in the free erythrocyte proto-, uro-, and coproporphyrins.

- 2190** Rubino, G.F., Teso, G., and Rasetti, L. (Univ. Turin, Italy): ERYTHROCYTE DELTA-AMINO-LAEVULINIC ACID DEHYDRASE IN ANAEMIA. Acta Haematologica 24:300-10, 1960.

The ALA dehydrase of erythrocytes was determined (by the method of Gibson et al (1955), slightly modified by the authors) in 37 normal individuals and in 14 patients with anemia. In normal persons the ALA content averaged 1.01 µM/hr/ml. The synthesis of porphobilinogen in human erythrocytes was partially inhibited by phosphates. The ALA content of the erythrocytes varied according to the type of anemia. It was increased in hemolytic anemia and decreased in Fe deficiency, Pb poisoning and macrocytic anemia. The ALA activity increased with appropriate therapy. (From authors' summary; 18 references)

- 2191** Rubino, G.F., Teso, G.A., and Rasetti, L. (Univ. Turin, Italy): Azione del piombo sull'escrezione urinaria nell'uomo dell'acido δ-aminolevulico e del porfobilinogeno. (ACTION OF LEAD ON THE URINARY EXCRETION IN MAN OF δ-AMINOLEVULIC ACID AND PORPHOBILINOGEN.) Bollettino della Società Italiana di Biologia Sperimentale 36:253-5 (Mar. 31), 1960.

Uroporphyrin (UP), coproporphyrin (CP), ALA, and porphobilinogen (PBG) were determined in the urine of 13 healthy subjects and 11 Pb poisoning patients. While CP and ALA and UP were clearly increased, PBG was 1/5 of normal values. These data demonstrate therefore, that Pb blocks the enzymes active in heme synthesis at 2 points: at the level of PBG synthesis proceeding from ALA and at the level of protoporphyrin 9, so that the CP and UP accumulate in the urine and PP in blood. (16 references)

- 2192** Saita, G. (Univ. Milan, Italy): L'attività antitrombinica plasmatica nel saturnismo. (ANTITHROMBIN ACTIVITY IN LEAD INTOXICATION.) Medicina del Lavoro 51:694-704 (Nov.), 1960.

The thrombin time was increased in 9 out of 19 Pb poisoning cases studied, and the increase was correlated with the severity of the cases. The antithrombin is neutralized by protamine sulphate, adsorbed from plasma by BaSO<sub>4</sub> and inactivated at 56° C. It is suggested that, in cases of Pb poisoning, the antithrombin in the plasma belongs to the heparin cofactor B complex. In these cases, an increase of thrombin time is found even when other tests of altered liver function are negative or show small deviations. A table showing values for antithrombin activity includes values of hemoglobin, coproporphyrin and Pb in urine, and urinary Pb after EDTA for every subject. (30 references)

- 2193** Salvi, G., Ambanelli, U., and Gherardi, L. (Univ. Parma, Italy): Considerazioni

clinico terapeutiche sull'intossicazione acuta e subacuta da piombo tetraetile. (CLINICAL MANAGEMENT OF ACUTE AND SUB-ACUTE INTOXICATION FROM TETRAETHYL LEAD.) Folia Medica 43:421-33 (May), 1960.

The therapy of TEL poisoning is discussed. A study of 19 acute and subacute cases showed that  $\beta$ -mercaptoethylamine in doses of 200-400 mg/24 hr iv had a generally positive effect on the patients, but it was not effective in a rapidly fatal case which was treated at a late date. Autopsy revealed the following total Pb values (mg): brain, 11.63; liver, 26.60; kidney, 1.26; and lung, 4.05; stomach, 0.248 (in 26.2 g); in blood, 171  $\mu$ g%; in urine, 1.2 mg/l. (23 references)

- 2194** Sambron, J., and Gastard, J. (Rennes, France): L'encéphalopathie saturnine. (SATURNINE ENCEPHALOPATHY.) La Presse médicale 68:1885-8 (Nov. 12), 1960.

The literature on Pb encephalopathy is reviewed including the use of chelating agents in the treatment of Pb poisoning. (73 references)

- 2195** Sambron, J., and Gastard, J. (Rennes, France): Traitement par un chélateur (EDTA calcique) d'un cas d'encéphalopathie saturnine professionnelle. (TREATMENT BY A CHELATOR (CALCIUM EDTA) OF A CASE OF OCCUPATIONAL SATURNINE ENCEPHALOPATHY.) Thérapie 15:353-60, 1960.

The authors describe a case of occupational Pb encephalopathy in a 32-yr-old battery worker who complained for 6 mo prior to admission of headaches and experienced several repeated attacks of general paralysis. He was examined neurologically and clinically and although a cerebral tumor was at first thought of, his pallor and the discovery of the Burton line, together with hematologic signs indicated Pb poisoning. He was treated with  $\text{CaNa}_2\text{EDTA}$  twice/day for 5 days. Then, when symptoms of agitation developed, the treatment was interrupted for 5 days after which it was repeated for a 2nd course of 5 days. When he was discharged from hospital after 43 days he was in an excellent condition again.

The authors discuss Pb encephalopathy because of its rareness from a 3-fold point of view; diagnostically, pathogenetically and therapeutically. (25 references)

- 2196** Sano, S., Inoue, S., Harada, A., and Orita, Z. (Univ. Kyoto, Japan): RELATION BETWEEN FREE PROTOPORPHYRIN AND HAEMOGLOBIN IN RED BLOOD CELLS IN LEAD POISONING. Acta Scholae Medicinalis, Universitatis in Kioto 36, No. 3:182-5, 1960.

Thirty-one workers of a steel mill, who complained of such symptoms as loss of appetite, abdominal pain and muscle weakness were examined in order to establish a possible relationship between free erythrocytic copro- and protoporphyrin and urinary coproporphyrin, and peripheral blood values such as red cell count, Hb, reticulocytes, stippled erythrocytes and hematocrit. Ten healthy adult men served as controls. Urinary coproporphyrin was increased in only 19 of the Pb-exposed workers; erythrocytic protoporphyrin was increased in

all, reaching a value of 10-50 times above normal. Stippled erythrocytes were significantly increased in most men, but there was no correlation between the number of the stippled cells and erythrocytic protoporphyrin. In 14 cases, the increase of protoporphyrin was accompanied by anemia and decreased Hb content, while in 17 cases the red blood cell count and Hb content were within normal limits.

In order to understand the mechanism of the above findings, the following experiment was carried out: Three rabbits were injected daily for 30 days with 19 mg vitamin  $\text{B}_{12}$  and 15 mg folic acid simultaneously with an iv administration of 1 mg Pb as Pb acetate in glucose solution. There was no decrease in Hb content and erythrocyte count in the vitamin-treated compared with the nontreated rabbits, while protoporphyrin increased about the same in both groups, and urinary coproporphyrin remained about unchanged.

In explanation of these findings it is proposed that the biosynthesis of porphyrin and heme proceeds differently; or a hypersynthesis of porphyrin occurs, followed by Hb formation from this increased protoporphyrin in the presence of vitamin  $\text{B}_{12}$  and folic acid, by influencing the metabolism of ribonucleic acid, play an important role in globin formation. Further studies on globin, porphyrin and heme formation are suggested.

- 2197** Savičević, M., Stanković, M., Stanković, R., and Godić, V. (Inst. Hyg., Belgrade Univ., Yugoslavia): Uticaj vode i klime banje banjske na zdravlje hronično trovanih olovom. (EFFECT OF MINERAL WATER AND CLIMATE IN BANSKA SPA ON CHRONIC LEAD POISONING.) Srpski Arhiv za Celokupno Lekarstvo 88:655-64 (June), 1960.

Forty workers with chronic Pb poisoning were treated in the Banjska spa in order to evaluate the effects of sulfur mineral water and the spa treatment regime in particular. Twenty-five drank the mineral water (0.072 g  $\text{H}_2\text{SO}_4$ /l) and took sulfur baths; 15 served as controls. The treatment had a positive effect on the elimination of Pb and on a series of disorders. The authors conclude that other factors of a spa treatment undoubtedly play a part, but point out that a comparison with the control group shows the particularly advantageous effect of S-water alone. They suggest further comparative tests in the prevention and treatment of chronic Pb poisoning. (From authors' summary; 13 references)

- 2198** Schiemann, D.: Prophylaxe, Therapie und Rehabilitation bei Bleiarbeitern. (PROPHYLAXIS, THERAPY AND REHABILITATION OF LEAD WORKERS.) Ztschr. f.d.g. Hyg. u. ihre Grenzgebiete 6:20-38 (Jan.), 1960.

For preventive measures workers were divided into 3 groups: (1) Pb carriers, (2) Pb dyscrasias and (3) Pb toxicoses. Punctate basophilia is specific for Pb poisoning when the level reaches 6/50 microscopic fields; in the 3 groups, respectively, it is 6-25, 26-80 and >80 (sometimes 230 and rarely 300). Treatment in group 1 consists of bivalent Fe administration until the punctate basophilia is not >5/50 fields; group 2 is removed from exposure and treated; group 3 is removed from exposure for

~6 mo. Milk is no antidote to Pb; its alleged prophylactic action is attributed to formation of a protective layer against adsorption by the mucous membrane of the empty stomach. Rehabilitation problems of severe cases and of older workers are discussed. (From Bulletin of Hygiene 35:543-4 (June), 1960)

- 2199** Schroeder, H.A.: POSSIBLE RELATIONSHIPS BETWEEN TRACE METALS AND CHRONIC DISEASES. In Seven, M.J., and Johnson, L.A., ed.: Metal-Binding in Medicine. Philadelphia, Lippincott, 1960, pp. 59-67.

The title subject is discussed on the basis of: metabolic roles of trace metals; simple metal deficiencies; specific metal displacements and conditioned deficiencies; practical considerations of close competitions and possible chronic diseases; loose competitions and their significance; chronic diseases possibly linked to trace metal imbalances. Pb is mentioned in the next to the last heading in connection with the metals about which is little known: Al, Sn, Pb and Bi. However, extensive data on Pb indicate that the relatively large amounts contained in most tissues are accompanied by no overt effects (cited from Tipton, 1960). The last topic is introduced by saying that it is hard to obtain demographic data on abnormal trace metals, because areas in which populations unexposed to modern civilization can be studied are fast disappearing and chronic diseases are moving in. Zn, Cd, V, Pb and Mn have been linked with atherosclerosis, since human plasma cholesterol levels have been shown to fall during several days of iv  $\text{CaNa}_2\text{EDTA}$  therapy, associated with increased excretion of Cd, V, Pb and Mn (Perry, 1960). Pb has been also associated with hypertension together with other metals (Schroeder: Mechanisms of Hypertension. Thomas, 1957). In summarizing, the author designates Mn, Co, Cu, and Zn as the essential trace metals, though Mo, Rb, Sr, Ba, V, Cr, Ni, and possibly Ti and Al cannot be excluded from having normal biological roles; Ag, Au, Cd, Sn, Pb and Bi are "abnormal" with no normal role and probably are environmental contaminants. (55 references)

- 2200** Shraiber, L.B.: SENSITIVE FORM OF POLY-NEURITIS IN CHRONIC LEAD POISONINGS. Tr. Uzbeksk. Nauchn.-Issled. Inst. Sanit., Gigeny, i Profzabolevanii, 1960, No. 2: 73-89 (Published 1961).

The characteristic symptoms of sensory polyneuritis with chronic Pb intoxication, which were observed in 5 cases, are described as follows: decrease in distal sensitivity with the presence of definite areas of unchanged sensitivity (as a rule in the area of the wrists, lower third of the forearm, and sometimes in the lower extremities), shortening of motor and sensor chronaxy. The indexes of chronaxy on the surface of the palms are usually normal. Sensor polyneuritic disorders are one of the main symptoms for the early diagnosis of chronic Pb intoxication caused by exposure to low concentrations of Pb (0.00002-0.00005 mg/l. The mechanism of the action of Pb on peripheral neurons is discussed. (From Chemical Abstracts 57:8846, 1962)

- 2201** Smith, E.E., and Shirley, E.T.: LEAD INTOXICATION. Journal of the Oklahoma State Medical Association 53:209-11 (Apr.), 1960.

The patient, a 26-yr-old white man, from the middle socioeconomic class, was unaware of the potential danger of Pb poisoning associated with his work as a construction worker. In his work (applying a Pb-based paint to a bridge) he used a spray-gun but did not use any protective shield or mask. He had been doing this work for 15 wk with intervals. Two weeks prior to hospitalization he suffered from increasing irritability, anorexia, loss of weight, generalized myalgia, insomnia, malaise, progressive weakness, occasional bouts with nausea and a metallic taste in the mouth. Findings on admission showed a chronic illness, recent loss of muscle substance, a slight pallor, a Pb line on gums and some pyorrhea. Among the laboratory findings, Hb was 13.7 g%; hematocrit, 42%; 4% stippled erythrocytes. Urinary Pb 0.53 mg/l (upper limit of "normals," 0.2 mg/l). The treatment consisted of an iv course with  $\text{CaNa}_2\text{EDTA}$  over a 12-day period with a total of 16 g as a 5% glucose aqueous solution. On the 2nd day of the 1st wk of treatment urinary Pb was 6.25 mg/l. By the end of the 1st wk his vibratory sense and deep tendon reflexes had returned to normal, the appetite improved and insomnia disappeared.

The authors conclude with a brief discussion on the incidence and symptoms of Pb poisoning. (15 references)

- 2202** Stanković, M., Petrović, Lj., and Poletić, D. (Inst. Hyg. N.R. Serbia, Belgrade, Yugoslavia): APPLICATION OF  $\text{Ca}_2\text{EDTA}$  (DICALCIUM ETHYLENEDIAMINETETRAACETATE) FOR THE DIAGNOSIS OF LEAD POISONING. Acta Pharm. Jugoslav. 10:155-9, 1960.

The compound was administered orally to 24 printers, 18 persons with severe Pb poisoning, and 8 controls with no Pb exposure. The upper limit of Pb excretion in urine after 3 g  $\text{CaEDTA}$  was 0.340 mg/24 hr. (From Chemical Abstracts 55:15594, 1961)

- 2203** Stanković, M., Poletić, D., and Petrović, Lj. (Inst. Hyg., Belgrade, Yugoslavia): SIGNIFICANCE OF COPROPORPHYRINURIA IN LEAD EXPOSED WORKERS. In Proceedings 13th International Congress on Occupational Health, New York, July 25-29, 1960 (published 1961), pp. 368-71.

Analysis of urine samples from 367 Pb smelters exposed to 0.6-2.0 mg Pb/m<sup>3</sup> was made to determine the role that the increase of coproporphyrinuria (CP) might play as an aid in the prevention and early diagnosis of Pb poisoning. Results showed a statistical significant correlation between the CP and the urinary Pb values ( $r = 0.645$ ), although no absolute correlation was present. Mean values in µg/l calculated in 7 groups were: Pb in urine: 77.4, 143.0, 245.2, 350.3, 441.1, 533.2, 732.0; corresponding CP in urine: 90.9, 197.6, 481.8, 650.9, 767.8, 1019.1, 1404.5.

- 2204** Stehney, A.F. (Argonne Natl. Lab., Lemont, Ill.): RADIOISOTOPES IN THE SKELETON: NATURALLY OCCURRING RADIOISOTOPES IN MAN.

In R.S. Caldecott and L.A. Snyder, eds.: A Symposium on Radioisotopes in the Biosphere. Minnesota, University of Minnesota Center for Continuation Study of the General Extension Division, 1960, pp. 366-81.

A brief discussion is included of  $^{210}\text{Pb}$  in the body derived from the possible sources of direct ingestion of Pb (Dudley, 1957), inhalation of  $^{222}\text{Rn}$  and its decay products in air, and decay of  $^{222}\text{Rn}$  formed from  $^{226}\text{Ra}$  in the body. According to a personal communication by Hursh (1959) analysis for  $^{210}\text{Pb}$  in whole body ashes performed at the University of Rochester on 16 subjects gave averages of  $4.3 \times 10^{-14}$  and  $4.8 \times 10^{-14}$  Ci/g ash for  $^{210}\text{Pb}$  and  $^{226}\text{Ra}$ , respectively. Knowing that these bodies were ashed 10 yr previously, and using information as to Rn retention in dead bone prior to and after ashing (Rowland et al, 1958), an estimate of  $4.1 \times 10^{-14}$  Ci of  $^{210}\text{Pb}$ /g was obtained at the time of ashing. (48 references)

- 2205** Stepan, J., Vencovský, E., Hanzlíček, L., and Fridrich, E. (Karls Univ., Pilsen, Czechoslovakia): Mineralbestandteile im Liquor Cerebrospinalis von Geisteskranken, spektrographisch bestimmt. (MINERAL CONSTITUENTS IN CEREBROSPINAL FLUID OF MENTAL PATIENTS DETERMINED BY SPECTROGRAPHY.) Clinica Chimica Acta 5:124-30, 1960.

The cerebrospinal fluid of 16 mentally disturbed patients 21-56 yr old was first analyzed for 24 trace elements, including Pb, by an emission spectrographic method, then extended to include 263 patients (175 male, 88 female). Pb was among the elements found in traces; other elements were present, according to the tabulations, in concentrations of 1/10%, 1/100%, 1/1000%.

- 2206** Stocks, P., and Davies, R.I. (Univ. Coll. N. Wales, Bangor): EPIDEMIOLOGICAL EVIDENCE FROM CHEMICAL AND SPECTROGRAPHIC ANALYSES THAT SOIL IS CONCERNED IN THE CAUSATION OF CANCER. British Journal of Cancer 14:8-22 (Mar.), 1960.

A chemical and spectrographic examination of garden soils in North Wales, Cheshire and 2 localities in Devonshire was carried out in order to study possible correlations between the amounts of certain constituents and the frequency of cancer of the stomach. Median values found for Pb in soil were 2.05-5.2 ppm. There was no connection anywhere between Pb and the incidence of cancer of the stomach.

- 2207** Stöckly, A. (Swiss Accident Ins. Board, Lucerne): Vergiftungen durch Bleibenzin in kritischer Sicht. (A CRITICAL APPROACH TO CASES OF POISONING BY LEADED GASOLINE.) Praxis 49:828-31 (Aug. 25), 1960

R. Fatzer's article "A contribution to the problem of leaded gasoline" (Abstract No. 2128) reporting a case of gingivitis treated successfully with Ca-EDTA is critically evaluated. Since the patient, driver of a motor vehicle, also complained of intestinal, joint and back pains, insomnia and nervous irritability, and the drug administered to him is also used in the therapy of Pb intoxication,

the author felt justified in diagnosing the patient's illness as Pb intoxication without any further examinations. The author of the present article denies any specific relationship between Pb intoxication and gingivitis and stomatitis. They have not been observed in TEL poisoning. Occasionally, cases have been observed by SUVA where Pb sulfide was imbedded in the dental and oral mucosa which, however, were not accompanied by inflammatory processes. Thus, Fatzer's report does not prove the existence of Pb intoxication in the case reported nor does it prove the therapeutic efficacy of EDTA in cases of purulent gingivitis. According to Stöckly, TEL-containing gasoline is not much more dangerous than Pb-free gasoline for those handling it. He advises caution in ascribing causal relationships in the field of toxicology on the basis of isolated observations.

- 2208** Streit-Pawlowska, I., and Senczuk, W.: Zagadnienie ołowicy w wybranych działach stoczni. (LEAD POISONING IN SOME DOCK DEPARTMENTS.) Med. Pracy 11, No. 2:109-16, 1960.

The Pb levels in urine of 200 dock workers (122 painters, 67 cabling workers, and 11 administrative staff members representing controls) were determined. Of the 122 dock painters and 67 cabling workers, 72 showed  $>120 \mu\text{g Pb/l}$  urine. After treatment with  $\text{CaNa}_2\text{EDTA}$ , vitamins, liver extract and Fe preparations for 14 days, the Pb values were 70 and  $83 \mu\text{g/l}$ , respectively, for the groups previously showing 211 and  $145 \mu\text{g/l}$ , respectively.

It was concluded that besides treatment for Pb poisoning, improvements in sanitation and hygiene are important, along with periodic Pb urine determinations. (From Bulletin of Hygiene 35:760-1, 1960)

- 2209** Sverdlov, S.L. (City Hosp., Novozybkovsk, USSR): O bytovom khronicheskom svintsovom otravlenii. (ON DOMESTIC CHRONIC LEAD POISONING.) Sovetskaya Meditsina 24:135-6 (Feb.), 1960.

The hazards of Pb glazed pottery, frequently used in rural areas, are discussed. Pb poisoning often occurs in swine from feed stored in glazed containers, and in man from the use of glazed pottery for the preparation and storage of dairy products, etc. The importance of legal regulations of the Pb content in glazes is emphasized.

- 2210** Szechuan Medical College, Departments of Industrial Health and General Hygiene (Chengtu, China): NORMAL VALUES FOR URINARY EXCRETION OF LEAD AND COPROPORPHYRIN TOGETHER WITH BASOPHILIC RED BLOOD CELL COUNT IN CHINESE. Chinese Medical Journal 80:538-41 (June), 1960.

As summarized, normal values for daily urinary excretion of Pb in normal people should be based on how long they have lived in cities and what diet they are used to. Among 511 of 642 subjects studied, urban subjects excreted daily  $\text{av } 0.028 \pm 0.001 \text{ mg/l}$  with a range of 0.00-0.12 mg/l and a normal upper limit of 0.08 mg/l. New arrivals from the countryside with a lower dietary stand-

ard gave an average daily excretion of  $0.01 \pm 0.001$  mg/l ( $0.00-0.11$  mg/l) and an upper limit of  $0.05$  mg/l. Since workers in the Pb industry consist mostly of city dwellers, it seemed more reasonable to consider  $0.08$  mg/l as the upper limit of normal for early diagnosis of Pb poisoning.

Coproporphyrin in urine of  $50-100$   $\mu$ g/l and  $100-250$   $\mu$ g/l was found in  $12.3-12.9\%$  and  $2.1-5.6\%$  of the subjects, respectively;  $50-100$   $\mu$ g/l appears to come within the upper limit for normal people.

The number of basophilic erythrocytes in the peripheral blood of normal people showed a marked sex variation: upper limit of  $0.7\%$  in men and  $0.9\%$  in women.

The modified semi quantitative analysis of coproporphyrin in urine developed by the authors was found simple and accurate.

- 2211** Targowla, D., and Smagghe, G.: Enquête sur l'exposition mineure au plomb. Répercussions pathologiques. Valeur des examens hématologiques. (SURVEY OF MINOR EXPOSURE TO LEAD. PATHOLOGIC REACTIONS: VALUE OF HEMATOLOGIC TESTS.) Proceedings of the Society of Industrial Medicine and Hygiene, Paris, France. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 21:222-4 (Apr.-May), 1960.

The survey was conducted by the Toxicology Research group by examining 347 records of industrial physicians. The age of the workers, length of service, rheumatic, digestive, cardiac diseases, blood pressure and hematologic data were obtained. The frequency of clinical findings in 237 typographers of various types and cypesetters, 19 solderers and 13 with other occupations (painters, etc) were tabulated. On the basis of the data obtained it was concluded that minor exposure to Pb does not give rise to blood anomalies or to minor pathologic changes characteristic for Pb. The authors also concluded that routine hematologic examination is of doubtful value in the above situations since it does not permit the detection of a possible disorder arising from minor exposure.

- 2212** Thapar, R.K. (Parabjanj, Gonda, U.P., India): ANAEMIA IN INDUSTRIAL WORKERS OF KANPUR. J. Indian Med. Assoc. 35, No. 3: 97-110, 1960.

The high incidence and the severe forms of anemia found among various branches of the industrial population ( $58\%$  as compared to  $29\%$  of mild anemia among rural inhabitants) are discussed, and Pb exposure is considered as one of the factors causing anemia among Pb workers. (From Excerpta Medica, Sect. 17, 7:Abstr. 2605, 1961)

- 2213** Thorsen, K.: (THE DIAGNOSIS AND THERAPY OF LEAD INTOXICATION.) Ugeskr. Laeg. 122: 975-9, 1960.

The importance of coproporphyrin determinations in urine for the early detection of Pb poisoning is emphasized, and therapy with Tetracemin is suggested. Four cases are described. (From Deutsche Zeitschrift für die gesammte gerichtliche Medizin 51:248 (Abstracts), 1961)

- 2214** Tipton, I.H.: THE DISTRIBUTION OF TRACE

METALS IN THE HUMAN BODY. In Seven, M.J., and Johnson, L.A., ed.: Metal-Binding in Medicine. Philadelphia, Lippincott, 1960, pp. 27-42.

The concentrations of essential elements (Co, Cu, Mo, Mn, Zn), abnormal elements showing organ specificity (Al, Ba, Cd, Cr, Ti, V), and abnormal elements without marked organ specificity (Ag, Cu, Bi, Ni, Pb, Sn), were determined in 11 tissues of 121 adults ( $\geq 20$  yr) and 67 infants and children ( $< 20$  yr). The analyses were made by the emission spectrography method (Ahrens, 1950). All subjects were US citizens. In treating the data, only those individuals known to have died from traumatic accident and with no known disease were included in Group I, those who died from cardiovascular accident in Group II, Group III included those who died from alcoholism (4), acute pulmonary edema (2), pulmonary embolus (2), aspiration of vomitus (1), cerebral atrophy (1), multiple sclerosis (1), and shigella enteritis (1).

The Pb values for the groups, respectively, with median in parentheses: aorta,  $5-430$  (170),  $15-280$  (115),  $80-340$  (148); brain,  $<5-240$  (5),  $<5-70$  (5),  $5-40$  (5); heart,  $<5-128$  ( $<5$ ),  $<5-61$  (10),  $<5-35$  (12); kidney,  $5-520$  (110),  $40-240$  (92),  $42-660$  (93); liver,  $26-800$  (130),  $29-280$  (120),  $70-720$  (163); lung,  $5-550$  (47),  $15-150$  (60),  $15-145$  (56); ovary,  $<5-41$  (15),  $<5-16$  (12), --- (15); pancreas,  $10-750$  (52),  $10-110$  (57),  $13-340$  (49); prostate,  $<5-130$  (10),  $8-17$  (11),  $10-60$  (13); spleen,  $<5-8800$  (sic) (25),  $10-230$  (30),  $10-380$  (35); testes,  $<5-88$  (11),  $5-25$  (12),  $5-70$  (22). The values are for total range. The differences between the 3 groups were not striking, although in general the median and low values for the concentrations were greatest for Group III.

In discussing the results, the author notes that since emission spectrography is an analysis by comparison with a known standard, it is obvious that the method is only as good as the standard, and that a good agreement between laboratories cannot be expected unless these had been calibrated against a universal standard. She advocates that such a standard be developed and deposited with the Bureau of Standards.

- 2215** Truhaut, R., Albahary, C., Boudene, C., and Desoille, H. (France): CALCIUM DISODIUM EDATHAMIL AND THE PREVENTION OF LEAD POISONING. Abstracts of the 13th International Congress on Occupational Health, New York, July 25-29, 1960, Abstr. No. 19-5.

Various techniques for urinary Pb determination are discussed as well as the preventive treatment with EDTA, its modalities, and its risks.

- 2216** Tsuji, M.: STUDIES ON THE FLUCTUATION OF BLOOD CALCIUM IN LEAD POISONING. 1. THE SERUM CALCIUM CONTENT OF LATENT LEAD POISONED CASES. 2. TURNOVER RATES OF  $\text{Ca}^{45}$  IN BLOOD PLASMA OF LEAD POISONED ANIMALS. Journal of Osaka City Medical Center 9: 627-32; 633-41 (Feb.), 1960. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 2, April 1959-March 1961, pp. 23-6.

1. The average serum Ca concentration of 41 Pb workers was 104.8 mg/l. Urinary Pb ranged from 104.0-830 µg/l, Pb in the blood from 20.1-174.2 µg/100 g. In 1 case of acute Pb poisoning, the serum Ca was within normal limits. Other data included in the tabulation of findings were erythrocytes,  $324-530 \times 10^4$ ; Hb, 9.2-13.6 g/dl; uroporphyrin 27.5-400 µg/l. 2.  $^{45}\text{Ca}$  was given to normal rabbits, and to rabbits in which acute or chronic Pb poisoning had been induced. The total turnover rate of plasma  $^{45}\text{Ca}$  in normal rabbits was 15.6% min. In both acute and chronic poisoning there was a decrease of  $^{45}\text{Ca}$  turnover rate (20.7 and 24.7% respectively), which was not considered to be significant.

- 2217** Venditti, G., and Lalli, G. (Cent. Study Res. Med. Aeronautics, Rome, Italy): Le intossicazioni da carburanti con particolare riferimento a quelle che si verificano in campo aeronautico. (FUEL POISONING WITH PARTICULAR REFERENCE TO AVIATION TOXICOLOGY.) *Revista di Medicina Aeronautica* 23:57-102, 1960.

The chemical properties of the fuels employed in the Air Force are reviewed with special reference to their toxicity limits in man and their ill effect on the fitness of the ground personnel, which might become a cause of flight accidents. The toxicity and signs and symptoms of poisoning of TEL and ethyl fluid as well as treatment of poisoning are discussed in some detail. (56 references)

- 2218** White, H.H. (Natl. Inst. Neurol. Dis. Blindness, Univ. Kansas): Diagnostic et traitement de l'intoxication par le plomb. (DIAGNOSIS AND TREATMENT OF LEAD POISONING.) *World Neurology* 1:137-45 (Aug.), 1960.

The author discusses the title subject on the basis of 29 references.

Diagnosis may be confirmed by the presence of an excess of Pb in the blood and urine, but such quantitative studies should be repeated frequently. Coproporphyrinuria is also a reliable, rapid and simple method of determination. Usually small amounts of Pb are found in the tissue, the upper safe limit being 0.060-0.070 mg Pb/100 g whole blood, and 0.080 mg Pb/l urine. These values cannot be accepted however, without taking the complete clinical picture of the patient into account.

In describing the earlier treatments of Pb intoxication, the author points out the ineffectiveness and toxicity of BAL. CaEDTA as a chelating agent is recommended because it is nontoxic and eliminates the Pb rapidly from the organism via the urine. The average recommended daily dosage for children is: 65-75 mg/kg body weight and for adults 30 mg/kg weight. Administered intravenously (iv), and given in fractions of the total amount, the dosage should be dissolved in a 250-500 ml glucose or saline solution. If given im or sc, it should be dissolved in a 20% solution with 0.5% procaine. This treatment should be repeated if the Pb concentration remains at the toxic level, or if important neurologic manifestations persist. Orally, CaEDTA may be administered in cases of chronic Pb poisoning to adults, however, not to

children because of its possible harmful effects. CaEDTA decreases the morbidity of Pb intoxication in adults, but it is not certain yet whether it may prevent the mental deterioration which succeeds Pb encephalitis in children. In a few cases of Pb encephalitis in children cerebral decompression or an iv injection with urea may be necessary in order to avoid brain compression. Early diagnosis and early treatment for children are necessary.

- 2219** Whitehead, T.P., and Prior, A.P. (South Warwickshire Hosp. Group Lab., Warwick England): LEAD POISONING FROM HOMEMADE WINE. *Lancet* 2:1343-4 (Dec. 17), 1960.

The case of a 52-yr-old butcher admitted to the hospital in November 1958 with abdominal pains of 3 wk duration is reported. A tentative diagnosis of Pb poisoning was made after the following determinations: sedimentation rate, 65 mm in 1st hr; Hb, 8.1 g/100 ml; polychromasia and basophilic stippling; urinary Pb on 2 consecutive days, 0.31 and 0.40 mg/day (normal, <0.2 mg/day). The patient was discharged for Christmas and at that time examination of the well water at his home and the beer at the pub was negative. Questioning revealed that he was an enthusiastic wine maker and drinker, but his wine-making equipment showed nothing unusual. The patient was readmitted to the hospital in January with epileptic fits. Anemia and basophilic stippling were still present, urine showed coproporphyrins and Pb values of 0.75 and 1.0 mg on 2 consecutive days, reaching a peak of 17 mg/day after treatment with EDTA. A sample of the home-made wine was obtained and found to contain 7.5 mg Pb/l. Test solutions poured into an old pitted earthenware bowl used in fermenting the wine and in 2 earthenware storage barrels yielded 1000, 9, and 7 mg Pb/l respectively, the earthenware bowl being the source of the Pb in the wine. The patient had used this bowl since 1958 and had consumed ~1 qt of wine/wk.

- 2220** Yamaguchi, S. (Kyushu Univ., Fukuoka, Japan): CLINICAL AND EPIDEMIOLOGICAL STUDIES OF TETRA-ETHYLLEAD POISONING IN JAPAN. *Kyushu Journal of Medical Science* 11:37-44 (Feb.), 1960.

Five outbreaks of TEL poisoning were observed in several rural districts near Fukuoka City from 1946-1957, in which 40 persons suffered from poisoning. Outbreaks 1 and 5 were of occupational origin and were due to ignorance and careless handling of TEL. In the 1st outbreak, a substance of unknown material had been used as a solvent for paint in a furniture factory. Although absolute proof could not be obtained, the description of symptoms fitted those from TEL. Of the 7 exposed, 3 died within 48 hr. The 5th episode involved 3 tank cleaners who recovered. The other 3 outbreaks occurred from domestic use of well water which was contaminated by TEL. Among those involved in the poisoning were persons who shared the same well. Outbreaks 2 and 4 were caused by TEL in oil drums which had been buried after the war. These drums containing TEL had rusted and the liquid had been leaking into the ground over a period of 10 yr. In outbreak 2, 22 persons were affected, 7 of whom died; Pb in water ranged from 3-557 µg/l. In the

3rd, of 9 exposed to 150 and 1100 µg TEL in water, 3 died; in outbreak 4, 26 homes were involved, though because of prompt action upon complaints of irritating odor of the water from the residents, illness and deaths were prevented. TEL content was up to 14.5 µg/l.

- 2221** Zielhuis, R.L. (Netherland Inst. Prev. Med., Leiden): De betekenis van de voeding voor het ontstaan en het verloop van de industriële loodintoxicatie. (SIGNIFICANCE OF NUTRITION IN THE ORIGIN AND COURSE OF INDUSTRIAL LEAD POISONING.) Voeding 21: 399-424 (Aug. 15), 1960.

From a review of the existing literature on the relationship between nutrition and Pb intoxication, the author draws the conclusion that many questions remain unanswered. He holds, however, that the nutrition affects the absorption, deposition or excretion of Pb, and affects the reaction of the organs with Pb. From the review the following seems to be more or less definitive: (1) An adequate Ca-supply stabilizes Pb metabolism, so sufficient Ca-supply is desirable, a surplus of Ca-supply is probably not utilizable. (2) Disturbance of the acid/base equilibrium caused either by nutrients or otherwise (infections) can mobilize the Pb from the bones, especially in combination with Ca-deficient food. (3) A quantitatively and qualitatively sufficient intake of protein is desirable. (4) Several vitamins have an influence on the reaction of Pb in the body. The author concludes that a lacto-vegetarian diet with little fat probably is the best diet for Pb workers. About 0.5 l of milk is highly recommended. (93 references).

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- 2222** Albahary, C. (France): PREVENTION OF LEAD POISONING. Third World Congress on the Prevention of Occupational Risks. Paris, France, 1961:491.

Because of the possible harmful effects caused by CaNa<sub>2</sub>EDTA, especially to the kidneys, when used orally as a prophylactic measure against Pb intoxication, the author recommends the use of CaNa<sub>2</sub>EDTA aerosols in a concentrated 1 g solution at the end of the work day. These small doses of chelates seem to be harmless.

- 2223** Albahary, C., Truhaut, R., Boudene, C., and Desoille, H. (Paris, France): Le dépistage de l'imprégnation saturnine par un test de mobilisation du plomb. (THE DETECTION OF LEAD ABSORPTION BY A TEST OF LEAD MOBILIZATION.) Presse Médicale 69: 2121-3 (Nov. 11), 1961.

The effectiveness of a mobilization test using CaNa<sub>2</sub>EDTA, in detecting latent stages of Pb absorption, was studied in the following 4 groups of individuals: 20 controls; 11 subjects suffering from mild chronic Pb intoxication; 12 workers subjected to a mild Pb exposure who did not show any clinical signs of intoxication besides a small degree of stippling of erythrocytes and a higher than normal Pb level in the urine (100-370 µg/l); 16 subjects possibly exposed to Pb, but lacking any clinical or laboratory signs of Pb absorption. Pb excreted in the urine, 24 hr after slow iv ad-

ministration of 0.5 or 1 g CaNa<sub>2</sub>EDTA in an isotonic glucose solution was, respectively (µg/24 hr): 85-465; 1200-8105; 940-6975; 450-920 (in 9 out of 16 subjects). Findings obtained in the last group indicated a light exposure to Pb which, however, had not been recognized by any other tests. The authors state that Pb levels >800 µg/l, 5-6 hr after CaNa<sub>2</sub>EDTA injection, or 700 µg in the total urine of 24 hr might be considered to be pathologic. Pb concentrations of 300 µg or higher in the urine of the 2nd day after the injection might indicate an abnormal Pb absorption. When carrying out the test, diuresis should be promoted by an intake of 300 g water. It is recommended that urinary Pb excretion be determined not only at 24 hr but also at 5 and 10 hr following injection of the chelating agent. (28 references)

- 2224** Alfonzo, J.V., Cañizales Guédez, E., Müller, P.A., and Osorio Murga, M. (Dept. Malariology and Environmental Health, Venezuela): Las coproporfirinas urinarias en el control preventivo del saturnismo industrial. (URINARY COPROPORPHYRINS IN THE PREVENTIVE CONTROL OF INDUSTRIAL SATURNISM.) Revista Venezolana de Sanidad y Asistencia Social 26:530-5 (Sept.), 1961.

Pb levels in the blood were determined in 317 workers from storage battery factories, foundries and printing plants, who had been exposed to Pb from <6 mo to >5 yr, and the presence or absence of urinary coproporphyrin was measured fluoroscopically. Data were tabulated separately for the 3 types of industry according to period of exposure (<6 mo, 7-12 mo, 13-59 mo, 60 mo or more), listing the percentage of subjects with 0.40, 0.40-0.59, 0.60-0.79 and 0.80 mg Pb/100 ml of blood, respectively. A definite relationship was noted between urinary coproporphyrin and the Pb content in blood at Pb levels >60 mg/100 ml and particularly >80 mg/l. The possibility of using the fluoroscopic determination of urinary coproporphyrin for the screening of Pb-exposed subjects was discussed.

- 2225** Al'pern, L.L., Khotenko, V.G., and Gurevich, O.M. (San.-Epidemiol. Station Kirov District, Moscow, USSR). K voprosu o periodicheskikh meditsinskikh osmotrakh rabochikh ruchnogo nabora tipografii. (PERIODIC MEDICAL EXAMINATION OF MANUAL COMPOSITORS.) Gigiena i Sanitariya 26: 66-9 (May), 1961.

The authors point out that in spite of modern printing methods, shops using manual compositions still exist. They had investigated 4 such shops and found possibilities of Pb poisoning in workers. Examination of drawers holding type revealed dusts with Pb contents up to 3%. In 1958-59, 125 analyses of air in the areas of manual compositors showed Pb concentrations far exceeding the MAC. High Pb contents were also found in the hand wash-water of the workers. Hematologic findings on 50 workers (employed ≥3 yr) showed decreased hemoglobin and stippled cells to be within normal limits, but in 1/3 the reticulocyte counts were increased. The urine of 2 workers contained 0.06-0.1 mg Pb/l, indicating excessive absorption. Case reports of 2 female workers are briefly presented; they showed a mild form of Pb poisoning.



In closing, the authors recommend that manual compositors be subjected to periodic physical examinations in order to prevent poisoning.

- 2226** Amorati, A., Bersani, A., and Stancari, V. (Univ. Bologna, Italy): Contributo alla conoscenza della patologia dei lavoratori della ceramica. (CONTRIBUTION TO THE KNOWLEDGE OF CERAMIC WORKER'S DISEASES.) Rassegna di Medicina Industriale 30:46-70 (Jan.-Feb.), 1961.

The authors carried out a clinical-statistical study of a group of 1911 ceramic workers, employed in industries of various sizes and importance of the Emilia and Romagna region, who were periodically examined in conformity with the Silicosis Act. A decreased incidence of pneumoconiosis (6.89% of the ceramic workers investigated, with 0.25% of nodular type) and an almost total absence of Pb poisoning was found. (From authors' summary) (34 references)

- 2227** Anatovskaya, V.S. (Ukrainian Inst. Ind. Hyg. Occup. Dis., Khar'kov, USSR): Belkovyi polyarograficheskii effekt pri khronicheskoi intoksikatsii svintsom. Soobshchenie I. (PROTEIN POLAROGRAPHIC EFFECT IN CHRONIC LEAD INTOXICATION. I.) Gigiena Truda i Professional'nye Zabolvaniya 5, No. 5:37-42, 1961.

Assuming that intoxication by Pb blocks the SH groups of protein molecules, the amount of free SH groups in blood must be lowered. Sixty cases of chronic Pb intoxication were examined. Serum of healthy men was used as a control. By refraction, the quantity of protein and protein fractions were determined. The serum and its protein-free filtrate were then subjected to polarographic analysis. The height of polarographic waves of serum of healthy persons averaged 56.76 mm; average wave in the Pb-poisoned persons was 46 mm, and 53.9 after treatment. The protein-free serum filtrate gave a 26-mm wave height for healthy persons and 23 mm under condition of Pb intoxication (22 after treatment). Subacute intoxication gave the lowest protein waves. The authors conclude that the height of polarographic waves does not depend on the absolute amount of protein in the serum. It is also connected with the presence of unblocked SH groups. Difference in height of waves in healthy and intoxicated persons averages 10 mm. Rise or the polarographic curve in treated patients depends on free SH groups. The height changes of the polarographic curve may be used effectively as an index of therapy. (13 references)

- 2228** Ashby, M.G. (England): LEAD ENCEPHALOPATHY. Proceedings of the Royal Society of Medicine 54:228-9 (Mar.), 1961.

The case of a woman, age 46, who had been employed in a Pb accumulator factory for 5 yr is described. Her work consisted of supervising the spreading by machine of a moist mixture of litharge and red Pb onto Pb accumulator plates; she was inadequately protected from fumes, and her environment was very dusty. She had been in good health until ~3 mo before admission to the hospital when she started having frontal headache and some colicky

abdominal pain. Two mo later, 3 epileptiform convulsions occurred followed by transient diplopia and forgetfulness, and after the last attack she became delirious. Laboratory tests showed: Hb 75% (Haldane); basophilic stippling in red cells 3700/million; the red cells appeared hypochromic; excess values of coproporphyrin III in urine; the Pb content of urine was 400 µg/24 hr. The diagnosis of Pb poisoning with Pb encephalopathy was made. Treatment with daily iv injections of CaNa<sub>2</sub>EDTA in saline solution was not successful, but a 2nd course of more prolonged administration (2-3 hr iv once daily for 5 days) produced, on the 1st day, a total of 3.63 mg Pb in urine, 2.65 mg on the 2nd, and 1.80 mg on the 5th. The patient recovered within about 6 wk. Follow-up 2 wk later showed Hb 106%, and no punctate basophilia.

- 2229** Bátskor, I.A., Kovács, I., and Pascéri, I. (Inst. Forens. Med., Budapest, Hungary): Die Wirksamkeit der CaEDTA-Behandlung in der Prophylaxe von Bleivergiftungen. (THE EFFECTIVENESS OF CaEDTA-TREATMENT IN THE PROPHYLAXIS OF LEAD INTOXICATION.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 11:261-4 (Nov.), 1961.

The prophylactic effect of Mosatil on Pb intoxication was tested on 25 workers in 2 accumulator factories, who did not show clinical signs of Pb intoxication (Pb-line, pallor, etc, but had been exposed to Pb from 3 mo-32 yr. They were divided into 2 groups, one showing slight Pb absorption with 100-300 µg/l porphyrin in urine, 100-300/million stippled erythrocytes (SE) (13 cases), and the other, higher Pb absorption group with >300 µg/l porphyrin in urine, >300 SE (12 cases). Mosatil was given orally (3 g/day for 10 days); Pb exposure was not changed. In the 1st group the number of SE was reduced in 50% of the cases and porphyrin in urine diminished to values below normal in almost all cases. Considerably less improvement was observed in the 2nd group. SE dropped to numbers below normal in only 1 patient and porphyrinuria was reduced in only 30%.

On the basis of the results, it is concluded that the use of Mosatil is indicated in cases where Pb absorption is slight, without changing working conditions; however, where Pb absorption is of higher degree, it is indicated only with removal of the worker from exposure to Pb. It is also admonished that in the latter case improvements in working conditions are absolutely necessary.

- 2230** Bátskor, I.A., and Timar, M. (Budapest): Az óloműrtés vizsgálata az ólommérgezés kezelése per os adagolt CaEDTA-val. (THE TREATMENT OF LEAD POISONING WITH CaEDTA PER OS.) Egészségtudomány 5, No. 3:259-63, 1961.

Examinations have been carried out in order to determine whether the administration of CaEDTA proved to be suitable in the treatment of Pb poisoning and on the other hand whether the increased Pb excretion caused by the effect of CaEDTA could be used in determining the Pb exposure more exactly. On the basis of the examinations it has been established: With per os treatment (during 15-20

days, daily 3 x 1 g) favorable therapeutic results might be obtained and therefore the treatment seems to be indicated in all cases where intravenous or intramuscular treatment was not applicable. The increased urinary Pb excretion has not proved to be suitable for the exact determination of the exposure. The increase in the Pb excretion due to the effect of CaEDTA basically differs in range in the different Pb-poisoned individuals and those who are working in Pb exposure but have no poisoning. The degree of the increase of Pb excretion due to the effect of CaEDTA is determined by the state of poisoning and not by the degree of exposure. The examination of the Pb excretion due to the effect of CaEDTA can be used in the diagnosis of Pb poisoning. (From Bulletin of Hygiene 37:22, 1962)

- 2231** Belknap, E.L. (Marquette Univ. Med. School, Milwaukee, Wis.): MODERN TRENDS IN THE TREATMENT OF LEAD POISONING. A REVIEW OF THE LITERATURE ON THE USE OF EDATHAMIL CALCIUM-DISODIUM. Journal of Occupational Medicine 3:380-91 (Aug.), 1961.

A review of the literature on the use of CaNa<sub>2</sub>EDTA over a 10 yr period in the treatment of inorganic Pb poisoning is presented. The dosage and results of treatment of 118 reported cases are tabulated. All but 1 received the CaEDTA intravenously. A bibliography of 46 references and a supplementary list of 25 references on EDTA treatment of Pb absorption in children is included.

- 2232** Beritic, T., and Stahuljak, D. (Yugoslav Acad. Sci. Arts; Univ. Zagreb, Yugoslavia): LEAD POISONING FROM LEAD-GLAZED POTTERY. (Letters to the Editor.) Lancet 1:669 (Mar. 25), 1961.

The authors emphasize the problem of Pb poisoning from Pb-glazed pottery used by peasants for the preparation and storage of wine, pickles, etc., and report that, in their practice (in Yugoslavia), they have treated, within 6 yr, >40 patients with severe Pb poisoning, including 3 cases of encephalopathy (1 fatal), and 6 cases of Pb palsy. Approximately 20-30 g of Pb is used to make a small earthenware pot or jug. The authors think that Pb contamination is greater before the glaze becomes cracked or broken.

- 2233** Bongard, E.M. (Clin. Div. Gorki Sci. Res. Inst. Ind. Hyg. Occup. Dis., USSR): Sosudistye narusheniya pri khronicheskoi intoksikatsii tetraetilsvintsom. (VASCULAR DISORDERS IN CHRONIC INTOXICATION WITH TETRAETHYL LEAD.) Kazanskii Meditsinskii Zhurnal 6:72-3 (Nov.-Dec.), 1961.

The author had found that in chronic TEL poisoning vascular changes were very variable; among 120 such patients, 20 showed a definite and 26, an inconstant rise in arterial pressure. Of the 20, only 2 were >51 yr old, 3 were 46-50 and 15, 30-45. Other disorders observed and discussed are: angiospastic manifestations, cardiac disorders, mental disturbances, and special tests performed, such as the elastometric, reaction to UV light, finding of hypothermia, and others. On the basis of the observations, the assumption of central

nervous system involvement is justified; also that most probably the disturbances are attributable to changes centering in the diencephalon.

- 2234** Bonsignore, D. (Univ. Genoa, Italy): Premesse biochimiche alla fisiopatologia del ricambio porfirinico nel saturnismo. (BIOCHEMICAL APPROACH TO THE PHYSIOPATHOLOGY OF PORPHYRIN METABOLISM IN LEAD POISONING.) Lavoro Umano 13, No. 12:606-18, 1961.

The mechanism of porphyrin and heme biosynthesis and metabolism, including the enzymatic reactions involved, is reviewed. Hypotheses on the site of action of Pb in cases of Pb intoxication, and the possibility of an experimental clinical approach to the study of the mode of action of Pb are discussed. (47 references)

- 2235** Borbély, F. (Univ. Zürich, Switzerland): Fehldiagnosen bei Bleivergiftungen. (ERRONEOUS DIAGNOSIS IN LEAD POISONING.) Praxis 50:813-7 (Aug.), 1961.

Toxic effects can produce or mimic almost any type of ordinary disease. Routine laboratory tests and physical examinations are not designed to uncover a possible occult toxicologic etiology but the latter should be considered more often in the diagnosis of disease.

The author describes 21 of 40 cases of Pb intoxication of which only 17 had been recognized or assumed as having to do with Pb intoxication, causing delay of correct diagnosis and treatment in all the others. The erroneous diagnoses made were as follows: Ventricular hypersecretion, appendicitis and cholecystopathy in the case of Pb ingested from foods cooked in an antique Pb-coated copper pan. Epidemic hepatitis in 2 cases and gastroenteritis in 1 case of Pb ingested by drinking cider from a Pb contaminated cider barrel. Duodenal ulcer, alcoholic polyneuritis, post-infectious polyneuritis, gastric ulcer, post-infectious colitis, "nervous breakdown," achlorhydria with neuritis and neurosis, and Tabes dorsalis in 8 cases of occupational Pb exposure. In the last case of the 8, 2 laparotomies were performed before the correct diagnosis of chronic Pb poisoning was made. Other cases of Pb poisoning were caused by a Pb- and As-containing material for implantation in plastic surgery. Incorrect diagnoses in these cases were anemia, acute abdomen, hepatitis, porphyria, and other conditions.

Persons with chronic Pb poisoning usually display symptoms of gastrointestinal dysfunction with anorexia, constipation and colic, called by the author "Pb dyspepsia." Painful exacerbations (classical Pb colic) often mimic appendicitis or hepatitis. Pb carriers frequently have stomach and duodenal ulcers. Diagnosis by therapy with Ca gluconate given iv as pain reliever has often revealed the true etiology of spasmodic complaints. Anemia, often refractory to therapy, is a common occurrence in Pb intoxication. Psychosomatic syndromes reminiscent of hysteria, neurosis, and signs suspicious of brain tumor are often present. Careful diagnostic studies should be performed to differentiate between Pb or other metal poisoning and diseases of nontoxic origin.

- 2236** Bruckner, J., and Šedivec, J.: HAZARDS OF SILICOSIS AND LEAD POISONING IN BATCH-ROOMS IN GLASS WORKS. *Pracovní lékařství* 13: 237-42 (June), 1961.

Out of 123 workers working in an atmosphere with 10-25 times higher than the permissible value for silica dust and 10-30 times higher for Pb than allowed by Czechoslovakian standards, only 11 showed various stages of stigmatization and interstitial fibrosis and 1 case of Pb poisoning. (From *Chemical Abstracts* 55:26273, 1961)

- 2237** Brusgaard, A. (Nat'l. Dept. Labor, Oslo, Norway): Vurderingen av blyverdier i urin. (EVALUATION OF LEAD CONTENT IN THE URINE.) *Nordisk Hygienisk Tidsskrift* 42: 71-4, 1961.

About 800 urine spot samples from Pb exposed workers showed a strong positive correlation between urine specific gravity and Pb content/l of urine. A correction to a standard sp gr of 1025 is strongly recommended as the corrected Pb values in urine give a more valid expression of Pb risk and exposure. The above sp gr value was established on the basis that 69% of the men exposed to Pb showed a urinary sp gr ranging from 1020-1029.

- 2238** Bushev, T.A. (District Hosp., Gorodnya, USSR): K praktike primeneniya unitiola pri svintsovykh otravleniyakh. (THE USE OF UNITHIOL IN LEAD POISONING.) *Terapevticheskii Arkhiv* 33:103-4 (May), 1961.

Acute Pb colic was treated successfully with 1-2 daily doses of 2-5 ml each of a 5% solution of unithiol, administered im for an average period of 10 days.

- 2239** Calabrese, A., Astolfi, E., and Mariani, F. (Coll. Med., Buenos Aires, Argentina): Tratamiento oral del saturnismo por ver-senato de calcio. Estudio clínico y experimental. (ORAL TREATMENT OF LEAD INTOXICATION WITH CALCIUM VERSENATE. CLINICAL AND EXPERIMENTAL STUDY.) *Dia Médico* 33:2292-4 (Oct.5), 1961.

Three groups of rabbits were poisoned with 1 mg Pb acetate/day, group 1 by iv injection, groups 2 and 3 by gastric tube. In addition, groups 1 and 3 were given 100 mg CaEDTA, orally and by gastric tube, respectively. After 15 days all animals showed signs of Pb poisoning. Death occurred in the order of groups 3, 2, 1.

Twenty-three workers suffering from Pb intoxication as diagnosed by Burton's line, porphyrinuria, anemia and the presence of stippled cells and Pb in the blood, were given orally for 1 mo 200 mg CaEDTA/day. Improvement was noted in most cases after 15 days. In a serious case of a 37-yr old woman poisoned by litharge, oral and iv treatment were alternated.

The authors conclude that orally administered EDTA is useful as a detoxicant in cases that are not severe or as a continuation of iv treatment. However, oral treatment is contraindicated when the patient, concomitantly, is exposed to ingestion of Pb. Orally administered EDTA is not metabolized; it is eliminated in the urine by 34% in 48 hr and by 98% in 96 hr. Doses up to 98 g with-

in 22 days do not cause untoward effects. The classic treatment consists of 5 g/day for 5 days and the same regimen repeated after 5 days rest.

- 2240** California, Department of Public Health: OCCUPATIONAL DISEASE IN CALIFORNIA ATTRIBUTED TO PESTICIDES AND AGRICULTURAL CHEMICALS, 1959. Berkeley, 1961, 30 pp.

A statistical compilation is presented of the data on cases of occupational diseases attributed to pesticides and other agricultural chemicals in 1959 in the State of California. The total number of cases attributed to Pb and/or As compounds was 22, with the following clinical type of distribution: Systemic poisoning, 9; dermatitis, 12; unspecified, 1. The distribution by industrial groups was: Agriculture, 14; construction, 3; service, 1; government, 4. The occupational distribution was: Craftsmen and foremen, 1; truck and tractor drivers, 1; servicemen, 1; farm laborers and foremen, 13; gardeners, 4; other, 1; not stated, 1.

- 2241** California State Department of Public Health (Berkeley): LEAD POISONING IN INDUSTRY. Occupational Health Technical Information Service 1961, 6 pp.

Although cases of fatal Pb poisoning have declined over the last 30 yr, nonfatal Pb poisoning is still a common systemic occupational disease and exposure is known to be possible in >100 different kinds of industries. Routes of absorption, acute and chronic types of poisoning, clinical and laboratory tests, therapy and prevention are discussed.

- 2242** Carducci, A., and De Judicibus, C. (Univ. Bari, Italy): Rilievi clinici e funzionali O.R.L. in soggetti esposti all'intossicazione saturnina. (CLINICAL AND FUNCTIONAL O.R.L. FINDINGS IN SUBJECTS EXPOSED TO LEAD POISONING.) *Folia Medica (Naples)* 44:1061-72 (Dec.), 1961.

An otorhinolaryngologic study was conducted on 16 subjects, average age 40 yr, who had been employed in an accumulator factory in which they had been exposed to Pb dust and vapors for 7-36 yr. Thirteen men showed parodontosis and 2 exhibited the typical gingival line. A deficiency of the hearing function of a perceptive type, which was limited to the right side of the tone field, was found in 11. Since such factors as preceding affliction, acoustic traumas and presbycusis could be excluded, the deficiency of hearing was attributed to the toxic effect of Pb. (14 references)

- 2243** Carow, G., and Leist, J. (Mainz-Weisenau; Rüsselsheim, Germany): Beobachtungen über Veränderungen der Laboratoriumsbefunde bei Bleiarbeitern in einem Metallbetrieb. (OBSERVATIONS ON VARIATIONS IN LABORATORY FINDINGS IN LEAD WORKERS IN A METAL FACTORY.) *Zentrablatt für Arbeitsmedizin und Arbeitsschutz* 11:289-93 (Dec.), 1961.

The data obtained on 1000 Pb workers (a total of 7855 laboratory values) twice a year, over a period of 5 yr were analyzed. Pb exposure was then divided into the following 4 stages: healthy

workers; stage of stimulation; presaturnism Grade 1; presaturnism Grade 2. The Hb values were, respectively, 96.6, 105.4, 102.7, 84.4; red cells, million/mm<sup>3</sup>, 4.57, 5.41, 5.06, 4.24; basophils/10,000, 0, 0, 35.9, 132.1; coproporphyrinuria, 0, 0-(+), +, ++, +, +++; Pb in blood (mg%), 0.031, 0.059, 0.069, 0.085. Statistical analysis revealed a correlation between seniority (length of exposure) and Pb intoxication. Basophilic erythrocytes, as porphyrinuria, decreased with length of work. There seemed to exist a growing resistance to the effects of Pb, which may be explained as an acquired immunity. Special value is placed on the stimulation stage which should caution the industrial physician in the judgment as to placement of the employees in the Pb environment.

- 2244** Chen, P.S., Jr., Terepka, A.R., and Hodge, H.C. (Univ. Rochester, Rochester, N.Y.): THE PHARMACOLOGY AND TOXICOLOGY OF THE BONE SEEKERS. *Annual Review of Pharmacology* 1:369-96, 1961.

Pb is included in this review because of its systemic effect and its importance in the toxicology of the future. Publications concerning diagnostic procedures and treatment of Pb poisoning are cited and a reconsideration of the MAC of Pb for continuous exposure is recommended.

- 2245** Danieli, G., Gajdos-Lörök, M., and Gajdos, A. (Hôtel Dieu, Paris, France): (A NEW TEST FOR LEAD POISONING - INCREASE OF  $\delta$ -AMINOLEVULINIC ACID IN URINE AND PLASMA.) *Pathol. et Biol.* 9:1481-6, 1961.

In Pb poisoning, either experimentally induced in rabbits or clinically observed in man, the plasma and urine demonstrated increased concentrations of  $\delta$ -aminolevulinic acid, measured by column chromatography on Dowex 2 and 50. The normal human concentrations are  $1.63 \pm 1.12$  mg/l urine and  $32.2 \pm 12.5$   $\mu$ g/100 ml plasma. In 24 cases of human Pb poisoning the range of urinary concentration was 5-58 mg/l and of plasma concentration, 66-138  $\mu$ g/100 ml. Elevations of plasma or urine concentrations were noted sporadically in a series of 59 patients with diseases other than Pb poisoning. In this series, elevations of both plasma and urine concentrations were observed in only 2 patients, both with liver cirrhosis. (From *Chemical Abstracts* 56:1719, 1962)

- 2246** Davidson, A.N.M., and Silver, A.L.L. (Southport, Lancashire; Fleets, Hants., England): HOME-MADE WINE AND LEAD-POISONING. Correspondence. *British Medical Journal* 2:1086 (Oct. 21), 1961.

In reference to Lane, C.R. and Lawrence, A. (*Brit. Med. J.* 2:939-40, 1961), the authors recall similar cases of Pb poisoning caused by home-made wine 30 yr ago in Devonshire and repeat the warnings. Silver, however, argues that so much Pb must have been ingested in the past that these and similar cases reflect unusual susceptibility on the part of the patients. He has found that intravenous Ca gluconate may give immediate and dramatic relief of the pain of Pb colic, and may therefore be valuable in diagnosis.

- 2247** Davis, P.L. (Paoli Med. Center, Pa.):

LEAD POISONING WITH BLADDER COLIC AND AMBLYOPIA. Letters to the Editor. *Journal of the American Medical Association* 175:257 (Jan. 21), 1961.

The character of Pb as the most serious, most frequent and most insidious of all occupational poisons, besides being a typical cumulative one, is demonstrated by the history of a 43-yr-old patient, working in 1 of 3 gasoline stations owned by him. At the end of each day's work he washed the upper part of his body including the upper extremities with gasoline but always bathed with soap and water when he arrived home. His main complaint was extreme perineal and retropubic pressure and pain. The other symptom was severe amblyopia without evidence of any changes in the fundus or signs of optic neuritis. He had a blue line on the gums. Hb level was 11.6 g; erythrocytes, 3,490,000/mm<sup>3</sup>. The blood smear revealed many stippled red cells. Examination of a thin, wet, heparinized blood droplet with a dark field condensor showed a fluorescence in >87% of the red cells; urinary Pb was 0.47 mg/l.

Diagnosis was "bladder colic" and amblyopia due to chronic Pb poisoning. Three daily iv injections of CaNa<sub>2</sub>EDTA in 5% glucose in water and an im injection on the 4th day of BAL produced complete recovery. The case illustrates the great importance of inquiring not only into the patient's occupation, but also into his social and working habits.

- 2248** De Bruin, J.: De dosering van Ca-EDTA bij de behandeling van chronische loodintoxicatie. (Ca-EDTA DOSAGE IN THE TREATMENT OF CHRONIC LEAD POISONING.) *Nederlands Tijdschrift voor Geneeskunde* 105:482-4 (Mar. 11), 1961.

As the result of reports that CaEDTA, in daily doses ranging from 4-40 g, had nephrotoxic effects, the author, with experience of 60 cases of Pb poisoning, tried doses up to 2.65 g (for an adult weighing 75 kg). Evaluating his experience of the effect of this treatment on the metabolism of Pb, he decided to alter the administration. His 16 cases responded rapidly and well to 2.65 g intravenous injections on alternate days. Treatment should be continued until urinary Pb excretion level reaches a normal level of 100-300  $\mu$ g. The treatment is safe and certain. (From *Bulletin of Hygiene* 36:745 (Aug.), 1961)

- 2249** De Dominicis, G. (Italy): Sul saturnismo. (LEAD POISONING.) *Minerva Medica* 52: 3643-5, 1961.

Recent developments in the field of Pb intoxication are reviewed. The following topics are discussed briefly: metabolism of Pb and its relation to Fe; siderocytes and reticulocytes in experimental saturnism; occupational Pb intoxication in the automobile and printing industry; use of chelating agents in diagnosis, prophylaxis and treatment of Pb intoxication; and the occurrence of gastroduodenitis and peptic ulcers in saturnism.

- 2250** De Freitas Tavares, J., and Porto, A.L. (Univ. Coimbra, Portugal): O emprego dos quelantes no tratamento do saturnismo. (THE USE OF CHELATING AGENTS IN THE TREAT-

MENT OF LEAD POISONING.) *Jornal do Medico* (Porto) 44:925-9 (Apr. 29), 1961.

Following a review of the chemical structure and chelating properties of EDTA, the authors describe 3 cases of occupational poisoning (a 37-yr-old painter, a 13-yr-old battery plant worker and a 33-yr-old fuel tank sounder, suffering with colic and other manifestations of Pb poisoning). Treatment with  $\text{CaNa}_2\text{EDTA}$  was successful. The authors recommend that in order to prevent Pb poisoning, the workers should, in addition to the classical methods of prescribing milk and protective measures such as masks and gloves, receive from time to time chelating agents administered orally. (31 references)

- 2251** Dinischiotu, G.T., Muică, N., Gradina, C., and Elias, R. (Inst. Hyg., Public Health, Romania): Studiul sindromului asteno-vegetativ in saturnismul industrial. (STUDY OF THE ASTHENO-VEGETATIVE SYNDROME IN OCCUPATIONAL SATURNISM.) *Studii si Cercetări Medicina Interna* 2:37-54, 1961.

A group of 100 patients, during various stages of Pb intoxication, were subjected to tests in order to study the vegetative tonus of various functional systems at rest and at work. On the basis of such studies as blood tests, plethysmography, optical adaptation, urea and creatinine clearance and others the conclusion was drawn that the disturbance of the vegetative system was due to Pb. The vegetative manifestations become less intense in chronic Pb intoxication. The asthenovegetative syndrome disappears gradually when the patient is removed from exposure to Pb. In some severe cases of Pb encephalopathy a persistent asthenia may occur as a sequela. (From authors' summary) (20 references)

- 2252** Elkins, H.B. (Div. Occup. Hyg., Boston, Mass.): MAXIMUM PERMISSIBLE URINARY CONCENTRATIONS: THEIR RELATIONSHIP TO ATMOSPHERIC MAXIMUM ALLOWABLE CONCENTRATIONS. Proceedings of the International Symposium on Maximum Allowable Concentrations of Toxic Substances in Industry, Prague, Czechoslovakia, April, 1959. *Pure and Applied Chemistry* 3:269-73, 1961.

Factors influencing the results obtained in the determination of the maximum permissible urinary concentrations (MUC) of Pb and its relationship to atmospheric MAC are discussed. The calculation of the urinary Pb concentration in terms of mg/24 hr or mg/l is affected by the fluid balance. Comparison of the amount of Pb excreted (mg/day) to volume of urine shows that the Pb concentration in spot samples varies 20-fold when the concentration of the urine is changed by varying the fluid intake. Therefore, it is suggested that the Pb concentration be related to the concentration of total solids (as measured by specific gravity) or of creatinine in the urine, as a reference point. Using this method, less fluctuations were observed than when no adjustment was made. The MUC (mg/l), MAC (mg/m<sup>3</sup>), and MUC/MAC for Pb are, respectively: 0:20, 0.20, and 1.0.

- 2253** Eskew, A.E., Crutcher, J.C., Zimmerman, S.L., Johnston, G.W., and Butz, W.C.

(Army Med. Lab.; Vet. Admin. Hosp., Atlanta, Ga.; Columbia, S.C.): LEAD POISONING RESULTING FROM ILLICIT ALCOHOL CONSUMPTION. *Journal of Forensic Sciences* 6:337-50 (July), 1961.

Five hospital cases of Pb poisoning in Atlanta, Ga., from heavy drinking of illicit alcohol for as long as 19 yr are described. The main complaint of the patients had been intermittent pain in the lower abdomen with headache, nausea and constipation or diarrhea for several weeks before admission. Laboratory findings showed anemia and other signs suggesting Pb poisoning in 3 cases which were successfully treated with  $\text{CaNa}_2\text{EDTA}$ . One of the 2 fatal cases had been diagnosed as acute syndrome due to alcoholism and not as Pb poisoning when autopsy revealed the following Pb values (mg/100 g wet tissue): brain, 0.83; liver, 1.6; kidney, 0.78. The other fatal case had twice previously been admitted to the hospital with the above listed complaints but he had always denied drinking "moonshine" or having any exposure to Pb. However, serum Pb determination subsequent to his 1st discharge showed 0.27 mg% Pb, and during his 2nd stay at the hospital he received  $\text{CaNa}_2\text{EDTA}$  treatments which produced urinary Pb excretion of 1.37 mg/l-0.75 mg/l during 10 days. Except anemia, all signs of poisoning disappeared, and the patient was discharged, but he was readmitted again after several weeks of heavy "moonshine" drinking and died after 48 hr. Upon admission, his hemoglobin was 10.4 g, hematocrit 34, peripheral blood smear showed marked basophilic stippling, leukocytes 18,600, 93% neutrophils, 4% lymphocytes, 3% monocytes, bilirubin 1.2 mg%; Coombs' test was positive, urinalysis negative. No treatment for Pb poisoning was attempted because of the patient's extremely poor condition and because it was felt that his clinical status was a brain syndrome due to alcohol poisoning. Autopsy revealed degenerative changes of the tubular epithelium of the kidney with large numbers of intranuclear inclusion bodies consistent with Pb poisoning. The liver and brain were strongly positive for Pb by spectrographic analysis. The conclusion was drawn that the manifestations in this patient might have been due to encephalopathy caused by Pb poisoning secondary to consumption of "moonshine." Analysis of samples from 87 seized stills from this area showed 0.01-0.09 mg Pb/l in mash, 0.12-74 mg Pb/l in distillates from automobile radiators, and 0.04-2.12 mg Pb/l in distillates from containers other than radiators.

- 2254** Falkowska, Z., Sobkiewicz, H., and Tur, J. (Acad.-Med., Warsaw, Poland): Cas de saturnisme chronique avec atteinte du système nerveux central et de l'organe de la vue (I). (CASES OF CHRONIC SATURNISM WITH INJURY OF THE CENTRAL NERVOUS AND VISUAL SYSTEM (I).) Proceedings of the Society of Industrial Medicine and Hygiene. *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 22:759-61 (Dec.), 1961.

A report of 22 cases of chronic Pb intoxication in taxicab drivers in Poland is presented. General complaints were attacks of headache accompanied

by vertigo, nausea and vomiting. Ten subjects suffered from pain above the eyeball, 11 from disturbed equilibrium. Pb colic was found in 3 men, anemia in 5, chronic hypoacid gastritis in 9. The nervous system was affected in all patients; lesions were observed in the pyramidal system and cerebellum and in isolated cases in the extra-pyramidal system. Visual disturbances consisted of decreased acuity of sight and changed sensitivity to colors, central and paracentral scotoma in the visual field, dilations of the veins in the fundus of the eye, contraction of the arterioles and changes in the retina. The appearance of nystagmus, unevenness of osteo-tendon reflexes, total or partial absence of abdominal reflexes, ataxia and unintentional tremor suggested incipient multiple sclerosis. The theory of an etiologic relation between Pb intoxication and multiple sclerosis is discussed. It is pointed out that intoxication by heavy metals may cause a process of demyelination which has the appearance of multiple sclerosis. Only one case of Pb intoxication with a typical picture of multiple sclerosis is known. But the neurologic alterations in the 1st stage of Pb intoxication often consist of demyelination.

In the discussion Albahary states that experimental and statistical studies are needed to prove that multiple sclerosis might be caused by Pb intoxication. As to the cases reported, the presence of Pb in blood and urine (although such analyses were not mentioned in the summary of the paper presented) would indicate only that a person had absorbed Pb but would be meaningful only if it was excessive and consonant with the symptoms. As an example he states that Pb levels are the same in a case of appendicitis and in one of bone fracture.

- 2255** Fanci, U.: Saturnismo di origine alimentare in zone rurali degli Abruzzi. (SATURNISM OF DIETARY ORIGIN IN RURAL ZONES OF ABRUZZI.) Ann. d. San. Pubblica 22:627-48 (July-Aug.), 1961.

In the rural province of Abruzzi, the occurrence of "subsaturanism" caused by the use of Pb-containing food utensils which are inferior to safety standards set by the Italian law, is discussed. Thirteen such cases in patients 14-60 yr old, which were investigated in May 1957-June 1958, are presented. Also described is a family outbreak of food poisoning with 1 death, caused by the consumption of cream cheese prepared and kept in a tinned copper vessel. Clinical and post-mortem investigations revealed evidence of Pb poisoning in the 3 adult members of the family. (From Bulletin of Hygiene 37:573, 1962)

- 2256** Foreman, H.: USE OF CHELATING AGENTS IN TREATMENT OF METAL POISONING (WITH SPECIAL EMPHASIS ON LEAD.) In Johnson, L.A., and Seven, M.J., ed.: Proceedings of a Conference on Biological Aspects of Metal-Binding Held at the Pennsylvania State University, University Park, Pennsylvania, September 6-9, 1960. Federation Proceedings 20, Supplement No. 10, Pt. 2:191-6 (Sept.), 1961.

The effectiveness of EDTA in the treatment of Pb

and TEL poisoning in adults and children is reviewed. The present knowledge regarding the process of Pb intoxication, the mechanism of EDTA action, the question of proper dosage, route of administration and the toxicity of EDTA is discussed. A table evaluating the various chelating agents which have been tried clinically in metal poisonings is included. (80 references)

- 2257** Frant, R., and van Mourik, J.H.C. (Philips Health Inst., Eindhoven, Netherlands): A METHOD OF EVALUATING WORKERS' EXPOSURE TO HARMFUL SUBSTANCES. Proceedings of the International Symposium on Maximum Allowable Concentrations of Toxic Substances in Industry, Prague, Czechoslovakia, April, 1959. Pure and Applied Chemistry 3, Nos. 1-2:123-6, 1961.

The authors point out the importance of periodical medical examinations in providing a check of whether hygienic measures are being carried out and whether they are effective. They also point to the difficulties encountered by the individual variation in response to toxic exposures. As an example they cite an unpublished report by P.A. van Wely who set out to determine what symptoms of Pb poisoning were detectable among 59 applicants who had never been exposed to Pb, and found as many complaints and irregularities as in a group of Pb workers; laboratory tests showed that the latter were actually in a worse condition.

A procedure is described whereby absorption of Pb is estimated before poisoning occurs. Pb was taken as an example because most experience has been gained with it. The various subjective and objective symptoms and laboratory findings are given a point rating corresponding to their significance. The following 8 criteria are given 1 point each, and each person is graded by the number of symptoms he presents: general impression; irregular stools; constipation; colic; extensor weakness; tremors; Pb line in gums; livid complexion. The maximum obtainable by 1 person is 8, and the maximum by a group of N persons is 8N. The total number of points actually awarded, in respect to symptoms found, is n; this figure divided by the maximum obtainable and multiplied by 100 gives the group percentage:  $100 n/8N$ . Scaling of laboratory results is as follows: porphyrinuria ( $\mu\text{g/l}$ ),  $<200 = 0$ ;  $200-400 = 1$ ;  $400 = 3$ ; basophilic stippling/1000  $<0.5 = 0$ ;  $0.5-3.0 = 1$ ;  $>3 = 3$ ; Hb% (Sahli method),  $>80 = 0$ ;  $60-80 = 1$ ;  $<60 = 3$ . Here the maximum score obtainable is 9 and the calculation is similar to the above. As there was no clear case of poisoning, the authors subjected a number of factory departments to periodical examination. They were able to divide the results into 3 classes according to Pb exposure and average group percentage for clinical examination and laboratory tests respectively: no danger,  $\sim 1/10$ th MAC, 0-3, 0-2; some danger,  $\sim 1/2$  MAC, 0-3, 3-5; causing concern, MAC,  $\sim 0-3$ , 8-20.

- 2258** Genot, R. (Namur, Belgium): Le saturnisme, un mythe; non, c'est une réalité. (LEAD POISONING, A MYTH: NO, IT IS A REALITY.) Scalpel (Brux) 114:424-6 (May 6), 1961.

While occupational diseases have been brought under control due to increased industrial hygiene so that

virulent cases of Pb intoxication are rare, there are still reports of death and disability due to Pb and benzene intoxications and silicosis. Medical attention is now focused mainly on hematologic changes, the early signs of Pb intoxication, such as determination of basophilic stippling of erythrocytes and reticulocyte by the methods of Wolfer, modified by Naegeli, which is described by the author in some detail.

- 2259** Glück, A., Vidican, T., Bernstein, R., and Szinetar, V. (Cluj, Romania): Contributii la studiul tolerantei organismului față de plumb. (TOLERANCE OF THE ORGANISM TOWARD LEAD.) *Revista Medicala (Targu-Mures)* 7, No. 3:284-5, 1961.

A new index (Meulenpracht) was applied to the determination of the severity of Pb poisoning based on data on number of erythrocytes and quantity of bilirubin in blood. The coefficient of Pb tolerance, designated CT = bilirubin in mg% x 6 / number of erythrocytes in millions. The limit value 1 corresponds to 0.6 mg% bilirubin and 3,600,000 erythrocytes. In 61 cases parallelism was found between the CT and the values of urinary Pb.

- 2260** Gofman, J.W., deLalla, O., Johnson, G., Kovich, E.L., Lowe, O., Martin, W., Piluso, D.L., Tandy, R.K., Upham, F., Weitzel, R., and Wilbur, D.: CHEMICAL ELEMENTS OF THE BLOOD OF MAN. US Atomic Energy Commission Document No. UCRL 9897, Fall 1961, pp. 1-26.

The concentration of 40 elements was measured in the blood serum of 20-22 subjects, using the X-ray emission technique. The following values were listed for Pb (μg/ml): mean 0.00; SD of distribution 0.22; standard error of measurement 0.24; standard counting error 0.05; estimated mean from literature 0.03.

- 2261** Grandjean, E. (Federal Polytech. Coll., Zürich, Switzerland): Corrélations entre valeurs d'exposition et valeurs dans les matières biologiques. (CORRELATIONS BETWEEN VALUES OF EXPOSURE AND VALUES IN BIOLOGICAL MATERIALS.) Proceedings of the International Symposium on Maximum Allowable Concentrations of Toxic Substances in Industry, Prague, Czechoslovakia, April, 1959. *Pure and Applied Chemistry* 3, Nos. 1-2:275-6, 1961.

The title correlations were made for trichloroethylene, Hg, and Pb exposures. For the latter, the concentrations of Pb in air were measured at various operations in 7 factories; urinary and blood Pb and urinary porphyrin (UP) were determined on 89-120 workers. The following coefficients of correlation (r) were obtained: Pb in urine and in air 0.90; Pb in blood and in air 0.86; UP and Pb in air 0.78; Pb in urine and in blood 0.71; UP and Pb in urine 0.80; UP and Pb in blood 0.77. According to these correlations, the following tolerable limits were established: Pb in air 0.15 mg/m<sup>3</sup>; Pb in urine 0.15 mg/l; Pb in blood 0.05 mg/100 g; UP 0.6 mg/l. The author concludes that the urinary Pb well reflects the exposure to Pb and that it constitutes a good method for the

evaluation of Pb absorption.

- 2262** Grandpierre, R., Arnaud, Y., and Blanquet, P. (Coll. of Medicine, Bordeaux, France): (GAMMA SPECTROMETRIC EXPLORATIONS CONDUCTED ON PATIENTS TAKING THE CURE AT LUCHON.) *J. Med. Bordeaux Sud-Ouest* 138: 1036-45 (Aug.), 1961.

The deposition of radioisotopes such as natural γ emitters <sup>210</sup>Pb, <sup>226</sup>Ra, and <sup>210</sup>Po, in the bones was determined in 30 patients who were drinking the water at Luchon and were exposed to it in the form of aerosols and as steam in a vaporarium. <sup>210</sup>Pb and <sup>226</sup>Ra were detected in some patients; peaks were obtained most frequently in those being treated in the vaporarium and 8 of 14 tested gave positive readings, indicating absorption of Rn daughter products in their bones. In patients being treated by other means, the readings were doubtful or negative. (From Nuclear Science Abstracts 17:Abstract No. 27042, 1963)

- 2263** Grieco, A., and Sartorelli, E. (Univ. Milan, Italy): Atrofia ottica bilaterale di origine saturnina. (BILATERAL OPTIC ATROPHY CAUSED BY Pb INTOXICATION.) *Medicina del Lavoro* 52:780-3 (Dec.), 1961.

A case of bilateral optic atrophy due to retrobulbar neuritis caused by chronic Pb intoxication in a Pb smelter, who had been exposed to Pb for 23 yr, is described. The diagnosis of Pb intoxication was based on the patient's prolonged exposure to Pb vapors, previous history of Pb colic, presence of normochromic anemia, and on the abnormal Pb absorption which was detected 2 yr after the patient had been removed from the Pb environment. Laboratory tests showed 80 μg% Pb and 150 μg% protoporphyrin IX in blood, 70-80 μg Pb and 50-100 μg/24 hr coproporphyrin in urine.

- 2264** Harding-Barlow, I.: STUDIES ON THE TRACE ELEMENT CONTENT OF HUMAN TISSUES. Dissertation. University of Capetown, April, 1961, 202 pp.

To allow a comparison of "normal" (as represented by accidental death cases) and diseased tissue from the standpoint of distribution types, most frequent concentration range, and possible inter-element relationships, the author gives a histogrammic presentation of data in her thesis. Three main aims were: (1) to obtain as much information as possible about the concentrations and frequency distribution of trace elements in "normal" organs; (2) to obtain preliminary data concerning the trace element concentrations in carcinoma and eclamptic death cases; and (3) to examine data obtained in (1) and (2) for possible features which may be biochemically significant. Tissues were analyzed in duplicate by a dc arc spectrographic technique for the estimation of 21 elements, including Pb, in liver, lungs, spleen, kidneys, heart, pancreas, and brain (and uterus, ovaries, and breasts) in 68 accidental deaths, 9 carcinoma deaths, and 1 eclamptic death, mainly from the Cape Peninsula. Race groups represented were Cape Colored (36), Europeans (17), native Africans (9), Cape Malays (5), and Indian (1), with an age range of 16-74 yr.

Relative deviation of the trace element concen-

trations found ranged from 7-25%. Pb findings in  $\mu\text{g}/100\text{ g}$  dry tissue showed the following ranges: liver, 99-3660; lungs, 20-3380; spleen, 50-2750; kidneys, 30-2400; heart, 5-260; pancreas, 30-2400; brain, 8-370; uterus, 10-83; breast, 4.7-15.8; ovaries, 9-56. The largest amount of Pb was found in the liver. Results compared fairly closely with those of Tipton, Kock, Tietz, Stitch, Kehoe, and Letonoff. A comparison of results obtained in America (Tipton 1960) with those in Capetown by the author showed little geographical variation from place to place, except that of the spleen. However, geographical differences could not be compared critically since data from the literature were not very detailed. Age differences were not found to be significant.

By consideration of extreme values of elements occurring together in an organ from a given case, it was shown that certain combinations of elements were found frequently, and that these combinations did not depend on the type of organ studied. One example of these combinations was the combined enrichment of Pb and Fe, Pb being elevated with Fe more frequently than with any other element and more frequently than it is elevated on its own.

In analyzing the trace metal content of the organs of the 9 carcinoma patients, the author found that Pb values in the kidneys and pancreas tended to be low. Pb ranges in  $\mu\text{g}/100\text{ g}$  dry tissue were: liver, 174-1510; lung, 83-216; spleen, 115-800; kidneys, 76-3890; heart, 9-113; pancreas, 103-501; brain <15.5-68; tumor, 40-190. In the 1 case of eclampsia studied the elevation of Pb in kidneys found by Letonoff et al (1940) was not confirmed, but no conclusion can be drawn from 1 result. Pb results of this 1 case (in  $\mu\text{g}/100\text{ g}$  dry tissue) were: liver, 95; lungs, 55; spleen, 70.5; kidneys, 87.5; heart, 15.7; pancreas, 119; brain, 34.8; uterus, 24.7; ovaries, 34.8; thyroid, 18.7.

- 2265** Hardy, H.L.: CLINICAL EXPERIENCE WITH THE USE OF CALCIUM DISODIUM ETHYLENEDIAMINETETRAACETATE IN THE THERAPY OF LEAD POISONING. In Johnson, L.A., and Seven, M.J., ed.: Proceedings of a Conference on Biological Aspects of Metal-binding Held at the Pennsylvania State University, University Park, Pennsylvania, September 6-9, 1960. Federation Proceedings 20, Supplement No. 10:199-202 (Sept.), 1961.

The clinical effects of  $\text{CaNa}_2\text{EDTA}$  in the treatment of Pb poisoning are reviewed and its action in a number of individual cases is described. The amount of Pb removed by  $\text{CaNa}_2\text{EDTA}$ , the variation in time that lapses after its use and the return to normal of such indices of intoxication as the hematologic abnormalities and urinary coproporphyrin levels, are discussed. The possibilities of therapy with chelating agents in heavy metal poisoning are emphasized. The author concludes that in addition of the return to normal of the above-mentioned criteria, relief of neuropathy, and measurable improvement in the prognosis of childhood plumbism are real and objective criteria of clinical effect of  $\text{CaNa}_2\text{EDTA}$  in treatment of Pb poisoning.

- 2266** Heilmeyer, L., and Clotten, R. (Univ.

Clinic, Freiburg, Germany): Störungen des Porphyrinstoffwechsels bei Anämien. (CHANGES OF THE PORPHYRIN METABOLISM IN ANEMIAS.) Münchener Medizinische Wochenschrift 103:789-93, 862-5, 1961.

A discussion of Pb anemia is included in the paper. Porphyrin values in 2 cases of Pb intoxication are shown in a diagram. Although in Pb intoxications the Fe level in the blood plasma is high, the protoporphyrin (PP) concentrations are also significantly increased. It is therefore concluded that Pb interferes with the Goldberg enzyme which is responsible for the incorporation of Fe into PP. Although PP is greatly increased in the erythrocytes, it is not increased in the urine which, however, shows an increased level of coproporphyrin. Furthermore, Pb interferes with a lower stage of porphyrin synthesis by causing an increase of ALA in the urine to 22,800  $\mu\text{g}/24\text{ hr}$  in mild Pb intoxications and to 63,600  $\mu\text{g}/24\text{ hr}$  in more severe Pb poisonings. These anemias in which sufficient Fe is available but hemoglobin synthesis is insufficient, are called "sidero-achrestic" anemias.

- 2267** Hess, J.W. (Wayne State Univ. College of Med., Detroit, Mich.): LEAD ENCEPHALOPATHY SIMULATING SUBDURAL HEMATOMA IN AN ADULT. REPORT OF A CASE. New England Journal of Medicine 264:382-4 (Feb.23), 1961.

This report illustrates that acute Pb encephalopathy still occurs in adults in spite of general improvement in industrial health measures, and that the clinical picture may simulate other acute neurologic conditions. A 40-yr-old man who had a history of alcoholism, was admitted to the hospital because of a convulsion; his cerebral symptoms were attributed to alcoholism. After he had a number of further seizures during the following 4-5 days, laboratory tests were carried out. A blood smear revealed 18 basophilic stippled cells/1000 red cells. Plasma urea nitrogen was 40 mg/100 ml. Lumbar puncture showed an initial cerebrospinal fluid pressure of 225, a closing pressure of 180 mm of water, with a protein content of 107 mg/100 ml. Intravenous administration of EDTA after 3 days resulted in urinary excretion of 7.25 mg Pb/24 hr. Total urinary coproporphyrin excretion during the 4th day of EDTA therapy was 516  $\mu\text{g}/24\text{ hr}$  (normal value, <100  $\mu\text{g}/24\text{ hr}$ ). In addition to EDTA he was treated with diphenylhydantoin given im, and iv infusions of fluids and penicillamine. His condition improved rapidly and plasma urea nitrogen, spinal-fluid pressure and protein content in the spinal fluid returned to normal values. Upon questioning after his recovery, the patient stated that for the past 6 mo he had been breaking down old batteries and melting the Pb into piggyots, without wearing protective equipment. He also told that he had had intermittent abdominal cramps for 3 wk and mild headache, dizziness and mild dyspnea for 2 wk prior to admission. He was discharged after having received a total of 29 g EDTA in courses averaging 2 g daily for 2 periods of 1 wk each.

- 2268** Hill, C.R., and Jaworowski, Z.S. (Royal Cancer Hosp., London, England): LEAD-210 IN SOME HUMAN AND ANIMAL TISSUES. Nature (London) 190:353-4 (Apr. 22), 1961.



Measurements made of the levels of stable Pb and  $^{210}\text{Pb}$  in 6 samples of vertebral bones from British subjects who had died from malignant disease showed means of 6.3  $\mu\text{g/g}$  and 0.026 pCi/g wet tissue; 2 samples of ox shaft bone had means of 3.1  $\mu\text{g}$  and 0.25 pCi/g. The concentrations were found to be comparable to those reported by Hursh and Holtzman. Two liver samples were also analyzed for  $\alpha$ -radioactivity. It was found that  $\geq 80\%$  of the total activity was due to the presence of  $^{210}\text{Pb}$ . The much larger amount of  $^{210}\text{Pb}$  in ox bone is attributed to the previously reported occurrence of this nuclide on foliage (Hill, 1960).

- 2269** Hofreuter, D.H., Catcott, E.J., Keenan, R.G., and Xintaras, C. (US Publ. Health Serv., Cincinnati, O.): THE PUBLIC HEALTH SIGNIFICANCE OF ATMOSPHERIC LEAD. Archives of Environmental Health 3:568-74 (Nov.), 1961.

Approximately 1000 human blood samples and 250 urine specimens were collected and analyzed for Pb content during 1960, using the USPHS Method for Lead. About 120 people in each of the 6 cities under study (New Orleans, Dallas, Denver, Chicago, New York, Cincinnati) and 16 persons in a rural area contributed blood samples. Single specimens of urine were collected from 25% of the subjects in the urban location, but circumstances at the rural site precluded this collection. Only persons who had lived in an area for at least 5 yr were included; history as to occupations during the past 10 yr and smoking habits and a brief medical history were obtained. In addition, blood and urine samples were collected from a group of 88 men exposed to unusual amounts of motor exhausts in their employment at an auto inspection facility and a maintenance garage operated by a large midwestern city. Samples were obtained from all on Monday and from 66 of them on Friday of the same week. Aerometric measurements were made concurrently in this instance.

As tabulated, the mean Pb values in blood of the urban inhabitants ranged from 0.018-0.022 mg/100 g (ranges, 0.003-0.060); in the rural, 0.014 (0.001-0.038); the urine Pb of the urban area was 0.014-0.030 (0.002-0.081) mg/l. Among 58 individuals from the urban areas and 5 from the rural area with blood Pb values  $>0.030$  mg/100 g, 14 and 3, respectively, had a known occupational exposure to Pb. By exclusion of these individuals, the composite mean value for the urban blood samples was 0.019 and for the rural, 0.014 mg/100 g. The influence of sex, age, and smoking history was also studied: Males in the urban areas showed a mean Pb content of 0.021 mg/100 g blood (0.005-0.059); females, 0.016 (0.003-0.060); in the rural areas, the respective values were 0.016 (0.005-0.038) and 0.010 (0.001-0.018). As to age groups 15-30, 30-45, 45-60 yr, in the urban area the means were 0.019 (0.005-0.060), 0.020 (0.003-0.059) and 0.021 (0.004-0.053), and in the rural area, 0.015 (0.005-0.030), 0.014 (0.001-0.038), and 0.014 (0.001-0.036). Smokers and nonsmokers in the urban areas showed 0.021 (0.005-0.060) and 0.017 (0.003-0.044), and the rural dwellers, 0.017 (0.010-0.038) and 0.011 (0.001-0.036) mg/100 g.

Among the occupationally exposed men, 28 auto inspectors had a mean blood Pb of 0.030 (0.011-

0.041) mg/100 g; mechanics, 0.031 (0.008-0.059); clerks 0.024 (0.019-0.032); the urinary concentrations for these were, respectively, in mg/l: 0.041 (0.015-0.124), 0.046 (0.010-0.133), and 0.049 (0.022-0.078). Aerometric measurements at this installation showed average particulate Pb content, in  $\mu\text{g}/\text{m}^3$  (and range), outside of buildings, 2.1 (0.9-3.8); inspection lane, 14.8 (8.9-20.0); garage areas, 21.1 (5.2-131-6).

In summarizing the results, the authors observe that although significant differences were found between various classifications, the mean values for each group were within the recognized normal range of Pb concentrations. Not a single value exceeded the accepted high normal limit of 0.07 mg/100 g of whole blood. Also, these results tend to support previous reports concerning the human body's Pb concentrations. (14 references)

- 2270** Horiuchi, K.: FUNDAMENTAL STUDIES TO ESTABLISH A SUITABLE MAXIMUM ALLOWABLE CONCENTRATION OF LEAD IN INDUSTRIAL AIR. Pure and Applied Chemistry 3:145-50, 1961. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School. Vol. 2, April 1959-March 1961, pp. 46-51.

The author reviews the studies performed in Osaka City University Medical School toward the establishment of a MAC for Pb in air in industries. These included: (1) Experiment with 3 human subjects to 2 of whom Pb was administered orally for various periods over 9 mo (Oct 1952-July 1953); (2) experiment with dogs orally administered Pb; (3) with guinea pigs given radioactive Pb (RaD); (4) statistical study of the upper limits and averages of Pb in blood, urine and feces of Japanese in urban and rural areas; (5) statistical study on the upper limits and averages of Pb in blood, urine, and feces of laboratory animals; (6) a study of the Pb content in Japanese daily food; (7) studies on the MAC of Pb in air; (8) a study on a combination method of diagnosis of mild or latent Pb poisoning (an application of the statistical discriminant function). Papers of the last 2 studies were presented at the 11th International Congress on Occupational Health, Naples, 1954.

- 2271** Horiuchi, K., Horiguchi, S., Asano, I., Hashimoto, K., Noma, K., and Narita, I. (Osaka City Technol. Inst., Japan): A NEW NEBULIZER TO BE EMPLOYED IN THE FIELD OF OCCUPATIONAL HEALTH. (Journal of Osaka City Medical Center 10:351-5 (March), 1961. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School. Vol. 2, April 1959-March 1961, p. 40.

The new apparatus for the formation of mist of Pb solutions, shown in a diagram, enables a satisfactory particle size distribution (90-94%  $<5 \mu$  and 40-67%  $<1 \mu$  in diameter) to penetrate the respiratory tract of human subjects. It can also be used for the administration of aerosols of certain soluble substances.

- 2272** Horiuchi, K., Masuya, Y., Hashimoto, K., Asano, I., Iwamoto, R., Komoike, Y., Ara-

take, K., and Kuromyo, M.: AN EXPERIENCE OF INTRATRACHEAL ADMINISTRATION OF CALCIUM DISODIUM ETHYLENE-DIAMINE-TETRAACETATE (Ca-EDTA) BY LEAD WORKERS AT THEIR ACTUAL WORKING PLACE. Osaka City Medical Journal 7, No. 1:59-62, 1961. In Contributions from the Department of Preventive Medicine and Public Health, Osaka City University Medical School, Vol. 2, April 1959-March 1961, pp. 41-4.

Pb poisoning was treated by intratracheal administration of CaEDTA solution as an aerosol by new inhalation equipment which has an air compressor of 1/2 horsepower (almost 1 kg/cm<sup>2</sup> gauge pressure) and 10 glass nebulizers. The size of aerosol particles produced by this equipment was  $\sim 1 \mu$  in diameter. A 20% aqueous solution of CaEDTA was used. Five male Pb workers, 25-49 yr old who had worked in a Pb plant for 3-13 yr were selected. The air of the workplace contained means of 0.1-1.5 mg Pb/m<sup>3</sup>. The workers received  $\sim 4$  g CaEDTA daily for 4 days (at lunch recess). Before the experiment, urine coproporphyrin (CP) was 0.25-0.85, blood Pb 41.3-104.6  $\mu$ g/100 g, and urine Pb 0.151-0.288 mg/l. Urinary Pb increased soon after administration then decreased after inhalation was discontinued. CP elimination decreased significantly and continued to do so for at least 2 days after the inhalation period. No ill-effects from this method were noted.

- 2273** Hoschek, R. (Ind. Physician, Stuttgart, Germany): Bleispiegelwerte im Blut bei gesunden Arbeitern einer Bleifarbenfabrik. (LEAD CONCENTRATIONS IN THE BLOOD OF HEALTHY WORKERS IN A LEAD PAINT FACTORY.) Medizinische Welt 51:2687-90 (Dec.), 1961.

A group of 56 healthy workers employed in a Pb paint factory for 0.5-30 yr (av 5.7 yr) was tested for Pb levels in the blood. (The method used is not mentioned.) All workers were free of any signs or symptoms of Pb intoxication and showed neither stippled erythrocytes nor increased urinary porphyrins. Pb concentrations found in the blood ranged from 35-110  $\mu$ g%, av 64.6  $\mu$ g%. The seasonal averages, as shown in a figure were: for winter, 76.3, for spring, 66, and for late summer, 54  $\mu$ g%. It appeared that both urinary excretion and levels of Pb in the blood are subject to seasonal variations in that urinary Pb excretion is higher during the summer months and consequently the Pb level in the blood decreases. The author concludes that determination of the Pb level in the blood is not a suitable test for the diagnosis of Pb intoxication. Measurement of stippled erythrocytes and a quantitative analysis of urinary porphyrin are much more significant for the diagnosis of Pb intoxication. (22 references.)

- 2274** Howe, G.M. (Univ. Coll., Aberystwyth, United Kingdom): THE GEOGRAPHICAL VARIATIONS OF DISEASE MORTALITY IN ENGLAND AND WALES IN THE MID-TWENTIETH CENTURY. Advancement of Science 17, No. 69:415-25, 1961.

With the introduction of the comprehensive National Health Service in 1948, medical and statistical facilities were extended to all classes of society and reliable death certificates became available.

These were used by the author for his study for the years 1950-3. The following causes are dealt with: Arteriosclerotic heart disease, including the coronary; vascular lesions affecting the central nervous system; malignant neoplasm; bronchitis, and all causes. Pb is brought into discussion in connection with cancer of the stomach; high rates of mortality were shown in Wales and the north-west of England, although there were some exceptions. Caernarvon, Merioneth and Cardigan were found to be a continuous area of high mortality rates, >45% above the national average. The author urges, since it had been suggested that people there eat vegetables grown on soils of high organic content, that more attention be devoted to the water supplies of this part of Wales, especially those polluted by former Pb mine effluents. However, such factors would not explain the very high rates in other areas of Wales. The relationship between high mortality from lung cancer and densely populated areas is obvious, not only because of smoke but motor exhausts, and other factors.

The author concludes his analysis by saying that one cannot be dogmatic about any apparent spacial relationship between the distribution of disease and the manifold feature which diversify the geography of England and Wales. Correlations considered are climate, possibly operating through food and water supply, atmospheric pollution, soil type, sanitary and social environments, hereditary predisposition, increasing sedentary nature of work, anxieties, and the like. The answer probably rests with a complex of causes which can be resolved only by team work of those in medicine and allied sciences together with geographers.

- 2275** Hublet, P. (Belgium): COMMENTS RELATING TO THE PREVENTIVE ADMINISTRATION OF EDTA FOR THE PREVENTION OF LEAD POISONING. Third World Congress on the Prevention of Occupational Risks. Paris, France, 1961: 492.

Although the Pb-EDTA complex is harmless, due to the nephrotoxicity of EDTA alone, and the possibility of its causing vitamin B deficiency, the author is opposed to the current practice of oral administration of EDTA as a prophylactic measure in Pb intoxication. Experience has also demonstrated that in plants where the tablets were regularly administered, the personnel exposed to the risk of Pb poisoning thought it was fully protected against intoxication and tended to disregard individual elementary health measures, and that employers forgot that the elimination of toxic dust at the place of origin must be their prime concern.

- 2276** Humperdinck, K. (Ruhr Miners' Org., Bochum, Germany): Die Bleivergiftung. (LEAD INTOXICATION.) Knappschaftsarzt 26/27: 15-28 (Jan.-June), 1961.

A review of the literature dealing with the mechanism, symptoms, diagnosis and therapy of Pb intoxication is presented. (66 references.)

- 2277** Hutchinson, H.E., and Stark, J.M. (Dept. Haematol. Univ. and Western Infirmary, Glasgow, Scotland): THE ANEMIA OF LEAD POISONING. Journal of Clinical Pathology

14:548-9 (Sept.), 1961.

Three cases of Pb intoxication are briefly presented. A housewife who had taken large quantities of Pb and opium pills for diarrhea, and 2 Pb burners suffered from severe hypochromia. Serum Fe levels were normal, stippling of red cells was absent. Bone marrow showed normoblasts, erythropoiesis with excess stainable Fe. All 3 patients responded quite well to EDTA therapy and after diuresis with oral treatment of EDTA the Hb levels rose. The cause of anemia was found to be depressed hemoglobin synthesis and lag of red cell formation.

- 2278** Házl, F., Joachimsthaler, J., and Sýkora, J.: (CHRONIC LEAD POISONING AND EDTACAL SPOFA DURING PREGNANCY.) *Praktický Lekar* 41, No. 15/16:702-706, 1961.

Treatment of chronic Pb poisoning of pregnant women, working as Pb glazers, with Edtocal Spofa, is described. The problem of the pathological action of Pb on the course of pregnancy is discussed. (From Scientific Reports on Industrial Hygiene and Occupational Diseases in Czechoslovakia 6:Abstr. No. 165, 1962)

- 2279** Házl, F., Suchanová, L., and Sýkora, J. (Univ. Karlov, Prague, Czechoslovakia): Naše zkušenosti s prevencí a léčením otravy olovem pomocí komplexonu  $\text{CaNa}_2\text{EDTA}$ . (OUR EXPERIENCE WITH THE PREVENTION AND THERAPY OF LEAD POISONING WITH CALCIUM DISODIUM EDTA.) *Acta Universitatis Carolinae, Medical Supplement* 15:199-209, 1961.

For the prevention of occupational Pb poisoning a series of 4 iv injections of 2 g  $\text{CaNa}_2\text{EDTA}$  each was applied. The treatment was successful in women glazing tiles with a Pb-containing glaze, in workers removing minium polish and in men working with Pb-containing bronzes. Possible harmful effects of EDTA and the prevention of such possible metabolic disturbances by diet and medication are discussed. (32 references)

- 2280** India, Ministry of Labour and Employment (New Delhi, India): SILICOSIS HAZARD IN A LEAD AND ZINC MINE IN RAJASTHAN. New Delhi, Office of the Chief Adviser Factories, Report No. 21, 1961, 78 pp.

A medical and environmental study was conducted on the dust hazard at the Zawar Pb and Zn mine in Rajasthan, India. Only the mill workers at the crushing plants were exposed to dust concentrations exceeding the threshold limits. Medical examinations of a sample of 173 workers out of 606 miners and 101 workers at the concentration mill showed that 30.4% of the workers had evidence of dust deposit in the lungs, and 21.2% of those employed only in the Zawar mine. Blood tests revealed that 31.5% of the workers suffered from anemia, the cause of which was to be investigated. Recommendations for improving the environmental conditions are given. Periodic X-ray examination of miners and certain surface workers is advised. Skiagrams of 14 illustrative cases are included. (61 references)

- 2281** Jenšovský, L., and Roth, Z. (Inst. Ind. Hyg. Occup. Dis., Prague, Czechoslovakia):

Der normale Bleigehalt im menschlichen Blute. (THE NORMAL LEAD CONTENT OF HUMAN BLOOD.) *Naturwissenschaften* 48:382-3, 1961.

The Pb content of blood was determined by reversible polarography. Samples were analyzed from healthy individuals of varying ages. The general tendency was for a higher average Pb content in younger people and a lower content for people past middle age. The concentrations are depicted in a spread-graph.

- 2282** Jonderko, G. (Clinic for Internal Dis., Zabrze, Poland): Wartość rozpoznawcza oznaczania poziomu glutationu we krwi w przewlekłej ołowicy u ludzi. (DIAGNOSTIC VALUE OF THE DETERMINATION OF THE BLOOD GLUTATHIONE LEVEL IN CHRONIC POISONING IN HUMAN SUBJECTS.) *Polskie Archiwum Medycyny Wewnętrznej* 31, No. 5:647-55, 1961.

Investigations were conducted on a group of 51 males and 15 females exposed to Pb, a group of 30 males with chronic, chiefly hypochromic anemia, and 30 males with severe posthemorrhagic anemia. Among the subjects exposed to Pb, 30 males and 13 females showed symptoms of anemia, while 16 males and 2 females showed signs of Pb absorption. Blood glutathione level and index decreased markedly in cases of Pb-induced anemia. A differentiation could be made between the behavior of glutathione index in Pb-induced anemia and other anemias. Treatment with  $\text{CaEDTA}$  increased the glutathione index. Estimation of glutathione level and index may be of importance in the diagnosis and prevention of Pb poisoning. (From author's English summary)

- 2283** Karpatkin, S. (New York Univ., N.Y.): LEAD POISONING AFTER TAKING Pb ACETATE WITH SUICIDAL INTENT. REPORT OF A CASE WITH A DISCUSSION OF THE MECHANISM OF ANEMIA. *Archives of Environmental Health* 2:679-84 (June), 1961.

In the case reported, a 37-yr-old Negro woman had ingested ~7 g Pb acetate (Pb and opium solution NF). Her past history included jaundice and alcoholism (the latter since 1935). The intoxication was manifested by vomiting, transient proteinuria, anemia, transient extensor hand muscle paresis, weakness, headache, and paresthesias. The highest content of Pb in blood was obtained on the 8th day (0.028 mg/100 g) and although glassware not specifically treated with nitric acid was used, were considered to be consistent with values to be expected from a single acute exposure. A provocative test with EDTA clearly demonstrated that the patient had absorbed significant quantities of Pb from her gastrointestinal tract. The author discussed at some detail the patient's anemia, evidenced by a fall in hematocrit from 54-34 in a 2-wk period, by reviewing 7 reports of acute poisoning found in the literature of the past 20 yr. The findings in these cases are tabulated. A tabulation of the patient's hospital course is also included. This shows the blood cell counts, Pb in blood and urine, urine volume, and urinary coproporphyrins (negative from the 19th day). (20 references)

- 2284** Kasparov, A.A.: (ACCUMULATION OF LEAD IN THE WORKERS OF LEAD-ZINC MINES AND CONCENTRATION PLANTS.) Trudy Tadzhijskogo Meditsinskogo Instituta 51:53-7, 1961.

When 51 workers (21 women and 30 men), occupied in operations on flotation and crushing of ore, were examined, an increased content of Pb in urine (0.05 mg/l in 41 persons and >0.05 mg/l in 10 persons) was noted. The counts of hemoglobin, erythrocytes and leukocytes in the blood remained in the normal range. (From Chemical Abstracts 60: 13780, 1964)

- 2285** Keeling, J. (Wellington, New Zealand): LEAD POISONING AS AN OCCASIONAL HAZARD TO ARTISTS. New Zealand Medical Journal 60:555-9 (Dec.), 1961.

The annual reports of the Director-General of Health in New Zealand show that in 1949-53 there were 41 notifications of chronic Pb poisoning, all of which had an industrial source. In 1954-58 there were only 28 notifications, all except one having an industrial source. The distribution of the cases was, respectively, 9 and 14 in the battery industry; 11 and 3 in the paint industry. Two cases of Pb intoxication caused by accidental ingestion of basic Pb carbonate used in an artist's oil paint "Flake-White" were presented. A 26-yr-old man and a 58-yr-old woman suffered from abdominal colics. Laboratory tests showed 20,000 and 10,000 stippled cells/million red cells, respectively, and a large amount of coproporphyrin in the urine. In the 1st case Pb in the blood was 92 µg/100 ml and in the 2nd case Pb in the urine was 1100 µg/24 hr. Preventive measures have been taken by the Department of Health which requires the labeling of all artists' paints containing Pb in accordance with regulations 23 of the Lead Process Regulation 1950. (16 references)

- 2286** Kehoe, R.A. (Univ. Cincinnati, O.): VALUE OF CALCIUM DISODIUM ETHYLENEDIAMINETETRA-ACETATE AND BRITISH ANTI-LEWISITE IN THERAPY OF LEAD POISONING. In Johnson, L.A., and Seven, M.J., ed.: Proceedings of a Conference on Biological Aspects of Metal-binding Held at the Pennsylvania State University, University Park, Pennsylvania, September 6-9, 1960. Federation Proceedings 20, No. 3, Part II, Supplement No. 10: 196-9, 1961.

The author objects to the use of BAL in the therapy of Pb poisoning and cautions against the acceptance of CaNa<sub>2</sub>EDTA as the "specific remedy" for these cases even though it is an effective agent for the elimination of excess Pb from the body. The mechanism of Pb poisoning and its therapy by chelating agents is discussed.

- 2287** Kehoe, R.A. (Univ. Cincinnati, O.): THE METABOLISM OF LEAD IN MAN IN HEALTH AND DISEASE. Archives of Environmental Health 2:418-22 (Apr.), 1961.

(This is a condensation of the author's abstract of the Harben Lectures 1960, given at The Royal Institute of Public Health and Hygiene, London.)

Lecture No. 1: Normal metabolism of lead. Information gathered over a period of years has demonstrated the sources and the quantities of Pb

taken in daily from food and beverages by the average North American adult. A considerable portion of the ingested Pb is natural in origin; an appreciable proportion is also derived from the introduction of Pb into food and beverages in a great number of ways. The contribution of inhaled Pb is small but not insignificant. The quantities of Pb from these sources vary within certain limits by the natural and artificial characteristics of a given geographic area and society. The situation in USA will not apply, necessarily, elsewhere. The fate of the ingested and inhaled Pb by the adult (US) can be represented in terms of the patterns and quantities of the alimentary and urinary output of Pb, and the distribution of Pb in the tissues of the body. The Pb content of the food and beverages consumed daily by the US adult varies from <0.10 mg/day to >1 mg/day occasionally; the average (for any 1 individual) is from 0.12-0.35 mg/day. Inhaled Pb generally varies from ~0.01-0.09 mg (av 0.04 mg/day). Somewhat <10% of the ingested Pb is absorbed; most of it is eliminated in the feces (nearly the same as the amount in food, for some of the absorbed portion is returned to the alimentary tract in the biliary and digestive secretions). The finely divided Pb in the air is retained in the lung to the extent of 30-50% and that retained is absorbed fairly promptly under ordinary conditions. The absorbed Pb is excreted, in addition to via the alimentary tract, via the kidney (also in the sweat under appropriate conditions); the remainder is distributed in the tissues of the body (from which there is a roughly corresponding counterstream). Under usual circumstances the daily intake and output of Pb remain in essential balance after the establishment of an equilibrium at an early age, after which the concentration of Pb in the tissues undergoes little if any progressive change.

Lecture No. 2: Metabolism of lead under abnormal conditions. When the rate of absorption is increased beyond the range of "normal," an increase in the output of Pb in the urine first occurs (provided there is no impairment of the secretory apparatus). This is associated with an increase in the Pb content of the body which, after some lag, becomes demonstrated by a rise in the Pb content of the blood. If this increase in the rate of absorption is maintained at a sufficient level fairly uniformly, there will be a progressive increase at an essentially constant rate in the urinary excretion of Pb, in the Pb content of the body, and in the concentration of Pb in the blood. Ample evidence of this has been obtained in a series of balance experiments carried out over variably prolonged periods of time in which each of 4 human subjects ingested with each meal 0.3, 1.0, 2.0, and 3.0 mg Pb, respectively (in addition to that present in diet), for 364, 1456, 644, and 112 successive days, respectively. In another series of balance experiments, 6 subjects were exposed to the inhalation of Pb dispersed in particulate form for 7.5 hr/day for 5 days/wk over 2 yr or more, to stimulate prolonged occupational exposure to Pb compounds. These experiments are still in progress. The air of the chamber contained dispersions of minute particles (median size 0.05 µ) of Pb sesquioxide at 0.075 and 0.15 mg Pb/m<sup>3</sup> of air. Determination of the Pb content

of the expired air showed the extent of pulmonary retention of Pb, while observation of the interval between the initial exposure and urinary excretion gave the rate (and relative extent) of pulmonary absorption of Pb. In a later pair of experiments, Pb sesquioxide was dispersed in much coarser particles (1-3  $\mu$ ) to provide information on the influence of particle size on the behavior of Pb in the respiratory and alimentary tracts. The total intake of Pb (in food, beverages, and air) and the elimination were determined daily in all series of experiments. The results showed the following: There is a limited degree of absorption from ingested Pb, which continues at a fairly steady rate and induces, in proportion to the size of the daily dose, levels of Pb concentration in the tissues and in the excreta which increase at a steady rate during the entire period of ingested (4 yr in the most prolonged experiment). At the end of 4 yr, daily ingestion of 1.3 mg Pb resulted in  $\sim 0.065$  mg Pb/100 g of blood and 0.08 mg/l of urine; of the absorbed Pb,  $\sim 118$  mg were retained. In all likelihood, these values would continue to increase at the same rate indefinitely and would reach a dangerous level after a time. In the inhalation studies, a prompt increase in the Pb content of the tissues and excreta results; this progresses for 4-8 mo until a plateau is reached, the level of which is determined largely by the concentration of Pb in the air. No further change ensues unless the intensity of the exposure is altered. In both ingestion or inhalation, the cessation of exposure is followed by a gradual excretion of Pb from the body until, after a time appreciably longer than the period of exposure, the quantities in the excreta and blood reach the normal base lines. Absorption of Pb from the alimentary tract is poor, or 8-12% under the conditions of these experiments (maximum  $\sim 12\%$  of  $\sim 3$  mg/day). By contrast, pulmonary absorption is prompt and efficient. From 30-50% of particles of 0.05  $\mu$  (median) diameter are retained in the lungs. No risk of Pb poisoning is involved in these conditions of exposure in which the maximum concentration of Pb was 0.15 mg/m<sup>3</sup> of air. Concentrations of Pb in blood and urine at their peak after  $\sim 8$  mo of exposure to the maximum concentration were  $\sim 0.045$  mg/100 g and 0.085 mg/l, respectively; by this time, 25-30 mg Pb had been retained in the body of the subject.

Lecture No. 3: Present problems relating to the absorption of lead. Four of the many medical and hygienic problems are considered: (1) The diagnosis of Pb intoxication. Systematic investigation of occupational exposure to Pb in relation to the incidence of Pb poisoning and the extension of sound criteria to various cases and types of nonoccupational Pb poisoning have shown that Pb poisoning occurs only when certain limits of Pb concentration in blood, urine, and tissues have been exceeded. The threshold concentration in blood below which (during the period of exposure) no case of Pb poisoning has yet been seen, is  $\sim 0.08$  mg (allowing for a known positive or negative analytical error) of Pb/100 g. The corresponding concentration of Pb in the urine (of individuals without renal damage or impaired function) is a range of 0.15-0.24 mg/l, depending on the number and volume of urine samples yielding an

average result, and on the climatic conditions under which the samples were collected. (2) The problem of Pb poisoning in childhood. Although well documented, this condition arises frequently in many cities of the US because of lack of medical experience and reliable analytical facilities. Pb encephalopathy which is the most frequent presenting disease is often missed or not suspected. Precise determinations of Pb in blood are the most valuable in the diagnosis and prognosis, as well as for the proper control of therapy. The sampling of the urine of the small child is a relatively unprofitable diagnostic procedure. (3) Occupational hygiene in the Pb-using industries. Especially where all or some of the hazards are difficult to control, occupational hygiene can be soundly based on the analytical monitoring of exposed personnel. Analysis of blood is the most effective procedure in exposure to inorganic Pb compounds. In exposure to TEL, the Pb in urine is the only criterion that can be used during life. Men can remain at work in safety so long as the concentration of Pb in their blood does not approach 0.08 mg/100 g; if their exposure is terminated before they reach this level no intoxication will develop. After an appropriate period away from exposure they can return to work, providing they do not do so into the same conditions. (4) In the realm of public health. The facts concerning the metabolism of Pb are of paramount importance in the development of criteria for public safety. No standard of safety for any one of the general sources of exposure has validity of itself, but each may achieve validity in practice, when related to the others. Drinking water can readily be treated to 0.02 mg Pb/l; thus there is little excuse for the present standard of 0.10 mg/l. In view of the general opportunities for the ingestion of Pb, absorption from water should be as low as possible. To be safe over a lifetime, Pb intake from diet must be  $< 1.3$  mg/day and not  $> 0.6$  mg/day over any period of years. The latter amount given to a healthy young subject daily for 1 yr caused a barely detectable increase in urinary Pb (none in blood), and retention of  $\sim 8$  mg/yr. This could in all probability continue for a lifetime without risk. For higher intake, by extending the curves of the rate of increase in the concentration of Pb in blood so as to reach the threshold concentration of 0.08 mg/100 g, the time of incurring risk from the ingestion of 1.3, 2.2, and 3.2 mg/day is  $\sim 7.5$ , 3.9 and 0.64 yr, respectively. There has been little change in the past 20 yr in respect to the ingestion of Pb in food and beverages in the US. Pb in the air may have been increasing on the average but by no means universally. Apparently there is no risk at present in any part of the country outside of occupational conditions. There is need for a standard of safety for Pb in the air. That for occupational safety is not adequate. Experiments are under way to develop physiologic criteria from which such a standard can be visualized.

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Kehoe, R.A. (Univ. Cincinnati, O.): THE HARBEN LECTURES, 1960. THE METABOLISM OF LEAD IN MAN IN HEALTH AND DISEASE. LECTURE 1. THE NORMAL METABOLISM OF LEAD; LECTURE 2. THE METABOLISM OF LEAD UNDER

ABNORMAL CONDITIONS; LECTURE 3. PRESENT HYGIENIC PROBLEMS RELATING TO THE ABSORPTION OF LEAD. *Journal of the Royal Institute of Public Health and Hygiene* 24:81-97 (Apr.); 101-20 (May); 129-43 (June); 177-203 (Aug.), 1961.

See preceding abstract.

- 2289** Kehoe, R.A. (Univ. Cincinnati, O.): EXPERIMENTAL STUDIES ON THE INHALATION OF LEAD BY HUMAN SUBJECTS. Proceedings of the International Symposium on Maximum Allowable Concentrations of Toxic Substances in Industry, Prague, Czechoslovakia, April, 1959. *Pure and Applied Chemistry* 3:129-44, 1961.

The author reviews the work begun in 1927-28 of the occurrence and distribution of Pb in nature, especially biological materials, then of a systematic investigation of the metabolism of Pb in human subjects under normal conditions and by the daily administration of Pb orally over long periods of time (up to 4.5 yr) at several levels of dosage. In 1950 the study of the fate of Pb by inhalation of known concentrations in known states of subdivision was begun. As summarized by the author, from the aspect of specific criteria of industrial hygiene in the Pb-using industries, the most significant result of these experiments is the fact that no hazard of Pb poisoning is associated with the inhalation of air containing a fully respirable and absorbable compound of Pb in the concentration of 0.15 mg/m<sup>3</sup> over the period of nearly 2 yr. The experiments were carried out under conditions that simulate those of industry except for their strict uniformity and their virtually complete elimination of the ingestion of Pb in connection with the day's work. Kehoe emphasizes that the adoption of this level as a criterion of absolute safety would make no allowance for longer hours of work and exposure; for such disease states as may interfere with the normal disposition of absorbed Pb and with the situations in the Pb trades in which the ingestion of Pb is a significant factor in the total occupational absorption. He points out also that exposure of 1 subject was somewhat <2 yr, while actual occupational exposure may continue for many years. On the basis of some 20 yr experience since the present methods of analysis came into use and 10's of thousands results obtained on a large number of employees, the author's group have never encountered a single person in whose blood, at the onset of Pb poisoning, a Pb concentration of <0.08 mg/100 g was found. They consider that 0.07 mg/100 g leaves little margin of safety, and advise improvement of working conditions. If, in repeat analyses, the concentration reaches 0.08 mg, removal from the job is advised regardless of his apparent state of good or ill health until the blood Pb level has returned to normal (<0.6 µg) and the work conditions have been corrected. Men whose regular rate of urinary Pb excretion over a period of many years of stabilized exposure is represented by a concentration of Pb of not >0.10 mg/l or by a Pb output of not >0.12 mg/day, are not in danger of developing any form or degree of Pb intoxication.

- 2290** King, E., and Thompson, A.R. (London Hosp.; Vauxhall Motors Ltd., Luton, England): THE MEASUREMENT OF LEAD ABSORPTION IN INDUSTRY. *Annals of Occupational Hygiene* 3, No. 4:247-63, 1961.

Clinical examinations on 540 workmen in an industry using metallic Pb, along with determination of blood Pb, spot samples of urine Pb, and urinary coproporphyrin (CP), basophilic stippling, and Hb estimations, were made to illustrate the relationship between the criteria in regard to a working population exposed to a wide range of atmospheric Pb concentrations. The men were working at the time and no cases of clinical Pb poisoning were observed. There was difficulty in presentation of the data, i.e., a man in the worst position as regards atmospheric Pb could have received, because of correct use of protective equipment, a lower exposure than many of the workmen more remote from the main Pb process. However, the purpose of the investigation was to present data so that within the limits of medical and laboratory facilities and experience, a policy for control of Pb risk could be planned and understood.

Of the 540 men examined the following percentages were observed: clinically positive, 19; ≥trace CP, 24; ≥1 BS/1000 RBC, 48; ≥3 BS/1000 RBC, 7.6; ≤80% Hb, 1.9; ≥80 µg Pb/100 ml blood, 17; ≥150 µg Pb/l urine, 26. Of the 540 men the following additional statistics were calculated also showing percentages for the same categories, as given above: number taken off work; number with high exposure but clinically negative; high exposure, clinically positive; others clinically positive; others clinically negative.

In addition to these laboratory tests, white cell counts were performed on 40 men who showed the greatest overall evidence of Pb absorption. Results of the 5 tests were compared with each other along with an overall comparison. Methods of estimating the 5 criteria used were also given.

The authors concluded that although their data (illustrated in 14 figures) did not suggest a complete single answer, they did show that a policy would be successful when it is based on positive findings for the criteria chosen were followed by engineering action to find and remove causes.

- 2291** Kolkovski, P., and Rajceva, V. (Med. Lab. Transport Workers, Sofia, Bulgaria): Veränderungen im Serumweissspektrum bei fortgesetzter Bleieinwirkung. (CHANGES IN THE SERUM PROTEIN SPECTRUM IN CHRONIC LEAD EXPOSURE.) *Archiv für Toxikologie Fühner-Wieland's Sammlung von Vergiftungsfällen* 19:237-43 (Nov.), 1961.

The study included a total of 70 workers of all ages, employed for <1-25 yr, who were classified as follows: Group I, 6 men working in the smelting and casting of Pb and exposed to Pb vapors; Group II, 10 men working in the packing and shipping of Pb concentrate and exposed to Pb dusts; Group III, 54 men working with Pb containing materials, like painters, welders, locksmiths, etc. Ten healthy workmen with no Pb exposure served as controls. (The magnitude of the exposure is not indicated.) None of the workers showed signs of Pb poisoning, porphyrins in urine, or stippled erythrocytes. Pb values in urine were 0.03-0.09

mg/l in Group I and 0.01-0.02 mg/l in Group III. Laboratory findings were within normal limits for all 3 groups, and the only changes were observed in the protein spectrum of the blood serum.  $\gamma$ -Globulin values were increased considerably in Group I and less so in Group II. Also 69% of Group III showed some  $\gamma$ -globulin increase even though no Pb was found in the air of their working places. Generally, the changes were in direct proportion to the Pb concentration in air and the time of employment, but in Group I, the  $\gamma$ -globulin increase was higher in the younger workers with shorter employment time than in the older men with longer exposure. Increases in  $\alpha_1$ -globulins were observed in workers who had been employed for >25 yr.

The authors conclude that more extensive studies should be made before conclusions could be drawn, but strong indications exist that the changes in serum protein fractions could be used for the early detection of Pb intoxication before other signs of Pb exposure have appeared. (21 references)

- 2292** Konikova, G.S. (Inst. Hyg. Occup. Dis., Leningrad, USSR): Kholesterinovy i obmen u lyudei, podvergayushchikhsya dlitel'nomu vozdeistviyu svintsa. (CHOLESTEROL METABOLISM IN INDIVIDUALS SUBJECTED TO PROLONGED EXPOSURE TO LEAD.) *Terapevticheskii Arkhiv* 33:104-9 (July), 1961.

As found on 49 workers who had been long exposed to Pb, there was an increase of the total blood cholesterol, decrease of the phospholipid/cholesterol ratio, increase of cholesterol not bound or loosely bound to serum proteins, and a drop in the protein-free phospholipid/protein-free cholesterol ratio. Deviations from the normal were more pronounced in all respects in patients with Pb intoxication than in the control group. (From author's summary)

- 2293** Kośmider, S., and Petelenz, T.: Badania elektrokardiograficzne w przypadkach przewlekłych zatruc zawodowych ołowiem. (ELECTROCARDIOGRAPHIC STUDIES IN CASES OF CHRONIC OCCUPATIONAL LEAD POISONING.) *Polskie Archiwum Medycyny Wewnętrznej* 31: 1349-57, 1961.

Electrocardiographic examinations of 70 patients, 18-45 yr old, suffering from chronic occupational Pb intoxication, showed frequent appearance of cardiopathy accompanied by vegetative disturbances. The age <30 seemed to be particularly predisposed. In 13% of the cases slight organic changes were observed. The authors are of the opinion that shortening of the PQ interval with marked bradycardia is a characteristic trait of chronic Pb poisoning. (From authors' English summary)

- 2294** Kovnatskii, M.A. (USSR): Professional'nye faktory (promyshlennyye yady) i ateroskleroz. (OCCUPATIONAL FACTORS (INDUSTRIAL POISONS) AND ATHEROSCLEROSIS.) *Gigiena i Sanitariya* 26:62-9 (Sept.), 1961.

This review was prepared because of present interest in cardiovascular morbidity and mortality. Aside from individual factors, the occupational influences such as vibration, ultrasound, certain

toxic substances (Pb, CS<sub>2</sub> and CO) on the occurrence of cardiovascular disease, especially atherosclerosis, are discussed. The role of Pb is reviewed on the basis of 17 of the 45 references cited.

- 2295** Krause, D.P.: STABLE LEAD IN HUMAN BONE. In: Radiological Physics Division Semi-annual Report, January-June, 1961. US Atomic Energy Commission Document No. ANL-6398, 1961, pp. 77-80.

Pb in 12 cortical bone specimens from presumably nonexposed persons, was separated by diethyl dithiocarbamate extraction and determined colorimetrically with dithizone. The range of the data is from 4.0-59.0  $\mu$ g Pb/g ash with an average value of 24.8. The data are compared with other work on various types of bone. A plot of concentration vs age suggests a possible correlation between Pb concentration and age, with the higher Pb concentrations occurring at higher age. The author concludes that because of the small number of samples which have been analyzed, no definite conclusions regarding the variation of skeletal Pb with time can be drawn.

- 2296** Lane, C.R., and Lawrence, A. (St. Luke's Hosp., Guildford, Surrey, England): HOME-MADE WINE AS A CAUSE OF LEAD POISONING: REPORT OF CASE. *Medical Memoranda. British Medical Journal* 2:939-40 (Oct. 7), 1961.

The patient was a man of 52, who was hospitalized with abdominal colic, constipation and vomiting, and who would probably have been treated as a surgical emergency had it not been that a routine blood examination suggested hemolytic anemia and showed punctate basophilia. Examination of urine for Pb revealed 0.3 mg/l,  $\sim$ 10 times the normal amount, and the diagnosis was clear. He was treated with Ca disodium versenate (2 g/day for 7 days), and recovered in  $\sim$ 3 wk. The source of the Pb was obscure until he mentioned the fact that he made damson wine at home and had recently been drinking it; analysis showed 120 mg Pb/l. It had been prepared in a large old bread crock (70 yr old), and the glaze of this was found to give very strong analytical tests for Pb. The acid wine no doubt dissolved the glaze. These old vessels should not be used for wine making.

- 2297** Langenbach, J., and Unseld, D.W. (Municipal Hosp., Ulm, Germany): Untersuchungen über das sog. Depot-Blei im Organismus. (INVESTIGATION OF SO-CALLED DEPOT LEAD IN THE ORGANISM.) *Klinische Wochenschrift* 39:381-6, 1961.

Pb values in blood and urine were determined in normal individuals before and after injection of CaNa<sub>2</sub>EDTA. In subjects age 4-16 yr, the mean values were: blood 18.5  $\mu$ g/100 ml, urine 18.0 before and 82.6  $\mu$ g/l after the test. In subjects age 53-84 yr, the corresponding values were 11.7, 15.0, and 105.6. Urine values were higher in city dwellers than in persons from rural areas. Some cases with no clinical evidence of Pb poisoning and a slight or moderately increased urinary Pb level showed, after the injection, highly elevated Pb values (300-2300  $\mu$ g/l). In cases of cancer and

leukemia, Pb elimination was higher than normal before the injection and was only slightly increased after the test, suggesting a reduction in Pb retention in these diseases. The elimination was not affected during saluretic therapy.

- 2298** Lindberg, W. (Univ. Oslo, Norway): Blyverdier i urin i relasjon till urinens spesifikke vekt. (Bemerkninger til overlaege Arne Bruusgaards artikkel: Vurderingen av blyverdier i urine.) (LEAD VALUES IN URINE IN RELATION TO URINARY SPECIFIC GRAVITY. (REMARKS ON ARNE BRUUSGAARD'S ARTICLE: EVALUATION OF LEAD IN URINE.)). Nordisk Hygienisk Tidsskrift 42:239-46, 1961.

Pb concentrations in spot samples of urine, according to Levine and Fahy (1945) and Bruusgaard (1961), should be reported as mg/l adjusted to a mean specific gravity of 1.025 using the correction of 25/S, where S is the 2nd and 3rd decimal figure of the observed specific gravity. The validity of this correction factor is discussed, and the necessity of changing this factor to 35/S + 10 fit approximately the observed relationship in Bruusgaard's 800 samples from Pb exposed workers, is stressed. (From author's English summary)

- 2299** Lisker, R., Jinich, H., Sánchez Meda, L., and Guevara, L. (Nutritional Dis. Hosp., Mexico): Saturnismo. Informe de 6 casos, 4 de ellos no profesionales. (SATURNISM. A REPORT OF 6 CASES, INCLUDING 4 NONOCCUPATIONAL CASES.) Gaceta Médica de Mexico 91, No. 8:679-89, 1961.

The nonoccupational cases of Pb poisoning were 3 housewives and a 10-yr-old son of 1 of them. Diagnosis was justified on the basis of symptoms (mainly severe abdominal pains), stippled cells, urinary coproporphyrins and, in the case of the boy, none Pb line upon X ray. The poisoning was due to use of glazed utensils in 3 cases, and water containing 160 µg/l in the 4th.

The occupational cases were a miner and a plumber. The miner, 27 yr old, had been hospitalized several times in the company hospital, although no diagnosis had been made. He complained of severe abdominal pain, vomiting, loss of appetite. The only abnormal finding, other than the digestive, was pallor. Blood and urine analyses were practically normal. Ten days after the man was examined, he was brought to the hospital in a semistuporous condition and died within 6 hr. Autopsy showed in kidney and liver specimens a strongly positive reaction for Pb; there were gray spots in the subcortical zones of the brain. The author considers the terminal syndrome to be compatible with the diagnosis of acute Pb poisoning with characteristic encephalitis. The plumber, 62 yr old, had become ill 35 days before seen in the hospital, with epigastric pains which developed into severe colic. Stippled cells and Pb levels of 162 and 300 µg in 2 samples of 24-hr urine justified the diagnosis of Pb poisoning. Treatment was with EDTA in this case and in the 4 nonoccupational cases.

- 2300** Meltzer, L.E., Kitchell, J.R., and Palmon, F., Jr. (Presbyterian Hosp., Philadelphia,

Pa.): THE LONG TERM USE, SIDE EFFECTS, AND TOXICITY OF DISODIUM ETHYLENEDIAMINE TETRAACETIC ACID (EDTA). American Journal of Medical Science 242:11-7 (July), 1961.

In a study of the effectiveness of Na<sub>2</sub>EDTA in the treatment of coronary artery disease, the drug was administered within 2 yr to 81 patients in a total of 2000 consecutive infusions at 3-g doses in 0.5% solution over 2.5-3 hr. The regime was generally infusions given on alternate days (3 times/wk) and continued until a total of 20 was reached; therapy was then discontinued for 6-8 wk. No evidence of nephrotoxicity was found, but doses of 5 g or more are not recommended. Light signs of intolerance appeared infrequently, but no systemic reactions, anemia, dermatitis, hyperglycemia or bone decalcification was observed. The findings of this study are used for determining dosage, side effects, etc of EDTA in the therapy of Pb poisoning and other diseases. (37 references)

- 2301** Millar, I.B. (Borough Council Offices, Welshpool, E. Wales): GASTRO-INTESTINAL CANCER AND GEOCHEMISTRY IN NORTH MONTGOMERYSHIRE. British Journal of Cancer 15:174-99 (June), 1961.

In the discussion as to the causative factors for the high incidence of gastrointestinal cancer in North Montgomeryshire, mention is made of the presence of <sup>210</sup>Pb in soil as part of natural radioactive fallout. In 1956-57 the deposition of <sup>90</sup>Sr was 2600 µCi/m<sup>2</sup> (at Milford Haven) and 2260 µCi/m<sup>2</sup> of <sup>210</sup>Pb.

- 2302** Moreo, L. (Univ. Milan, Italy): Porfobilinogeno e uroporfirine nelle urine dei saturnini. (PORPHOBILINOGEN AND UROPORPHYRINS IN THE URINE OF PATIENTS SUFFERING FROM LEAD INTOXICATION.) Medicina del Lavoro 52:561-8 (Oct.), 1961.

Urinary coproporphyrin (CP), uroporphyrin (UP) and porphobilinogen (PBG) were studied in 2 groups of subjects with chronic Pb intoxication (9 cases with colic and 14 cases without colic), and in 6 subjects who had shown signs of Pb absorption. Urinary excretion of CP (mg/24 hr) in the 3 groups was 0.39-0.88 (in 1 case 3.69), 0.09-0.42 (in 1 case 1.04), and 0.13-0.3, respectively. UP ranged from 0.10-0.39 mg/24 hr in group I, was found only in 4 cases in group II (0.13-0.88) and was absent in group III. PBG values were normal in most cases ranging from 0.4-1.7, 0.3-1.5, and 0.5-1.1 mg/24 hr, respectively. Three cases in group I were followed daily. In 2 of them, treated with CaNa<sub>2</sub>EDTA, the excretion of CP and UP decreased rapidly and simultaneously, while in the untreated case the decrease in the urinary excretion of both porphyrins was very slow. Analysis of the excreted UP showed that it consists of a mixture of several porphyrins, about 80% of type III and a small amount of type I.

The pathogenic mechanism of uroporphyrinuria is therefore attributed to enzymatic blocks, induced by Pb in the more advanced stages of porphyrin synthesis and interfering with the synthesis of protoporphyrin from CP. (28 references)

- 2303** Murayama, H. (Osaka Municipal Hyg. Lab., Japan): STUDIES ON LEAD-WORKERS OF NEWS-



PAPER PRINTING OFFICES. Japanese Journal of Industrial Health 3:361-95, 1961.

The printing departments of 4 newspapers were involved in the study which was divided into 5 categories: (1) Pb concentrations in the air and the results of medical examinations of workers, (2) difference of Pb-poisoning symptoms, (3) specific gravity (SG) and hemoglobin (Hb) content of blood according to age groups, (4) change of blood symptoms with time, (5) health supervision. The 4 printing departments were similar in respect to processes and equipment and in all 4 the Pb concentration in the air rose above the threshold limit value of  $0.2 \text{ mg/m}^3$  for short periods at the metal pot, in the stereotype foundry, and in the flatplate foundry. In other areas the concentrations were below the threshold limit value. Blood examinations of the Pb workers revealed low values for SG, Hb, and red cells (RBC) as compared with controls and "normal" Japanese individuals. Basophilic stippled cells (BSC), coproporphyrin (CP), ALA and porphobilinogen in urine were high compared to controls. The workers also frequently showed subjective and objective symptoms of the digestive and nervous systems. Female employees had a higher rate of Pb-poisoning symptoms than did male workers, with 23% females needing therapy vs 9% males.

The frequency of Pb poisoning cases was slightly higher in the stereotype foundry, flatplate foundry, and distribution room than in other areas of the printing departments. Workers who inhaled relatively large amounts of Pb dust tended to show more CP in urine and higher Pb concentrations in the blood. Those who handled Pb or were exposed to printing ink (ie, distribution workers, mostly female) also displayed a higher frequency of Pb poisoning and had to take special precautions.

Blood SG and Hb showed a pattern of increase and decrease according to the duration of employment and age. Two stages of anemia were found: before and after 21-30 yr of age, or 5-9 consecutive years of employment. The 1st stage appeared in Pb workers as well as non-Pb workers, but recovery was incomplete in the former. The 2nd stage of anemia started 10 yr earlier in Pb employees than in non-Pb workers. Fe preparations decreased the anemia in young persons but Fe and CaEDTA did not help persons >30 yr of age.

Abrupt decreases of blood SG and Hb and increases of urinary CP and BSC occurred after the onset of exposure to Pb. Anemia was restored to a normal value after 19 mo while Hb was frequently lower than before the exposure. There were marked differences in individual cases although in general Hb and SG in blood did not show marked differences before and after a 6-yr period.

In discussing the health supervision in the printing departments, control of working environments and the need for medical examinations were stressed. In order to minimize exposure of workers to Pb, mechanization of working processes, proper ventilation, and educational programs in regard to personal hygiene are necessary. Pre-employment examinations are imperative with follow-up examinations every 3-4 mo during the 1st year and then periodically once every year with more frequent observations where necessary. Tests to be used, in order of importance, are blood SG's

(should be >1.054), Hb (should be >13.9 g/dl), and CP values; repetition of the 3 preceding tests, RBC and BSC counts, urobilinogen and urine albumin determinations; quantitative determination of Pb in blood and urine; other necessary clinical examinations. (From author's English abstract; 72 references)

**2304** Myślak, Z., and Buczkowski, M. (Clin. Inst. Occup. Med., Zabrze, Poland): Zagadnienie oddziaływania wersenianu wapnia (Ca-EDTA) na nerki w związku z leczeniem ołowicy. (THE EFFECT OF CALCIUM VERSENATE (Ca-EDTA) ON THE KIDNEY IN THE TREATMENT OF LEAD POISONING.) *Polskie Archiwum Medycyny Wewnętrznej* 31:853-6, 1961.

Kidney function tests (creatinine clearance, RN) were carried out on 20 out of 120 cases of chronic Pb poisoning treated by oral administration of CaEDTA. The results showed no harmful effect of EDTA on the kidneys during treatment. (From authors' summary; 13 references)

**2305** Namba, M., Fujita, H., Hijiya, T., Aii, H., and Kobayashi, S. (Psych. Neurol. Clin. Med. Coll., Yamaguchi, Japan): Über die Symptomatologie und Histologie der Bleitetraäthyl Vergiftung beim Menschen. (SYMPTOMATOLOGY AND HISTOLOGY OF TETRAETHYLLEAD POISONING IN MAN.) *Psychiatria et Neurologia Japonica* 63:37-8 (German summary); 706-21 (July), 1961.

The patient had been exposed from age 42 to TEL-containing gasoline; 4 yr later he noted sleep and olfactory disturbances which became intensified in his 53rd yr by headaches and fatigability. At the time, while at work in the gasoline storage installation, he was seized by severe dizziness and nausea and lapsed into a neurasthenic state. Since then he had avoided exposure to TEL; however, tremors, neuralgia, gingivitis and discoloration of skin appeared gradually. One year thereafter delirium and dementia were noted and he died within 1/2 yr. Spinal fluid showed increase in protein and cells. Histologic findings gave parenchymatous changes of the liver and kidney tubules, splenic hemorrhage and congestion. In the central nervous system there were: thickening of meninges, mild infiltration of the small round cells, proliferation of epithelial cells of the cerebral ventricle, proliferation and degeneration of arterioles and capillary wall in the region of the cerebral cortex, bundle formation of arterioles, infiltration of the small round cells of the vascular wall, necrosis of perivascular tissue, degeneration of nerve cells and increase and degeneration of the glia cells. Chemical analysis of 100 g each of formalin-preserved organs showed 0.386 mg Pb in the liver, 0.127 in the brain and 0.102 in the kidney, indicating manifold increases over normal. (33 references)

**2306** Năstorăscu, B., Ionăscu, C., and Dinischiotu, G.T. (Inst. Hyg., Public Health, Bucharest, Romania): La valeur comparative de certaines méthodes de dosage du plomb urinaire pour l'appréciation des risques et le diagnostic du saturnisme. (COMPARATIVE VALUE OF CERTAIN METHODS FOR THE DE-

TERMINATION OF URINARY LEAD FOR THE EVALUATION OF RISK AND DIAGNOSIS OF LEAD POISONING.) Proceedings of the International Symposium on Maximum Allowable Concentrations of Toxic Substances in Industry, Prague, Czechoslovakia, April, 1959. Pure and Applied Chemistry 3, Nos. 1-2:325-9, 1961.

The possibility of the presence of Pb in the urine of certain individuals, in a form other than that of a mineral salt precipitable as phosphate or oxalate, was studied on the following 3 groups of subjects: (1) 44 normal; (2) 15 exposed to Pb but without clinical signs of intoxication; (3) 57 suffering from chronic Pb intoxication (17 of them with colic). Determinations of urinary Pb were made in all subjects 2-5 times at 2-4 day intervals. The average values of precipitable Pb, determined by coprecipitation (Cholak et al, 1948, and others), and of total Pb after ashing were, respectively, in  $\mu\text{g/l}$ : 42.6 and 43.0 in Group 1; 95.5 and 130.4 in Group 2; 150.4 and 256.9 in Group 3.

The authors conclude that there is a fraction of Pb in the urine which cannot be separated by coprecipitation. This fraction, which seems to be an organic Pb complex, is almost zero in normal individuals (0.4  $\mu\text{g/l}$ ), significant in subjects exposed to Pb (34.9), and considerable in Pb-intoxicated individuals (106.86). The current method of determination of urinary Pb comprising the coprecipitation of Pb, is therefore not sufficient for the detection of elevated levels of Pb absorption.

- 2307** New Mount Sinai Hospital, Toronto: MEDICAL ROUNDS IN CANADA. APPLIED THERAPEUTICS CASE 9, 1961 (LEAD POISONING). Applied Therapeutics 3:509-11, 528 (July), 1961.

An interview of the patient and discussion of the case of Pb intoxication in a 48-yr-old man, who had been exposed to Pb fumes for 3 mo while working in a plant manufacturing ingots of brass, is presented. The patient suffered from abdominal pain and vomiting. Examination showed gingival lines and basophilic stippling. Following intravenous administration of EDTA twice daily for 5 days, the patient recovered. Some aspects of diagnosis and treatment of Pb intoxication are discussed.

- 2308** Ohde, I., and Schuettmann, W.: (ON THE THERAPY AND PREVENTION OF LEAD POISONING WITH DISODIUM CALCIUM SALT OF ETHYLENEDIAMINETETRAACETIC ACID.) Deutsche Gesundheitswesen 16:1167-72 (June 22), 1961.

- 2309** Parigi, A., and Pettinati, L. (San. Serv., Turin, Italy): Effetti a distanza di pregressa intossicazione da piombo. (LATE EFFECTS OF PREVIOUS LEAD POISONING.) Minerva Medica 52:3955-6 (Nov.), 1961.

Fifty subjects, 32-58 yr old, who had been removed from occupational Pb exposure for at least 5 yr after a period of acute intoxication, were studied. Fourteen (28%) showed hypertension and 11 (22%) albuminuria. Nine men who had had typical Pb colics during the period of exposure were subjected to further investigation. Five of them

were hypertensive and in 6 urinary coproporphyrin was  $>100 \mu\text{g/l}$ . Pb excretion in the urine, after administration of EDTA, increased in all 9 of this group, in 1 case 20-fold. The authors propose that men with previous Pb poisoning be subjected to prolonged treatment with EDTA until all signs of Pb accumulation in the organism have disappeared.

- 2310** Parmeggiani, L., and Palleni, R. (Univ. Milan, Italy): Osservazioni sull'impiego del dietilditiocarbamato di sodio in terapia. (OBSERVATIONS ON THE THERAPEUTIC USE OF DIETHYLDITHIOCARBAMATE.) Medicina del Lavoro 52:377-81 (May), 1961.

Na-diethyldithiocarbamate administered to patients either orally at doses of 2 g/day or iv at 200 mg showed an antabuse-like reaction; it increased urinary Ni excretion but did not affect urinary Ca values. In 7 Pb poisoning cases (no data given), the excretion of Pb was markedly and progressively reduced during 3 days of treatment. Subsequent iv administration of 1 g  $\text{CaNa}_2\text{EDTA}$  caused a rapid increase in urinary Pb values.

- 2311** Perry, H.M., Jr. (Washington Univ. School Med., St. Louis, Mo.): CHELATION THERAPY IN CIRCULATORY AND SCLEROSING DISEASES. In Johnson, L.A., and Seven, M.J., ed.: Proceedings on a Conference in Biological Aspects of Metal-binding Held at the Pennsylvania State University, University Park, Pennsylvania, September 6-9, 1960. Federation Proceedings 20, Supplement No. 10, Pt. 2:254-7 (Sept.), 1961.

In an evaluation of the use of chelates in atherosclerosis, the author reviews his experience with H. Schroeder in the administration of  $\text{CaNa}_2\text{EDTA}$  to such patients, to hypertensives and to hypercholesterolemics. In the course of these trials, they found that the urinary metal patterns (including Pb) were altered by parenteral EDTA. The conclusion as to effectiveness of the drug is that no effect on atheromatous lesions has been observed.

- 2312** Perry, T.L. (California Inst. Technol., Pasadena): URINARY EXCRETION OF TRACE METALS IN HUNTINGTON'S CHOREA. Neurology 11:1086-90, 1961.

The urinary excretion of Pb, among 14 trace metals, was studied spectrochemically in 9 normal adults, in 7 patients with Huntington's chorea, and 6 psychotic controls. No significant difference was found between the 3 groups. The suggested possibility that Huntington's chorea involves an abnormality in Cu metabolism was not confirmed. Pb concentrations in the normal controls ranged from 0.9-4.2  $\mu\text{g}/200 \text{ mg creatinine}$  (5-26  $\mu\text{g}/24 \text{ hr}$ ); in Huntington's chorea, 0.4-3.5 (21), respectively; in psychotic controls, 0-3.4  $\mu\text{g}/200 \text{ mg creatinine}$ . (17 references)

- 2313** Peters, H.A. (Univ. Wisconsin Med. School, Madison): TRACE MINERALS, CHELATING AGENTS AND THE PORPHYRIAS. In Johnson, L.A., and Seven, M.J., ed.: Proceedings on a Conference in Biological Aspects of Metal-binding Held at the Pennsylvania

State University, University Park, Pennsylvania, September 6-9, 1960. Federation Proceedings 20, Supplement No. 10, Pt. 2:227-34 (Sept.), 1961.

The author discusses the signs and symptoms of acute, chronic and mixed porphyria as based on his experience and the literature, and mentions the similarity to Pb poisoning. He calls attention to the existence of porphyric schizophrenic patients. The finding of elevation of urinary Zn and Cu suggested the possibility that excess Zn, Cu or other cations might be blocking several metalloenzyme systems, thus causing the disease. The application of BAL or EDTA or of both is described. In closing, he stresses the importance in the therapy of these patients of maximal nursing care, tracheotomy, attention to electrolyte balance, and avoidance of exposure to heavy metals, among others, in the more seriously involved patients. (42 references)

- 2314** Petrović, L. (Hyg. Inst. N.R. Serbia): Industrijski štrovi i kardiovaskularni sistem. (INDUSTRIAL POISONS AND THE CARDIOVASCULAR SYSTEM.) Glasnik Higijenskog Instituta 10:29-39 (July-Dec.), 1961.

The author summarizes his review by stating that changes in the cardiovascular system may be caused by numerous drugs and substances, including TEL and Pb. The changes are both of an organic and functional nature.

Pb is one of the most important industrial poisons damaging the cardiovascular system. According to some older research workers it has been maintained that Pb poisoning is regularly followed by hypertension. However, modern research workers in numerous papers have proved that in Pb poisoning, ie, in chronic exposure of workers to Pb, hypotension is found instead. Investigations by the author's group are in favor of hypotension. Hypertension may be found as a rule in Pb colics, and in poisoning followed by kidney lesions. Kidney lesions caused by Pb compounds are still under discussion. Classical principles of general technical, personal and medical prophylaxis applied at work with toxic agents are recommended as preventive measures. In systematic and periodical examinations contraindications at work should be carefully considered.

- 2315** Petrović, L., and Popovic, S. (Hyg. Inst. Med. Coll., Belgrade, Yugoslavia): Prilog poznavanju alergije kod radnika pri radu sa olovnim oksidom i olovnim sulfidom. (A CONTRIBUTION TO THE STUDY OF ALLERGY AMONG WORKERS EXPOSED TO LEAD OXIDE AND LEAD SULFIDE.) Glasnik Higijenskog Instituta 10:21-4 (July-Dec.), 1961.

Allergy was investigated among 441 workers of a Pb smelter, who were divided into 4 groups, according to their working places, history of past allergic conditions, and exposure to dust. On the basis of clinical examination and skin tests carried out, using standard and specific allergens, it was established that the dust containing Pb oxide or Pb sulfide is not the cause of allergy. This dust does not act as a predisposing factor for allergic sensitization.

- 2316** Portal, R.W. (Central Middlesex Hosp., England): CEREBRAL TUMOUR IN A LEAD WORKER. British Journal of Industrial Medicine 18:153-6 (Apr.), 1961.

A 63-yr-old Pb worker with ~35 yr of service, who had always been in good health, suddenly collapsed showing the clinical signs of Pb poisoning. Based on these, as well as on laboratory tests (coarse stippling of red cells) and his favorable response to EDTA (Pb in urine on day of 1st infusion, 3.78 mg/24 hr; next day, 0.38, etc.) which brought recovery within 1 mo, the case was diagnosed as Pb encephalopathy. Two months later, however, the disturbances reappeared, and the patient died after 4 wk. Autopsy revealed a large cerebral tumor but no nerve cell damage in other parts of the brain or any significant indications of Pb poisoning in other organs. The following Pb values were determined in wet tissue (µg/g): skull 170; femur 120; kidney: medulla 2.0, cortex 2.9; heart 0.4. The conclusion was drawn that the patient had not suffered from Pb poisoning, but that all the signs were attributable to the neoplasm.

- 2317** Pott, R. (Hamburg, Germany): Praxis der Bleiüberwachung in einem Bleihüttenbetrieb. (CONTROL OF LEAD EXPOSURE AS PRACTICED IN A LEAD FOUNDRY.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 11:211-4 (Sept.), 1961.

The author discusses his practical experience as industrial supervisor of health for 600 workers in a Pb foundry in Germany. He objects to the employment of women and adolescents <21 yr of age in places of Pb exposure, and does not recommend the hiring of workers with various respiratory gastrointestinal, renal and nervous disturbances. This policy is advisable for health reasons as well as for medicolegal considerations because of the difficulties arising later in the appraisal of eventual workman's compensation claims. Generally, workers exposed to Pb should be examined every 1-3 mo. The author defines what is understood by a Pb-carrier, as opposed to a state of poisoning, ie, in the latter, symptoms occur, while in the former, while elevated absorption is indicated, a worker may feel well and have no complaints. He also considers that technical improvements should be taken into consideration prior to medical measures.

Various dust-eliminating devices and masks are discussed as well as records for follow-up studies of each worker. Prophylactic treatment of the workers with EDTA has been practiced with good results for 4 yr. It was found that a long lasting treatment with small doses of 1 g EDTA/day was more successful than a 3-4 wk treatment of 3 g EDTA/day orally.

- 2318** Puchlev, A., Popov, N., Astrug, A., Dotschev, D., and Petrinska, S. (Med. Coll., Sofia, Bulgaria): Über die endemische Nephritis in Bulgarien. (THE ENDEMIC NEPHRITIS IN BULGARIA.) Schweizerische Medizinische Wochenschrift 91:751-6, 1961.

An endemic renal disease is described which is spread throughout 20 towns in some districts of North Bulgaria. The etiology is unclear. Urine

tests revealed slight albuminuria, a low specific gravity, and a rather scant sediment. Tests of the drinking water and the soil for toxic substances (including Pb) showed quantities within the normal range. Clearance tests revealed an early lesion of the renal tubules and a later affection of the glomeruli. Virological and mycological examinations gave negative results. A potentiated toxic influence of some heavy metals (Pb, U) is suggested. (23 references)

- 2319** Radošević, Z., Šarić, M., Beritić, T., and Knežević, J. (Inst. Med. Res., Yugoslav Acad. Sci. Arts, Zagreb): THE KIDNEY IN LEAD POISONING. *British Journal of Industrial Medicine* 18:222-30 (July), 1961.

Clinical observations are presented on the effect of Pb on the kidney of 53 male and female patients, aged 20-60 yr, exposed to Pb for from 2 mo-35 yr. Pb poisoning was due to occupational exposure in 44 cases and to use of Pb-glazed pottery for household purposes in 9 cases. Gastrointestinal poisoning was present in 49 subjects, neuromuscular in 3 and a combined gastrointestinal and encephalopathic type in one. Clinical observations included determination of the number of erythrocytes ( $<3$  in 4,  $>4$  million/mm<sup>3</sup> in 22), stippled cells ( $<3000$  in 8- $>20,000$ /million in 10), reticulocytes ( $<10$  in 1- $>100/1000$  in 4), Pb level in blood ( $<60$  in 2- $>200$  µg/100 ml in 5), urinary porphyrins ( $<100$  in 8- $>500$  µg/100 ml in 4), blood pressure and renal function tests. Chronic nephropathy was found only in 2 patients with the longest and most severe exposure to Pb. Twenty-three patients showed functional renal lesions tending to normalize. Blood pressure was persistently raised in 1 further patient and only in the acute stage of poisoning in 2 others.

The authors conclude that Pb intoxication can cause renal lesions which, for the most part, are functional and temporary. In repeated poisoning and long and severe exposure organic renal lesions are possible. The disturbances observed may be ascribed to disordered intrarenal circulation, due to the spastic effect of Pb on intrarenal blood vessels, and to a direct toxic or indirect hypoxic effect of Pb on the tubules. When investigating renal function, the authors observed that the timing of individual tests is of paramount importance. Some lesions are subject to changes in the natural course of Pb poisoning, and unless this is borne in mind, apparently contradictory results may be obtained. A review of the literature on the effect of Pb on the kidney is included. (52 references)

- 2320** Rasetti, L., Cappellaro, F., and Gaido, P. (Univ. Turin, Italy): Contributo allo studio del saturnismo da olii lubrificanti additivati. (STUDY OF SATURNISM CAUSED BY ADDITIVES TO LUBRICANTS.) *Rassegna di Medicina Industriale e di Igiene del Lavoro* 30:71-5 (Jan.-Feb.), 1961.

The Pb naphthenate hazards were investigated on workers employed in the maintenance and lubrication of the rolls of machines for hot-strip milling of ingots. Of the workers exposed, 10 were charged with filling the tanks with mineral oil

containing Pb, daily cleaning of filters and controlling the distribution systems. The cleaning of filters, done daily and taking 2 hr was the operation of greatest contact with the lubricant; 4 workers were so involved. Examination of these workers, 19-57 yr old, who had been in continuous contact for 4 mo-12 yr with additives to lubricants containing 10% Pb naphthenate, yielded the following results: Pb in blood 35-98 µg%, Pb in urine 65-900 µg/24 hr and 410-1750 µg/24 hr after intravenous administration of 2 g versenate; erythrocytic protoporphyrin 72-899 µg%, urinary coproporphyrin 74-1640 µg/24 hr; basophilic stippling was noted in 3 subjects. The clinical findings indicate that 65% of the workers had been intoxicated with Pb, or had absorbed Pb. In addition, 2 other men of the group, after treatment with CaEDTA, exhibited a 3-5-fold increase of urinary Pb excretion, which is a definite sign of Pb absorption.

The mode of cutaneous absorption of Pb naphthenate was studied in 3 subjects by rubbing 6 ml of the additive oil, containing 192 mg of metallic Pb onto their forearms. Blood samples, taken 5, 10, 30, 60, 240 and 480 min after the application, showed that absorption of Pb after 10 min increased to an average of 176% and to 338% within 30-60 min, then decreased rapidly and returned to its original value 8 hr later. It was calculated that one of the subjects, by skin exposure on an area of 64 cm<sup>2</sup>, had absorbed an amount of 5 mg Pb. The possibility of a daily absorption of 100-200 mg Pb by this route was pointed out.

- 2321** Rathus, E.M. (Brisbane, Australia): REPORT ON A FURTHER INVESTIGATION AT MOUNT ISA MINES, WITH PARTICULAR REFERENCE TO A COMPARATIVE STUDY. *Queensland Government Industrial Gazette* 48:15-28 (Sept. 12), 1961.

The report on the technical and hygienic conditions at the mines includes data obtained from routine laboratory tests on 285 men working around the smelters and 217 smelter workers. Air samples in the smelters contained 0.01-13.0 mg Pb/m<sup>3</sup>, and the men exposed to the higher concentrations wore masks. The smelter workers showed 0.01-0.56 mg Pb/l urine, the majority being in the 0.01-0.2 mg/l group; coproporphyrins (CP) were 0-1600 µg/l, with 77% of the men showing normal values up to 100 µg/l; stippled cells (SC) were 0-6000. Pb in blood, as determined in 13 men, ranged from 0.02 mg/100 ml-0.06 mg/100 ml. One man who had been employed for only 1 wk showed 0.09 mg Pb/100 ml in blood, a SC count of 8000, Pb excretion of 0.24 mg and CP of 400 µg, but another man, who had worked 4 yr as a smelter furnaceman, had no complaints and showed 0.03 mg Pb/100 ml blood, excretion 0.15 mg/l, SC 250, and CP 100 µg/liter. Hemoglobin values were determined in half of the men of each occupation. This cross section as a whole did not show anemia except for some single cases who demonstrated high susceptibility to Pb. During the past year, 9 "boarded" cases (ie, referred to Lead Board) showed a rise of SC to 10,000/million and  $>0.3$  mg Pb/l urine. Out of 19 men interviewed because of high SC counts, only 4 had any complaints at all and these were quite unspecific. The conclusion

is drawn that the duration of Pb exposure exerts little effect on the blood forming organs but that the intensity of the exposure is much more important.

- 2322** Ravasini, C. (Univ. Milan, Italy): Osservazioni cliniche ed elettroencefalografiche su di alcuni casi di intossicazione professionale da piombo. (CLINICAL AND ELECTROENCEPHALOGRAPHIC OBSERVATIONS IN SOME CASES OF OCCUPATIONAL LEAD POISONING.) Rivista Sperimentale di Freniatria e Medicina Legale delle Alienazioni Mentali 85: 1447-56 (Dec.), 1961.

Eight male subjects, 36-58 yr old and exposed to Pb for a period of 22 mo-30 yr, were studied. The most frequently noted clinical symptoms were asthenia, tremors, incoordination and accentuated osteotendinous reflexes; the electroencephalograph showed a rhythm of low voltage with flattened, dyssynchronized tracings. The pathogenic mechanism of Pb intoxication was discussed. (13 references)

- 2323** Ritter, J., and Dacquet, J. (Inst. Hyg., Rabat, Morocco): Dépistage et traitement ambulatoire par voie orale du saturnisme par le versenate de calcium disodique (E.D.T.A.:  $\text{CaNa}_2$ ). (DETECTION AND AMBULATORY TREATMENT OF LEAD POISONING BY ORAL ADMINISTRATION OF CALCIUM DI-SODIUM VERSENATE.) Maroc Médical 40:377-82 (Apr.), 1961.

The program for the prevention of Pb poisoning in foundry workers in Morocco begun in 1957 is described. At the comprehensive 6-mo health examinations, 10 ml of 5%  $\text{CaNa}_2\text{EDTA}$  is given intravenously; if this is followed by a urinary Pb excretion of  $>0.06$  mg Pb/24 hr, the case is classified as suspicious and EDTA injections are repeated for 2-3 more days. Pb levels  $>0.08$  mg are regarded as certain signs of Pb poisoning. If the stippled cell count exceeds 3/1000 red cells, treatment with 6 tablets of 0.25 g EDTA in the morning and evening is continued for 4 days and the course is repeated twice after 5-day intervals. A number of examples are presented, and serial results of this effective policy are tabulated. This test supplements other tests such as stippled cell counts or coproporphyrin determination. The authors conclude that ambulatory treatment orally administered is simple, practical, effective and well tolerated.

- 2324** Roth, I., and Goreczky, L. (Natl. Railways, Hungary, Budapest): Über die Bedeutung der  $\delta$ -Aminolävulinäure bei latenten und manifesten Bleivergiftungen. (SIGNIFICANCE OF  $\delta$ -AMINOLEVULINIC ACID IN LATENT AND MANIFEST LEAD POISONING.) Zeitschrift für die Gesamte Innere Medizin und ihre Grenzgebiete 16:1078-81 (Dec.), 1961.

In 53 subjects aged 20-40 yr (51 men and 2 women), who were occupationally exposed to Pb but showed no clinical evidence of Pb poisoning, normal values of ALA were found only in 3 cases, in 6 cases the 15-20-fold of the physiological values was reached and the highest value (7030  $\mu\text{g}/100$  ml) was

35 times the normal. Urinary Pb ranged from 50-840  $\mu\text{g}/\text{l}$ , exceeding 400  $\mu\text{g}/\text{l}$  only in 4 cases. A case of Pb intoxication is described in a 35-yr-old female ceramics worker who suffered from abdominal pain, vomiting and loss of appetite. Urinary excretion of ALA and porphobilinogen was up to 87,000 and 4600  $\mu\text{g}/24$  hr, respectively. Pb excretion in urine was 80  $\mu\text{g}/\text{l}$ , while CP (360-2300  $\mu\text{g}/24$  hr) and UP (240-400  $\mu\text{g}/24$  hr) remained normal. Concentrations of total porphyrins in bile and feces were not raised. Increased excretion of ALA is therefore a pathogenomic change to be considered in early diagnosis of Pb intoxication. (12 references)

- 2325** Rotta, C., and Parigi, A.: Prevenzione del saturnismo mediante versenate di calcio per via orale. (PREVENTION OF LEAD INTOXICATION BY ORAL ADMINISTRATION OF CALCIUM VERSENATE.) Medicina del Lavoro 52:769-79 (Dec.), 1961.

The prophylactic effect of  $\text{CaNa}_2\text{EDTA}$  was studied in 280 Pb filers who were exposed to inhalation and ingestion of Pb particles. The drug was administered orally in daily doses of 2.5 g for alternate weeks over a period of up to 15 mo. Periodic check-ups during treatment did not disclose any significant side effects. The beneficial prophylactic effect of EDTA was demonstrated by comparing 2 groups of subjects, exposed to the same occupational environment, one group being treated and the other untreated. Some subjects, ~3-4%, in spite of treatment began to develop signs of a considerable Pb absorption. In these cases the elimination of Pb and the disappearance of the symptoms were achieved only by iv administration of  $\text{CaNa}_2\text{EDTA}$ . (33 references)

- 2326** Rozenberg, P.A., and Smirnova, M.I. (Moscow, USSR): (RADIOACTIVE PHOSPHORUS INCORPORATION INTO ERYTHROCYTES DURING CHRONIC LEAD INTOXICATION.) Gigiena Truda i professional'nye Zabollevaniya (Moscow) 5, No. 5:35-7, 1961.

(The English title, published in the journal and quoted above, is an accurate translation from the Russian and implies passage of  $^{32}\text{P}$  into the erythrocytes.) The introduction mentions, that in Pb poisoning, the normal ratio between hemoglobin Fe and plasma Fe is altered, the plasma Fe being increased. It is argued that this indicates a disturbance of Fe interchange and it is reasonable, therefore, to see if other forms of interchange such as P compounds, are affected in Pb poisoning. Briefly, labeled Na orthophosphate was added to defibrinated blood. After 2-hr incubation the sample was centrifuged and the erythrocytes were washed 3 times. After resuspension a sample was taken for erythrocyte and  $^{32}\text{P}$  count. Fifty-three patients were investigated, 6 had a mild degree of Pb poisoning, 21 a moderate degree and 4 a severe degree, 2 patients had late sequelae. The remaining 20 formed a control group. Ages ranged from 22-59 yr. The rate of uptake (incorporation) of  $^{32}\text{P}$  of the control group was 6.6-7.8% (other workers quoted found 6-7.5% and 7.5-16.7%). The mild group, who exhibited a small fall in the number of erythrocytes with some basophilic granules and in whom the urinary Pb was 2 mg/l during

treatment with EDTA, showed a slight reduction of  $^{32}\text{P}$  uptake in half the cases and a normal uptake in the others. In 8 (of the 21) moderate cases the uptake was 8-11.5% on admission and 8.92% after treatment. In 7 other moderate cases the uptake of radiophosphorus by the erythrocytes was lowered (5.6-6.4%). After treatment this remained lowered (5.6-6.4%). In the remaining 6 members of the moderate group the  $^{32}\text{P}$  uptake was normal at 6.7-7.6%. During treatment "the maximum output of Pb in urine did not exceed 4 mg/l. In only 1 patient did it reach 6.25 mg/l." The 4 severely affected patients exhibited severe Pb colic and "a steady fall of hemoglobin and erythrocytes." In 2 the uptake of  $^{32}\text{P}$  was decreased, 5.4-6.5%, in 1 it was increased to 9% and in the other it was normal. On treatment with EDTA there was from 0.38 to 6.25 mg of Pb/l of urine. In the 2 patients with "residual appearances of Pb poisoning" (no details) the  $^{32}\text{P}$  uptake was raised, 9.4-9.7%. During treatment the Pb in urine was only 0.075-0.4 mg/l. No connection was found between the  $^{32}\text{P}$  uptake and the morphological picture of the blood. It is argued that Pb phosphate can affect the permeability of the cell membrane (Clarkson and Kench, 1958) and that the persistence of the disturbances observed even after treatment points to the permanent nature of the damage to erythrocytes. (This paper unfortunately seems to be based on a misinterpretation of Clarkson and Kench (1958) who did not consider permeability of the cell envelope in this connection, but examined aggregation to the surface of the erythrocytes.) (From Bulletin of Hygiene 36:995, 1961)

- 2327** Rubin, M. (Georgetown Univ. Med. School, Washington, D.C.): DESIGN OF CHELATES FOR THERAPEUTIC OBJECTIVES. In Johnson, L.A., and Seven, M.J., ed.: Proceedings of a Conference in Biological Aspects of Metal-binding Held at the Pennsylvania State University, University Park, Pennsylvania, September 6-9, 1960. Federation Proceedings 20, Supplement No. 10, Pt. 2:149-57 (Sept.), 1961.

The author recounts the start of his work with EDTA and related compounds by undertaking toxicologic tests in 1948 at the suggestion of the Food and Drug Administration, toward the potential use of it in food as rancidity and discoloration inhibitor. Feeding experiments in animals were followed by parenteral administration, which revealed the binding capacity with Ca, and subsequently with metals. This led to the consideration of possible medical use of the nontoxic form of CaEDTA. Although it was not very effective in experimental acute Pb poisoning (because of non-identity of animal studies with the clinical course in humans) a clinical trial in a severe case of Pb poisoning in a child was undertaken. The author remarks that this application of CaEDTA in Pb poisoning provides an example of the recognition of physical and chemical properties of a compound which led to its testing and application in a preselected area of therapy. (54 references)

- 2328** Saita, G., and Moreo, L. (Univ. Milan, Italy): Acido delta-aminolevulinico e por-

fobilinogeno nelle urine di intossicati da piombo. ( $\delta$ -AMINOLEVULINIC ACID AND PORPHOBILINOGEN IN THE URINE OF PATIENTS WITH LEAD POISONING.) Medicina del Lavoro 52: 668-75 (Nov.), 1961.

Urinary elimination of ALA and porphobilinogen (PBG) was studied in normal subjects and in 20 cases of Pb intoxication (5 with colics, 15 without) before and during treatment with  $\text{CaNa}_2\text{EDTA}$ . The Mauzerall-Granick method was used. Also determined and tabulated were free erythrocyte protoporphyrin, Pb in blood and urine, coproporphyrin in urine, stippled cells and hemoglobin. Normal values for ALA and PBG ranged from 1.5-2.8 and 0.3-1.2 mg/24 hr, respectively. Before therapy ALA was 9.6-53 mg/24 hr, av 28.7, in subjects without colics and 17-45, av 31, in patients with colics. During treatment with 2 g/day of EDTA these values decreased to an av of 15.6 and 15.8 mg/24 hr, respectively. PBG values were normal in all cases.

The rise in excretion of ALA is attributed to the inhibitory action of Pb on SH-containing enzymes which are responsible for the conversion of the ALA to PBG. Treatment with EDTA reduces the enzymatic block caused by Pb. (33 references)

- 2329** Sassi, C., Finulli, M., and Nava, C. (Univ. Milan, Italy): Il saturnismo nella lavorazione dello stearato di piombo. (LEAD INTOXICATION IN WORKERS EXPOSED TO LEAD STEARATE.) Medicina del Lavoro 52:658-67 (Nov.), 1961.

Out of 43 cases of Pb intoxication investigated, 27 patients were engaged in the production of Pb stearate and 16 in the manufacture of plastic materials where Pb stearate is used. Their chief symptoms were abdominal pain (in 40 patients) which frequently took the form of true colics, anemia (in 32), liver enlargement (in 16), gastric duodenitis (in 16). Laboratory tests yielded the following average values: Pb in blood, 120  $\mu\text{g}\%$ , Pb in urine, 305  $\mu\text{g}/\text{l}$ , urinary coproporphyrin, 60  $\mu\text{g}\%$ , protoporphyrin in erythrocytes, 253  $\mu\text{g}\%$ , stippled cells, 4100/million. A group of 56 workers, exposed to Pb stearate for an average of 6 mo in a well ventilated area, was examined. Abdominal pains, frequently accompanied by constipation, but without true colics, were observed in 1/3 of the subjects, but there were only 6 cases of anemia. Average values for urinary Pb and coproporphyrin, Pb in blood, and stippled cells were, respectively: 135  $\mu\text{g}/\text{l}$ , 32  $\mu\text{g}\%$ , 105  $\mu\text{g}\%$ , and 1050/million. Prophylactic treatment with iv doses of 1 g CaEDTA twice a day for 3 days in 32 subjects who showed abnormal Pb absorption enabled all workers to continue their work. Another group of 11 subjects engaged in the production of Pb stearate for 2 mo in a poorly ventilated area in which the atmospheric Pb concentration ranged from 0.20-3.00  $\text{mg}/\text{m}^3$  was also examined. In spite of treatment with Ca versenate (2 g/day per os for 2 periods of 10 days), almost all subjects complained of abdominal disturbances, nausea, anorexia, 1 subject suffered from typical colic, and 4 from mild toxic hepatitis. Tests for Pb absorption showed elevated values after 15 days of work.

It is concluded that in the course of chronic Pb intoxication, caused by exposure to moderate amounts of Pb stearate, the symptoms resemble

those appearing in inorganic Pb intoxication, while in cases of extensive exposure to Pb steady additional harmful effects occur in the liver.

- 2330** Schlang, H.A. (US Naval Hosp., Jacksonville, Fla.): POISONING CAUSED BY TETRAETHYL LEAD. *Aerospace Medicine* 32:333-5 (Apr.), 1961.

Nine cases of TEL poisoning had occurred as a result of exposure to Pb gasoline in closed spaces aboard an aircraft carrier. Gasoline spillage had occurred repeatedly from a defective pump, but operational requirements were such that use of the pump was not suspended. None of them was fatal and although poisoning in 1 conceivably left the patient with a severe residual psychiatric disorder, no other sequelae were noted. One of the cases was life threatening and is presented in detail. EDTA treatment together with supportive treatment brought complete recovery in ~2 mo. The author discusses the management of such patients: Supportive treatment is important to control the physiologic derangements secondary to the intoxication; these are similar to those occurring in any case of delirium with coma, and consist in maintenance of the nutrition, hydration, ventilation and control of potential infection and energy wasting. He emphasizes the need for heavy and continuous sedation. The mainstay of specific therapy is CaNa<sub>2</sub>EDTA for the mobilization of Pb from the body.

- 2331** Sessa, T., and Tempone, G. (Univ. Naples, Italy): Su alcuni casi di encefalopatia saturnina. Contributo clinico. (SEVERAL CASES OF SATURNINE ENCEPHALOPATHY. CLINICAL CONTRIBUTION.) *Folia Medica (Naples)* 44:185-204 (Mar.), 1961.

The present knowledge of Pb encephalopathy is reviewed. Four cases are presented of Pb intoxication with encephalopathy in workers, 30-60 yr-old, who had been exposed to Pb for 16-40 yr (2 of them printers, 1 in the cotton industry handling Pb carbonate, the job of the 4th man is not given). The presence of Pb in the body fluids and of urinary coproporphyrin demonstrated the existence of Pb poisoning. The functional symptoms such as headaches, insomnia, irritability, the remarkable quantity of Pb in the cerebrospinal fluid (22 and 28 µg in 2 cases) and cerebral X rays, electroencephalograms, and rheoencephalograms indicated the presence of encephalopathy. Treatment with CaEDTA brought a reduction in the amount of Pb in the spinal fluid and had a favorable effect on the neuropsychic symptoms. (19 references)

- 2332** Silvestroni, A., and Rossi, A. (Univ. Naples, Italy): Il comportamento del reogramma cerebrale nella intossicazione saturnina. (THE BEHAVIOR OF THE CEREBRAL RHEOGRAM IN LEAD POISONING.) *Folia Medica (Naples)* 44:817-35 (Oct.), 1961.

Cerebral rheograms were taken in 23 subjects, aged 15-80 yr and exposed to Pb for 3-50 yr. None of the tests were made during periods of colic or immediately thereafter. The cranial leads were the following: frontal, bitemporal, occipital, at right and left hemisphere, occipitoglabellar.

Correlation was made in a group of 15 patients with electrocardiographic and in 8 with stethoscope phonocardiographic results. Each case is briefly described with data given for blood pressure, cholesterol in blood, Pb in blood and urine, stippled erythrocytes and the rheographic findings. In 7 of them, arterial hypertension, and in 3, clinical, EKG, radiographic and biochemical signs of arteriosclerosis were found. Fifteen of the men, who had had exposures of >10 yr, showed rheographic abnormalities while the rheogram was normal in 8 subjects with Pb exposures of <10 yr. The rheographic alterations were greater in the hypertensive or arteriosclerotic patients. However, it is concluded that rheographic alterations are not characteristic for occupational Pb poisoning but that they usually occur when anatomical or functional changes in the walls of the cerebral blood vessels are present in all disease states.

- 2333** Stanković, D. (Central Hyg. Inst., Sarajevo, Yugoslavia): Slučaj hroničnog saturnizma sa akutno cikličkim tokom posle uzimanja velike količine alkohola. (A CASE OF CHRONIC SATURNISM WITH A CYCLIC DEVELOPMENT INTO ACUTE LEAD POISONING FOLLOWING THE INGESTION OF LARGE QUANTITIES OF ALCOHOL.) *Glasnik Higijenskog Instituta* 10:41-8 (July-Dec.), 1961.

A case of chronic Pb intoxication with a cyclic evolution into an acute state among smelters attending blast furnaces is described. When seen, the 52-yr-old patient exhibited among other signs, 58% hemoglobin, 800 µg/l urinary porphyrins, serum Fe of 85 µg%, and 120 µg% Pb in blood. In summarizing the report, the author states that the consumption of a large quantity of beverages by persons exposed to Pb can cause the mobilization of deposited Pb into the blood with acute symptoms. He points out that among the workers of the foundry, particularly those living in rural areas, it is the custom of treating stomach disorders with highly spiced beverages. In the case of workers exposed to high absorption of Pb such treatment as well as alcoholism is very dangerous for the combination may cause the development of an acute stage of poisoning with colic and even death.

- 2334** Stich, W. (Univ. Munich, Germany): δ-Aminolävulinacidurie. Ein neues biochemisches und diagnostisches Kriterium der Bleivergiftung. (δ-AMINOLEVULINIC ACID IN THE URINE. A NEW BIOCHEMICAL AND DIAGNOSTIC CRITERION OF LEAD POISONING.) *Klinische Wochenschrift* 39:338-41 (Apr.), 1961.

Urinary ALA was determined in 20 normal subjects, 15 patients with Pb intoxication and 140 workers of a Pb-Cu foundry. Normal persons excrete an average of 2130 µg/day. In the 15 patients, urinary ALA ranged from 11,240-102,400 µg/day. The tabulation includes the clinical symptoms along with the values. For the 140 Pb workers values for ALA and porphobilinogen (PBG) varied from 42-14,100 and 10-2200 µg/100 ml respectively; 64% of the workers showed a pathologic increase of ALA and only one had a PBG level above normal. (16 references)

- 2335** Talentì, M., and Palla, A. (Univ. Rome,

Italy): I moderni antidetonanti delle benzine carburanti. (MODERN ANTIKNOCK AGENTS IN CARBURETTING GASOLINES.) Nuovi Annali d'Igiene e Microbiologia 12:358-70 (Sept.-Oct.), 1961.

The toxicity of TML versus TEL is discussed and it is pointed out that the greater toxicity of TML, in practical use, is insignificant. (From authors' English summary)

- 2336** Teisinger, J. (Inst. Ind. Hyg. Occup. Dis., Prague, Czechoslovakia): Tests biologiques d'exposition. (BIOLOGICAL EXPOSURE TESTS.) Proceedings of the International Symposium on Maximum Allowable Concentrations of Toxic Substances in Industry, Prague, Czechoslovakia, April, 1959. Pure and Applied Chemistry 3:253-67, 1961.

See Abstract No. 2071.

- 2337** Teisinger, J., and Srbová, J. (Inst. Ind. Hyg. Occup. Diseases, Prague, Czechoslovakia): Metoda k diagnostické mobilizaci olova v ambulantní praxi. (A METHOD FOR DIAGNOSTIC LEAD MOBILIZATION IN AMBULATORY PRACTICE.) Časopis Lekařů Českých 100:155-7 (Feb.), 1961.

In the test described, 3 g of  $\text{CaNa}_2\text{EDTA}$  (15 ml Edtocal Spofa) are administered iv after the intake of 1 liter of tea. Samples of urine are collected for 6 hr and analyzed for their Pb content.

During this period an av 56% of the total 24-hr Pb are excreted. The results are calculated as the absolute amount/24 hr. (From authors' summary)

- 2338** Teisinger, J., and Stýblová, V. (Univ. Carolinae, Prague, Czechoslovakia): Neurologický obraz chronické otravy olovem. (NEUROLOGICAL PICTURE OF CHRONIC LEAD POISONING.) Acta Universitatis Carolinae, Medica Supplementum 14:199-206, 1961.

Sixty-one Pb workers from various industries where they had been exposed to large amounts of Pb, were examined. No neurological disorders were detected in 10 subjects; in 21, functional disorders, with prevalence of vegetative neuroasthenic complaints, were observed; 15 exhibited organic changes mostly affecting the central nervous system. The incidence of nervous lesions correlated in frequency and seriousness with the severity of the Pb intoxication. (From authors' summary)

- 2339** Thould, A.K.: LEAD ENCEPHALOPATHY. Proceedings of the Royal Society of Medicine 54:228-9 (Mar.), 1961.

The case of a 46-yr-old woman is described who developed signs of Pb encephalopathy after supervising for 5 yr the spreading by machine of a moist mixture of litharge and red Pb on accumulator plates. Clinical findings and results of blood and urine analyses are given. The urine contained 400  $\mu\text{g}$  Pb/24 hr.  $\text{CaNa}_2\text{EDTA}$ , 3 g in 50 ml of normal saline, was given, iv, over 5-10 min/day for 5 days as recommended by Sidbury (1955). Urine was collected for the 1st and last 24 hr of the course and the Pb content estimated. Only a small quantity of Pb was found in the urine, therefore a 2nd course was instituted 5 days later, giving 2 g in 500 mg normal saline, iv, over 2-3 hr/day

for 5 days as recommended by Leckie and Tompsett (1958). The 24-hr urinary Pb excretion was 3.65 mg on the 1st day, 2.65 on the 2nd, and 1.80 on the 5th. She improved well and was discharged within 6 wk.

- 2340** Tikhonov, I.I. (San.-Epidemiol. Station, Ordzhonikidze N.-Caucasian R.R., USSR): K profilaktike svintsovykh pishchevykh otravlenii v svyazi s prigotovleniem chanakhi v glinyanoi glazurovannoi posude. (PREVENTION OF FOOD POISONING DUE TO LEAD IN CONNECTION WITH THE PREPARATION OF CHANAKHI IN GLAZED EARTHENWARE.) Voprosy Pitaniya 20, No. 4:80-1, 1961.

In the restaurants and dining cars of the N-Caucasian railroads, "chanakhi" is frequently prepared not only for the passengers but for the employees. This dish is usually prepared and stored in glazed earthenware; in fact, in cookbooks it is stated that it is best so prepared. Over several years, the author had observed that a number of cases of Pb poisoning had been admitted to the clinics of the railroad, which had been caused by the storage of plum and other preserves in glazed containers. For this reason, chanakhi was prepared in his laboratory by following an accepted recipe per portion of: 150 g lamb, 200 g potatoes, 50 g tomatoes, 50 g cabbage, pepper and salt, and 100-150 ml water, then allowed to stand for 1-1/2-2 hr or more before being baked and then allowed to cool. The earthenware used was of varying wear: with intact glaze (I), with poorly preserved glaze (II), and greatly worn or old glaze (III). The specimens analyzed amounted to 400 g. The analyses performed in October and November (2 samples) 1956 and in February and March 1957 showed in I, 2430, 410, 124, 43.6, and 17.16 mg Pb; in II, 140, 52, 36, 12.2, and 6.0 mg; in III, Pb was not detected. The author concludes that the 1st serving analyzed with 2430 mg Pb can cause acute poisoning, and from the others, chronic poisoning could occur.

- 2341** Timár, M. (Natl. Ind. Hyg. Inst., Budapest, Hungary): Vorschläge zur Bestimmung der biologischen Grenzkonzentration einiger Stoffe. (PROPOSED BIOLOGICAL DETERMINATION OF MAXIMUM PERMISSIBLE CONCENTRATIONS OF CERTAIN SUBSTANCES.) Proceedings of the International Symposium on Maximum Allowable Concentrations of Toxic Substances in Industry, Prague, Czechoslovakia, April, 1959. Pure and Applied Chemistry 3, Nos. 1-2:277-9, 1961;

The implication of the maximum allowable threshold limit and the biological threshold limit are discussed. Based on studies of Pb workers the following biological threshold limits are proposed; Pb in blood 69  $\mu\text{g}$  (determined by Teisinger's method); CO-hemoglobin 10%; urinary phenol 80-100 mg/l.

- 2342** Tipton, I.H., and Cook, M.J.: STATISTICAL INTERPRETATION OF TRACE ELEMENT CONCENTRATIONS IN HUMAN TISSUE. In Morgan, K.Z.: Health Physics Division Annual Progress Report for Period Ending July 31, 1961. US Atomic Energy Commission Document No.



ORNL-3189:203-6 (July 31), 1961.

In an analysis for 7 essential and 10 nonessential elements in 7 organs of 166 adults >20 yr of age, who had been victims of instantaneous accidental death in 11 cities in the US, the following Pb values (in ash) were found, with occurrence in % given first, then median, low and high, in µg/g, respectively: aorta 100, 150, 10, 520; brain 70, 5, <5, 450; kidney 100, 98, 6, 680; liver 100, 130, 22, 1000; lung 100, 49, <5, 630; spleen 98, 28, <5, 2000; heart 62, 10, <5, 180. Concentration variability for these tissues was 8.5, 6.8, 5.1, 4.2, 8.2, 10, and >5.8.

- 2343** Tüppich, E., and Minden, H. (Occup. Dis. Clinic; Inst. Ind. Hyg., Acad. Soc. Hyg., Ind. Hyg., Med. Educ., Berlin-Lichtenberg, Germany): Klinischer Beitrag zur Frage der Blutdruckregulation und der Herz- und Kreislaufbeteiligung bei Bleivergiftung. (CLINICAL OBSERVATIONS ON THE BLOOD PRESSURE AND THE CARDIOVASCULAR SYSTEM IN LEAD POISONING.) Archiv für Gewerbepathologie und Gewerbehygiene 18, No. 5:467-78, 1961.

This study was made on 115 hospital patients, 16-64 yr old, with mild to severe subacute Pb poisoning. The severity of poisoning was graded as follows: Incipient, Hb ≥80%, RBC ≥4 million, basophils 0.5-30/1000; mild, Hb 70-79%, RBC 3.5-3.9 million, basophils 20-50/1000; moderate, Hb 60-69%, RBC 3.0-3.48 million, basophils 30-60/1000; severe, Hb ≤60%, RBC <3 million, basophils 45-70/1000. As the basophils varied sharply, diagnosis was mainly on the basis of Hb and RBC. Porphyrinuria was also examined in some cases. Most of the patients showed increase in blood pressure, especially in the systolic phase, which disappeared with the other poisoning signs and could not be correlated with age or degree of intoxication. Temporary increase in blood pressure was observed in 29.6% of the cases, mostly in the younger patients. The changes reported are not considered to be of renal origin but they seem to be an indication of increased adrenalin release in acute and subacute Pb poisoning. In 5.2% of the patients, EKG's showed temporary slight changes which could be regarded as reversible myocardial alterations due to Pb intoxication, appearing in cases of previously existing coronary complications.

Bradycardia was observed in 10.9%, and tachycardia in 7%. The conclusion is drawn that acute Pb poisoning could cause cardiac infarction under such preconditions, but the extent to which such infarction is attributable to Pb exposure should be evaluated in each case separately. (24 references)

- 2344** Tregubenko, I.P., Yashunskii, V.G., and Semenov, D.I. (Acad. Sci., Sverdlovsk, USSR; All-Union Res. Chemopharmaceutical Inst., Moscow): (ACCELERATION OF THE EXCRETION OF YTTRIUM, CERIUM, AND LEAD FROM THE BODY WITH THE AID OF ETHYLENE-DIAMINE-TETRAACETIC ACID, DIETHYLENETRIAMINE-PENTAACTIC ACID AND THE DIAMINO-DIETHYLESTER OF TETRAACETIC ACID.) Biochemistry (USSR) (English Translation) 26:154-63 (July-Aug.), 1961.

The diaminodiethylester of tetraacetic acid (DDTE), diethylenetriaminepentaacetic acid (DTPA), and ethylenediaminetetraacetic acid (EDTA) were tested for accelerating the elimination of Y, Ce, and Pb from the body. Following DDTE and DTPA injection, increased elimination with urine and feces of Y and Ce, but not of Pb, lasted several days. DTPA should be particularly efficient with regard to metals which are mostly deposited in the liver. A theoretical interpretation is presented of the differences in the efficacy of the chelates. (From Nuclear Science Abstracts 15:Abstract No. 25834, 1961)

- 2345** Truhaut, R. (Univ. Paris, France): Les limites tolérables dans les milieux biologiques: Aspects analytiques, biochimiques et pharmacologiques. (TOLERABLE LIMITS IN BIOLOGICAL MATERIALS: ANALYTIC, BIOCHEMICAL, AND PHARMACOLOGIC ASPECTS.) Proceedings of the International Symposium on Maximum Allowable Concentrations of Toxic Substances in Industry, Prague, Czechoslovakia, April, 1959. Pure and Applied Chemistry 3, Nos. 1-2:205-52, 1961.

This is an extensive discussion and review, based on 330 references, of what needs to be considered in the establishment of biological tolerable limits in the exposure to numerous substances, including Pb. This the author does by considering the choice of biological material for analysis and conditions of collection; undertaking of preliminary treatment (such as mobilization with chelates); consideration of certain biochemical modifications produced by the poisons; choice of analytical methods; base biochemical data for the interpretation of results.

- 2346** Unseld, D.W. (Municipal Hosp., Ulm, Germany): Nachweis, Beurteilung und Therapie von Residuen einer Bleivergiftung. (DETECTION, EVALUATION AND THERAPY OF THE RESIDUAL EFFECTS OF LEAD POISONING.) Med. Welt 51:2685-6 (Dec.), 1961.

The so-called "late effects of Pb" are discussed. They are diagnosed by the "Mosatil test." If the test is positive, the organism should be delead by means of chelators and the progress of the treatment checked by repeated Mosatil tests. (From Deutsche Zeitschrift für die gesamte Gerichtliche Medizin 54:34 (Abstracts), 1963)

- 2347** Vilaseca, G.C. (Buenos Aires, Argentina): La intoxicación por el tetraetil de plomo. (POISONING BY TETRAETHYL LEAD.) Semana Médica (Buenos Aires) 118:1341-7 (June 1), 1961.

The article describes chemical and physical properties of TEL, exposure routes, its absorption and clinical characteristics of the intoxication. Symptoms of 78 patients (reported by Machle, 1935) are tabulated. The importance of Pb determinations in urine and blood for diagnosis is pointed out. Treatment and prophylaxis are discussed.

- 2348** Weinig, E., and Bärner, B. (Inst. Legal Med., Univ. Erlangen, Germany): Über den normalen Bleigehalt der menschlichen Knochen. (THE NORMAL LEAD CONTENT IN HU-

MAN BONES.) Archiv für Toxikologie  
Fühner-Wieland's Sammlung von Vergiftungs-  
fällen 19:34-48, 1961.

The literature is reviewed, and a polarographic method for Pb determination in bone ash is described. Results of own studies on 30 persons, age newborn to 71 yr who had had no occupational exposure to Pb, are given. In the newborn (2 cases), ash of femurs contained 0.52 and 0.60 mg/100 g. In adults, the average ash values were as follows (mg/100 g): femur, 1.88 (range 0.80-3.21); tibia, 1.89 (1.22-2.81); ribs, 2.30 (1.36-3.52); vertebrae, 2.66 (1.44-5.31). No differences were found in "normal" bone (from 4 of the subjects) in respect to compact and spongy bone tissue.

The authors conclude from this study and those reported in the literature, that distribution of Pb can be considered characteristic of normal if the compacta and spongiosa do not exhibit significant differences, and if the Pb content in femur ash is not significantly higher than 3 mg/100 g. Generally in adults these range from 1-3 mg; in the 30's closer to 1 mg, in the 60's and 70's, between 2 and 3 mg, although low values may be found in advanced age.

- 2349 Wolff, H.P., and Fischer, R.: LEAD. In: Radioactive Isotopes in Physiology, Diagnostics, and Therapy. Vol.II. Berlin, Springer-Verlag, 1961, pp. 99-102.

Tracer studies on the resorption, excretion, and distribution of Pb are summarized. (From Nuclear Science Abstracts 16:Abstract No. 1398, 1962)

- 2350 Zabrodin, N.I.: (TRACE ELEMENTS IN HUMAN TUMORS IN TRANSBAIKAL REGION.) Trudy Nauchnoi Konferentsii po Primeneniyu Novykh Fiziko-Khimicheskikh Metodov Issledovaniy v Biologii i Meditsini Chita 1961: 50-1.

The content of trace elements in malignant and benign tumors was determined by semiquantitative spectral analysis. All tumors were found to contain Pb though the content was different in tumors and normal tissue. (From Chemical Abstracts 60: 13695, 1964)

- 2351 Zannini, D., and Lombardi, F. (Univ. Genoa, Italy): Intossicazione saturnina da uso di stabilizzanti con sali di piombo per materie plastiche. (LEAD INTOXICATION CAUSED BY THE USE OF STABILIZERS CONTAINING LEAD SALTS FOR PLASTIC MATERIALS.) Lavoro Umano 13, No. 4:145-54, 1961.

The use of organic and inorganic Pb compounds as stabilizers of polyvinyl chloride resins in the manufacture of plastics is described. A case of Pb intoxication in a 34-yr-old man, employed in the plastic industry for 3 yr and exposed to a large amount of Pb stearate in an area insufficiently ventilated and at high temperatures, is presented. The patient suffered from lack of appetite, asthenia, acute colic-abdominal pain and vomiting. Laboratory tests showed red cells, 2,900,000; Hb, 9.4%; white cells, 8000; Pb in blood, 102 µg%; coproporphyrin and Pb in urine, 4000 µg% and 174 µg%, respectively. After administration of CaEDTA the patient recovered. Ex-

amination of 6 men and 3 women, 19-46 yr old, who had been employed at the plant for 2 yr, gave evidence of an abnormal Pb absorption, manifested by stippling of erythrocytes, raised amount of urinary porphyrin and Pb in 2 subjects, an enlarged liver and a mild anemia in 1 subject. In vitro tests on the possibility of Pb absorption through the digestive tract showed that Pb combines with the gastric HCl to form  $PbCl_2$  which is soluble at body temperature. For prophylactic measures it is recommended that masks be worn and that the time of exposure in the dangerous areas be limited.

- 2352 Zielhuis, R.L. (Dept. Occup. Med. Netherlands Inst. Prev. Med., Leyden): COPROPORPHYRINURIA IN GROUPS OF WORKERS AS AN INDEX OF INORGANIC LEAD ABSORPTION. British Journal of Industrial Medicine 18: 58-62 (Jan), 1961.

The semiquantitative method of Donath was used in the examination of 513 Pb workers of various industries in the Netherlands. The Donath scale of coproporphyrin (CP) concentration is: (in µg/l) 1: 0-50, 2: 50-100, 3: 100-200, 4: 200-400, 5: 400-800, 6: 800-1600, 7: 1600-3000, 8: 3000-5000. One hundred twelve males, not exposed to Pb, were used as controls and showed a "normal" average Donath degree of 1.4. In 2 factories (A and B) each producing Pb pigments (mainly the chromate, sulfate, and stearate), the Pb-in-air concentration was determined in 1957-58, and in the same period 81 workers in factory A and 80 in B were examined for CP content. Results showed that workers exposed to  $<0.05$  mg Pb/m<sup>3</sup> never had a CP content  $>3$ ; with an exposure  $>0.15$  mg/m<sup>3</sup>, CP was  $\geq 3$ ; there was no increase in CP with increasing duration of exposure. The correlation coefficient for Pb-in-air concentrations with individual values of CP was 0.478 in factory A and 0.510 in factory B. The correlation between the percentage of workers with low hemoglobin (Hb) ( $\leq 13.7$  g/100 ml) and high CP was 0.91. The author concluded that if CP  $>1.5$ , there is an increased Pb intake; if CP is 1.5-2.5, the exposure is within allowable limits; if CP  $>2.5$ , the MAC for Pb in air (0.1 mg/m<sup>3</sup>) has probably been exceeded; from the frequency distribution of CP, the degree of air pollution with Pb and the degree of anemia due to Pb intake may be roughly estimated. If the CP values exceeded the allowable range, it is necessary to determine Hb and basophilic stippling.

- 2353 Zielhuis, R.L. (Dutch Inst. Preventive Med., Leyden, Netherlands): (DETERMINATION OF BLOOD AND URINE LEAD LEVELS FOR THE DIAGNOSIS OF LEAD POISONING.) Netherlands Tijdschrift voor Geneeskunde 105: 564-6 (Mar. 25), 1961.

Pb values in blood and urine are not sufficient evidence for the diagnosis of Pb poisoning. The diagnostic possibilities of the EDTA test are discussed. (26 references)

- 2354 Zielhuis, R.L. (Inst. Prev. Med., Leyden, Holland): MAXIMUM ALLOWABLE LIMITS IN BIOLOGICAL MATERIALS IN THE PREVENTION OF INORGANIC LEAD POISONING. Proceedings of the International Symposium on Maximum Al-

lowable Concentrations of Toxic Substances in Industry, Prague, Czechoslovakia, April, 1959. Pure and Applied Chemistry 3, No. 1-2:293-302, 1961.

See following abstract.

- 2355** Zielhuis, R.L. (Inst. Prev. Med., Leyden, Holland): Maximal zulässige Grenzwerte biologischer Reaktionen in der Verhütung gewerblicher Bleivergiftungen. (MAXIMUM ALLOWABLE LIMITS IN BIOLOGIC REACTIONS FOR THE PREVENTION OF INDUSTRIAL Pb-POISONING.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 11:129-34 (June), 1961.

Methods for routine analyses of blood and urine for Pb workers in industrial plants are discussed. In studies on 117 men, age 20-60 yr, with no Pb exposure, the following "normal" values were established: hemoglobin (Hb), 12.8-17.0 g%, av 15.5 g%; reticulocytes, 0.05-0.9%; no stippled cells (SC) were found in 80% of the men, but in 20%, the values were 0.1-0.5/1000; coproporphyrin (CP) in urine, 0-5 µg/l in 70%, 50-100 µg/l in 20%, and 100-200 µg/l in 10% of the men. In an attempt to detect a correlation between Hb values and SC, reticulocyte and CP counts, studies were made in several plants on single workers as well as groups (total 539 workers) exposed to Pb in air at various concentrations and for various periods of time. No decrease in Hb values was observed as long as the SC were <1-1.5/1000, but no constant relationship between Hb and reticulocyte or CP values could be established. From this study, the conclusion is drawn that the MAC for Pb in industry should be 0.1 mg/m<sup>3</sup> air (<0.15), and that there is no justification for increasing this value to 0.2 mg/m<sup>3</sup> as adopted by the American Conference of Governmental Industrial Hygienists in 1957. (16 references)

- 2356** Zimmer, F.E. (Danville Pa.): LEAD POISONING IN SCRAP-METAL WORKERS. Journal of American Medical Association 175:238-40 (Jan. 21), 1961.

Seven scrap-metal workers age 30-54 yr, employed in the cutting of steel bridge parts covered with Pb-containing paint, showed moderate to severe signs of Pb poisoning within 1-5 wk. Clinical findings and blood values are tabulated; Pb excretion in urine ranged from 0.21-1.89 mg/24 hr. Intravenous and oral treatment with CaEDTA is discussed; oral administration of CaNa<sub>2</sub>EDTA is to be avoided when Pb salts may be present in the gastrointestinal tract.

## 1962

- 2357** Abdalla, A., Hamamsy, A., and Taha, A. (Inst. Research for Tropical Med., Cairo, Egypt): THE EFFECT OF THE PRESENCE OF INCREASED AMOUNTS OF LEAD IN TARTAR EMETIC UPON THE TOXICITY OF THE DRUG. Journal of the Egyptian Medical Association 45, No. 7-8:735-41, 1962.

Tartar emetic is used for intravenous treatment of human schistosomiasis. Toxicity tests were carried out on samples of tartar emetic containing more than 5 ppm of Pb though otherwise conforming with established specifications. When mice were

injected subcutaneously with a single dose of tartar emetic containing 5, 20, 50 and 70 ppm Pb, respectively, the 50% lethal dose (LD-50) was (mg/kg) 24.8, 22, 18.5 and 16.4. A group of 50 patients suffering from Schistosoma were treated intravenously with 2 mg/kg of tartar emetic containing 20 ppm Pb, 3 times weekly for 4 wk. Nausea occurred in 40%, vomiting in 28%, giddiness in 23%; but no clinical or laboratory data indicative of Pb toxicity were found. As controls, 25 patients infected with Schistosoma were treated with tartar emetic conforming with the specifications of the British pharmacopoeia (Pb content not more than 5 ppm). The conclusion is drawn that although the acute toxicity of tartar emetic to mice increases with the parts per million amount of Pb present in the drug, and patients treated with tartar emetic containing 20 ppm Pb show signs and symptoms of greater toxicity than when treated with the drug containing 5 ppm Pb, the presence of Pb itself does not explain the occurrence of these phenomena. It is assumed that increased amounts of Pb in tartar emetic are rather to be regarded as an indicator of other unknown impurities which increase the toxicity of this drug.

- 2358** Aingorn, N.M.: (CONTENT OF CERTAIN TRACE ELEMENTS IN THE THYROID GLAND IN INHABITANTS OF THE TRANSBAIKAL REGION.) Mikroelementy v Vostoke Sibiri i na Dal'n. Vostoke, Informatsionnii Byulleten, Koordinatsionnaya Komissiya po Mikroelementam dlya Sibiri i Dal'n. Vostoka, No.1:30-2, 1962.

The content of various trace elements was determined in the thyroid gland of 55 persons killed in accidents. The Pb content of the thyroid was found to range from 0.003-0.03%. (From Chemical Abstracts 60:11147, 1964)

- 2359** Albahary, C., and Martin, S. (Hosp. Saint-Denis, France): Problèmes hématologiques posés par quelques maladies professionnelles. (HEMATOLOGIC PROBLEMS CAUSED BY SOME OCCUPATIONAL DISEASES.) Nouvelle Revue Française d'Hématologie 2:230-40 (Mar.-Apr.), 1962.

A review on blood changes which may develop in Pb intoxications is presented. (50 references.)

- 2360** Ambrosi, L. (Univ. Bari, Italy): Le sieroproteine nel saturnismo professionale. (SERUM PROTEINS IN OCCUPATIONAL SATURNISM.) Folia Medica (Naples) 45:404-14 (May), 1962.

Serum proteins were studied in 20 Pb-intoxicated subjects, 20-61 yr old, who had been exposed to Pb from 1-34 yr and at the time showed anemia, digestive disturbances, etc, elevated blood Pb, urine Pb, and porphyrinuria; some had already been pensioned. Total proteins in serum ranged from 6.40-8.20 g%, thus being within normal limits in most subjects. Serum albumin was significantly lower than normal in 6 (2.46-3.13 g%) and slightly lower than normal in 13 subjects (3.64-4.90 g%). Serum globulin ranged from 2.72-4.62 g%, with normal levels in only 3 cases. α<sub>1</sub>-, α<sub>2</sub>-, β-, and γ-globulins were increased in 12, 11, 5, and 6 cases, respectively, and ranged from 3.40-12.50, 5.70-15.40,

8.80-19.30, 9.60-30.20%, respectively. In 5 of the subjects the tests were repeated after 6 mo. Total serum proteins and albumin were reduced while values for  $\gamma$ -globulin had increased.

- 2361** Ambrosi, L., and Chiantera, A. (Univ. Bari, Italy): Quota serica del piombo in soggetti normali e saturnini. (LEAD IN THE SERUM OF NORMAL AND LEAD-INTOXICATED SUBJECTS.) *Folia Medica* (Naples) 45:129-36 (Feb.), 1962.

The distribution of Pb among the blood components was studied in 60 healthy individuals and in 15 Pb-exposed subjects. Pb levels were, respectively ( $\mu\text{g}\%$ ): whole blood, 15-29, 28-106.5; serum, 4-8.6, 5-13; coagulum, 25-56, 51-200. Serum Pb levels, which in healthy individuals varied from 10-18% of the Pb values found in whole blood, did not increase correspondingly to the coagulum levels, but remained always below 10% of the whole blood levels found in Pb-exposed individuals. Paper electrophoresis for the identification of protein fractions containing Pb is not useful in the pathology of occupational diseases.

- 2362** Anatovskaya, V.S.: (USE OF UNITHIOL IN THE TREATMENT OF CHRONIC LEAD INTOXICATION.) *Nauchnye Trudy Ukrainskii Nauchno-Issledovatel'skii Institut Gigieny Truda i Proizabolevanii* 29:50-6, 1962.

Patients with chronic Pb intoxication were divided in 2 groups. Symptomatic therapy (infusions of glucose, preparations of belladonna, insulin, choline chloride, methionine, vitamins, Na hyposulfite, I preparations and transfusions) was used in the 1st and 5 ml of 5% unithiol solution daily im in the 2nd group. Hemoglobin, basophils, blood Pb, and urinary Pb levels were examined. Unithiol treatment produced better results in normalizing all indexes examined than did symptomatic therapy. No side effects were observed. (From *Chemical Abstracts* 61:1156, 1964)

- 2363** Angevine, J.M., Kappas, A., DeGowin, R.L., and Spargo, B.H. (Univ. Chicago, Ill.): RENAL TUBULAR NUCLEAR INCLUSIONS OF LEAD POISONING. A CLINICAL AND EXPERIMENTAL STUDY. *Archives of Pathology* 73:486-94 (June); Addendum 74:151 (Aug.), 1962.

A case of Pb intoxication in a 60-yr-old man who had been exposed to Pb dust in a paint-mixing department for 35 yr is presented. The patient suffered from sharp epigastric pain associated with weakness, constipation, complete loss of appetite and gradual loss of weight. Urinary tests showed 0.026 and 0.102 mg Pb/l (0.039 and 4.05 mg/l after EDTA), coproporphyrinuria, and the presence of round, acid-fast particles sometimes surrounded by nuclear chromatin (upon Ziehl-Neelsen stain) in the urinary sediment. Intravenous renogram with radioiodine revealed reduced kidney function, more marked in the right than in the left. Percutaneous right renal biopsy showed badly scarred tissue, distorted tubules of which occasional ones had cuboidal cells; several of the latter contained large nuclear inclusions, characteristic of Pb intoxication. Electron micrographs of these preparations and those obtained from rats are discussed.

Twelve 4-mo-old male Holtzman rats were fed a diet containing 1% Pb acetate for 24 wk. Autopsies were performed at regular intervals. Renal inclusion bodies were seen with regularity after 2 mo of Pb ingestion. Microscopically they consisted of hyaline eosinophilic masses, varied in size and were more frequent in the nuclei of the cells of the proximal convoluted tubules. These changes observed in the nuclei are considered to be a response to the toxic action of Pb, reaching the tubules either through the blood or urine and interfering with enzymatic reactions. (19 references) (In an addendum appearing in the August issue, the author calls attention to a report published by Beaver, D.L.: The Ultrastructure of the Kidney in Lead Intoxication with Particular Reference to Intranuclear Inclusions, *Amer. J. Pathol.* 39:195-208, 1961, and mentions 2 additional cases of Pb intoxication with the above type of renal lesion.)

- 2364** Austoni, M., Scandellari, C., and Chiesura, P. (Univ. Padua, Italy): IRONKINETICS IN HUMAN LEAD POISONING. *Acta Isotopica* 2, No. 2-3:149-63, 1962.

The study was carried out in order to investigate whether alterations of the metabolism of Fe, observed earlier in animals, also occur in chronic Pb poisoning in man. Five patients, 4 of whom were exposed to high Pb risk for 2-6 mo and 1 for 8 yr, were injected with 0.5  $\mu\text{Ci}$  of  $^{59}\text{Fe}$ /kg, before any specific therapy was instituted. Over a 10-day study period, red-cell volume generally decreased; plasma volume was decreased in 1 case, at the lowest normal in 1 case and within normal range in 3 cases; plasma Fe was elevated in 4 cases and reduced in 1 case. The rate of Fe incorporation into the red cells was constantly decreased; the greater this decrease, the greater was the increase in plasma Fe. Hemolysis probably accounted for this phenomenon. Fe uptake in the bone marrow did not change significantly in the initial phase but was definitely lower in the erythrogenic stage. Data for Fe uptake in liver and spleen were not conclusive. Transfer coefficients of Fe from plasma into the bone marrow pool showed no correlation, but the amount transferred was definitely increased in 4 subjects. Fe of the erythropoietic labile pool was sharply decreased in all patients while the transfer coefficients from the erythropoietic labile pool to the stabile erythroblastic pool were constantly increased. The amount of Fe permanently incorporated into the erythroblasts and daily hemoglobin formation appeared constantly increased in 4 cases. Survival time of red cells was significantly decreased in 4 cases.

The data indicated that, besides hemolysis and increased erythropoiesis, a slowing down of the utilization of Fe for the synthesis of hemoglobin in the presence of an increased Fe fixation into erythroblasts, operates in anemia of chronic Pb poisoning.

- 2365** Baharycz, M., Kujawska, A., and Spett, K. (Inst. Med. Pracy, Zabrze, Poland): (AMINOACIDURIA IN PATIENTS WITH CHRONIC SATURNISM.) *Med. Pracy* 13:429-33, 1962.

Paper chromatographic tests of the urines of 19 patients with chronic Pb poisoning revealed that

urinary alanine was increased over the normal level of  $47.5 \pm 6.2$  mg/g creatinine in only 27%.  $\gamma$ -Amino-levulinic acid (normal  $1.9 \pm 1.2$  mg/g creatinine), was invariably increased to 2.2-39.5 mg/g creatinine. (From Chemical Abstracts 59:6889, 1963)

- 2366** Balbo, W., and Marucci, V. (Univ. Rome, Italy): Sul contenuto di acido delta-amino-levulinico nelle urine di un gruppo di soggetti esposti all'azione tossica protratta del piombo. (DELTA-AMINO-LEVULINIC ACID CONTENT OF URINE IN A GROUP OF SUBJECTS EXPOSED TO PROLONGED TOXIC ACTION OF LEAD.) *Zacchia* 25:43-56 (Jan.-Mar.), 1962.

The Pb concentration of blood and urine and urinary coproporphyrin were determined in 35 subjects 26-67 yr old, almost all of them typographers who had been exposed to Pb for 2-48 yr, and in 10 controls without known exposure to Pb. The Pb level of the blood was increased in 2 cases (1.37 mg/l and 0.625 mg/l) that of the urine in 9 cases (0.100-0.435 mg/l) and urinary coproporphyrin in 14 individuals (0.210-0.450 mg/l). The concentration of ALA which in the 10 unexposed subjects had been found to average 0.235 mg/100 ml, exceeded this normal value in 23 cases. No quantitative relation was noted between the Pb content in blood and urine and urinary coproporphyrin, but a simultaneous increase of urinary coproporphyrin and ALA was found in 37% of the patients.

- 2367** Balbo, W., and Marucci, V. (Univ. Rome, Italy): Studio sulle attività transaminasiche ed aldolasica del siero in un gruppo di operai esposti all'azione tossica protratta del piombo. (TRANSAMINASE AND ALDOLASE ACTIVITY IN THE BLOOD OF A GROUP OF WORKERS EXPOSED TO THE PROTRACTED TOXIC INFLUENCE OF LEAD.) *Zacchia* 25, No.4:419-32, 1962.

The activity of transaminase and aldolase was studied in the blood of 30 workers, 28 to 63 yr old who had been exposed to Pb as founders, varnishers and printers for 1-40 yr. The following data were determined (with normal threshold values given in parenthesis): glutamic oxalacetic transaminase, 2-42 units/cc, and 49 in 1 case (45); glutamic pyruvic transaminase, 5-40 (40); aldolase, 2-10 in 19 cases and 11.5-65 units/cc in 11 subjects (8); Pb in blood, 30.4-59.1  $\mu$ g/100 ml in 22 subjects and 62.0-93.9 in 8 subjects (60.0); Pb in urine, 12-95  $\mu$ g/l in 20 subjects and 110-375 in 10 subjects (95); urinary coproporphyrin, 45-110  $\mu$ g/l in 9 cases and 168-960 in 21 cases (160). Eight of the 11 individuals with increased aldolase activity also showed increased urinary coproporphyrin; in 6 of the 11, urinary Pb was increased and in 5 of the 11, blood Pb was increased. It is pointed out that any increase of transaminase and aldolase in the blood indicates a necrosis of those organs which mainly contain these enzymes, ie, heart, liver, brain and muscles. The subjects of this study were exposed to Pb but did not suffer from Pb poisoning. The slight increase of aldolase in 36.6% of the subjects points to an initial slight tissue damage. Therefore, such increase, in the presence of increased Pb levels in the blood and urine, might be a valuable sign for early diagnosis of Pb poisoning.

- 2368** Bartoš, V. (Příbram, Czechoslovakia): Použití EDTACALU Spofa v inhalační prevenci otrav olovem. (USE OF EDTACAL SPOFA BY INHALATION FOR THE PROPHYLAXIS OF LEAD POISONING.) *Pracovní Lékařství* 14:98-102 (Mar.), 1962.

Inhalation of  $\text{CaNa}_2\text{EDTA}$  by Pb-exposed workers has prevented Pb poisonings in industry where formerly Pb intoxications occurred quite frequently.

- 2369** Beard, R.R., and Finulli, M. (Univ. Milan, Italy): THE ACTION OF LEAD ON BLOOD: I. BASOPHILIC STIPPLED CELLS CONCENTRATED BY SEDIMENTATION. *Medicina del Lavoro* 53:773-8 (Dec.), 1962.

Stippled cells can be concentrated by sedimentation of blood in the cold for 2 hr or even more effectively by centrifugation at 3,000 r for 45 min. The excretion of coproporphyrin, the Pb content of the blood and the proportion of basophilic stippled cells in the peripheral blood before and after sedimentation was tabulated for 9 patients hospitalized for Pb colic, 6 patients with Pb anemia, 7 cases of chronic saturnism, 6 subjects exposed to Pb without symptoms of intoxication and 13 subjects without known exposure to Pb. Furthermore, blood counts were done on 8 guinea pigs, poisoned by daily administration by stomach tube of 50-60 mg Pb as Pb nitrate and on 1 guinea pig that had been splenectomized prior to Pb intoxication. Concentration of stippled cells may be a useful tool for detecting minor increases of basophilic stippling in situations where exposure to excessive Pb intake is suspected.

- 2370** Bell, R.F., and Gilliland, J.G. (Univ. of Colorado, Denver): URINARY LEAD-210 AS INDEX OF MINE RADON EXPOSURE. US Atomic Energy Commission TID-19436, 1962, 18 pp.

Inhalation exposure to Rn and its daughters resulted in a body retention of  $^{210}\text{Pb}$  which has a physical half-life of 22.2 yr. If a man with a normal body burden of 300-400 mg Pb approaches the recommended maximum permissible body burden of 4  $\mu\text{Ci } ^{210}\text{Pb}$ , this would represent only about 0.00001% of his body pool of Pb. Since calcium disodium ethylenediaminetetraacetate ( $\text{CaNa}_2\text{EDTA}$ ) enhances urinary Pb excretion, the authors believe that the provocative EDTA test presents a better index of the Pb burden of individuals than measuring the unenhanced urinary Pb excretion.

In order to define the body retention pattern of tracer amounts of  $^{210}\text{Pb}$  dogs were given intravenously a calibrated dose of  $^{210}\text{Pb}$  in the order of 1  $\mu\text{Ci}$ . After the excretion of  $^{210}\text{Pb}$  in urine and feces had been studied for a certain time, the provocative urinary test with  $\text{CaNa}_2\text{EDTA}$  was made. The results of these studies were tabulated. Subsequently, a study was begun of U miners with documented high, low, short-term and long-term exposure to Rn and Rn daughters. The few tests completed on the miners also indicated that the EDTA provocative urinary excretion gives a better index of the  $^{210}\text{Pb}$  body burden.

- 2371** Berenson, G.S., Akenhead, W.R., Crane, E.H., Jr.: CHRONIC INTOXICATION WITH AN UNUSUAL SOURCE OF LEAD: REPORT OF A CASE. *Southern Medical Journal* 55:246-8 (March), 1962.

A 38-yr-old woman, when seen by the authors, complained of pain in the abdomen, legs, back, and shoulders, occasional vomiting, and a chronic anemia. For the past 8 yr she had suffered attacks of abdominal pain lasting 5-8 days, and which recurred almost every 2-3 mo. Urinary excretion of Pb, coproporphyrin and urobilinogen was 299 mg/24 hr, 1.260 mg, and 0.342 mg/24 hr, respectively. The woman admitted that she had consumed large quantities of alcohol which she mixed with ice taken from an ice chest which contained a Pb plate. Analysis of the ice showed a Pb content of 5.1 mg/100 ml of water. Following the elimination of the Pb intake, the patient improved considerably.

- 2372** Beritić, T., and Sarić, M. (Inst. Med. Res. and Med., Zagreb, Yugoslavia): Patofiziologija i klinika saturnizma. (PATHOPHYSIOLOGY AND CLINICAL ASPECTS OF SATURNISM.) Arhiv za Higijenu Rada i Toksikologiju 13:45-67, 1962.

The authors review the pathologic physiology and clinical aspects of Pb poisoning on the basis of world literature, and describe the results of clinical and experimental studies performed in the Institute for Medical Research, which includes the Institute of Industrial Hygiene, in the field of occupational Pb poisoning in the past 10 yr. Special emphasis is given to clinical experience acquired through the study of hematologic tests for the diagnosis of Pb poisoning, examination of kidney function, laboratory experience on the determination of normal Pb values in blood, the evaluation and modification of methods for the determination of porphyrins in urine, and experimental experience relating to the effect of Pb on the neuromuscular system. (117 references)

- 2373** Borbély, F. (Inst. Forensic Med., Univ. Zürich, Switzerland): Ausserberufliche Bleigefährdung. Vier alimentäre und 48 iatrogene Bleiquellen. (NONOCCUPATIONAL LEAD HAZARD. FOUR ALIMENTARY AND 48 IATROGENIC LEAD SOURCES.) Internationales Archiv für Gewerbepathologie und Gewerbehygiene 19:329-39 (June), 1962.

The following 3 nonoccupational sources of Pb causing intoxication are described: (1) A Cu pan soldered with Pb contaminated the food cooked in it (1 case); (2) an apple cider keg was contaminated with a soluble Pb salt (3 cases); (3) glass pearls containing Pb, As, and Cd, were implanted in the submucosa of the nares for treatment of patients suffering from ozena (48 cases). Liver damage and digestive disturbances predominated in alimentary poisonings. One patient died of Pb encephalopathy following the parenteral intake of about 500 mg Pb, 150 mg As, and traces of Cd, and 15 showed characteristic clinical signs of Pb damage. Raised Pb blood levels were found in all men and Pb anemia in 1/2 of the cases. In the women, except for 1 case, elevated Pb levels in blood were accompanied by anemia. In the fatal case of encephalopathy, an ectodermal dysplasia of the anhydrous type was observed. The severity of the poisoning was probably conditioned by the absence of perspiration and the tendency to heat congestion. Detailed data for each case are tabu-

lated. The values for Pb in blood exhibited considerable variations in repeat analyses which could not be explained. As tabulated, they ranged from 7-464 µg/100 ml.

- 2374** Borra, J.L.R.: Intoxicaciones saturninas por vidriados plumbíferos. (LEAD POISONING CAUSED BY LEAD-CONTAINING EARTHENWARE.) Revista de Sanidad e Higiene Pública 36: 429-58 (Oct.-Nov.), 1962.

Various sources of nonoccupational Pb poisoning are reviewed. Among these, the more frequent causes in recent years include: improperly fired earthenware containing Pb silicate which may be dissolved in food by the action of salts, acids and fats; the use of Pb adulterants, principally in bread, to make it heavier; water contamination of Pb pipes; Pb contamination of wine and juices by Pb-containing presses, or of carbonated water by Pb-containing siphons. The toxic and lethal doses of Pb, the manifestations and diagnosis of chronic, acute and subacute poisoning are reviewed concisely.

The author then describes briefly the process and raw materials used in the manufacture of pottery, especially the Pb-containing glazes; the methods of determining Pb in air, urine, feces, water, wine; and extensively, the analysis of glazed earthenware and the Pb leaching into food. Such ware is commonly used in the villages for the storage and consumption of wine, and preparation of various foods, usually with vinegar. Several utensils, suspected of having caused poisoning in various villages, were analyzed as to the amount of Pb that would leach out of it into a mild acetic acid solution. Concentrations found ranged from 10.8-200 mg Pb and higher/l. It is estimated that the quantity of Pb ingested by the users was of the order of several grams which would be enough to cause death of entire families. Caution is expressed against the use of poorly fired earthenware. The regulations on the use of Pb-containing utensils for food as adopted in various countries are cited. No regulation applying specifically to food exists in Spain. The author recommends supervision of pottery manufactures and boiling of vessels in vinegar until the soluble Pb compounds have been dissolved. Measures of health supervision of people working with Pb compounds are proposed.

- 2375** Boyadzhiev, V., Stoev, V. and Petkov, G. (Med. Inst., Sofia, Bulgaria): Diagnostichno znachenie na nyakoi pokazateli za promenite vuv visshata nervna deinstvo pri olovnoto otravyane. (THE DIAGNOSTIC IMPORTANCE OF THE HIGHER NERVOUS SYSTEM IN CASE OF LEAD INTOXICATIONS.) Nauchni Trudove na Visshiya Meditsinski Institut Sofiya 41, No.5:99-113, 1962.

Changes of the latent period and velocity of locomotor reactions following light and sound stimuli as criteria of early functional changes of the cerebral cortex in Pb intoxications are discussed. The locomotor reflexes were checked by a chromoreflexograph in a group of 136 workers of a battery plant of whom 65 showed symptoms of mild to moderately severe Pb poisoning; 71 workers were not affected. The results of the study showed that the latent period of the locomotor reactions was length-

ened in all men who showed symptoms of Pb poisoning. There was a correlation with the age of the worker and the length of exposure. It is pointed out that the locomotor reactions should be evaluated as early criteria together with the classic signs of Pb poisoning.

- 2376** Boyett, J.D., and Butterworth, C.E. (Med. Coll. Alabama, Birmingham): LEAD POISONING AND HEMOGLOBIN SYNTHESIS. REPORT OF A STUDY OF FIFTEEN PATIENTS WITH CHRONIC LEAD INTOXICATION. *American Journal of Medicine* 32:884-90 (May), 1962.

Fifteen patients with chronic Pb poisoning, which in all but one had developed as a result of the ingestion of moonshine whiskey containing Pb, were studied. Urinary excretion of Pb in all but 1 ranged from 0.10-0.86 mg/l, mean hematocrit was 33%; the number of stippled erythrocytes was increased in all but 1 patient while the reticulocyte count was elevated in only 2 subjects. Serum Fe was within normal limits. Tests made on 5 patients showed normal excretion of porphobilinogen but significantly increased excretion of ALA acid and of copro- and uroporphyrin. The rate of disappearance of  $^{59}\text{Fe}$  was essentially normal. The data obtained suggested that Pb affects the synthesis of porphobilinogen from ALA acid and the formation of heme from protoporphyrin and Fe.

- 2377** Brener, K.M.H. (Med. Inst. Kazakhstan, Alma Ata, USSR): Zustand des Magen-Darm-Kanals bei chronischem Saturnismus. (STATUS OF THE GASTROINTESTINAL TRACT IN CHRONIC LEAD POISONINGS.) *Radiologia Diagnostica* (Berlin) 3:353-7, 1962.

The intestinal tract was studied by X rays in chronic Pb poisoning in patients with slight, moderate or severe colics. In cases with slight colics a hypermotor hypertonic dyskinesia was prevalent whereas cases with moderate and particularly with severe Pb colics were characterized by strong atonia and akinesia. These findings point out that Pb colics should not always be treated with antispasmodic drugs but that the treatment should be based on the roentgenologically ascertained kind of dyskinesia.

- 2378** Brigatti, L., Parigi, A., and Varetto, L. (Div. Med. Inst. Cardiologia, Torino, Italy): Il comportamento delle transaminasi in soggetti esposti al rischio saturnino. (BEHAVIOR OF TRANSAMINASES IN SUBJECTS EXPOSED TO THE RISK OF LEAD INTOXICATION.) *Minerva Medica* 53:1225-6 (Apr. 21), 1962.

Serum glutamic oxalopyruvic transaminase (SGOT) and serum glutamic pyruvic transaminase (SGPT) were determined in 98 subjects, av 30-35 yr old, employed as Pb-filers for an av of 6-18 mo. Values of 40 units SGOT and of 30 units SGPT were considered normal. Both transaminases were measured once in 45 subjects; twice, at 3-6 mo, in 45; 3 times in 7; and 4 times in 1 subject. Elevated values of SGOT and SGPT were found in 5, 17, 5, and 1 cases, respectively. On the whole, 25% of all the determinations showed abnormal values ranging from an av of 40-60 units for SGOT and slightly less for SGPT, with 28% of the cases showing ab-

normal values in 1 determination. Since no significant correlation was found between levels of serum transaminases and age, time of exposure, level of coproporphyrin, and clinical observations, and because of the possible intervention of hemolytic saturnine anemia in testing levels of transaminases, it is concluded that at the present time levels of serum transaminase do not constitute a constant index for detection of Pb absorption, which can be recommended for practical use.

- 2379** Buckup, H., and Mappes, R. (Inst. Forens. Med., Bochum, Westfalen, Germany): Vergleichende Untersuchungen über die Ausscheidung von  $\delta$ -Aminolävulinäure und andere Zeichen erhöhter Bleiaufnahme. (COMPARATIVE TESTS CONCERNING THE EXCRETION OF  $\delta$ -AMINOLEVULINIC ACID AND OTHER SYMPTOMS OF INCREASED LEAD ABSORPTION.) *Zentralblatt für Arbeitsmedizin und Arbeitsschutz* 12:293-5 (Dec.), 1962.

$\delta$ -Aminolevulinic acid (ALA) and coproporphyrin (CP) and results of the analysis of 125 urine samples from 100 Pb-exposed subjects are tabulated. The data obtained showed that the determination of ALA and CP is hardly more conclusive than the determination of solely CP, in connection with a count of stippled erythrocytes. The extra time required for the determination of ALA is justified only in cases of differential diagnosis of undetermined diseases.

- 2380** Bustelo, J.: Saturnismo latente entre los soldadores de material de hierro galvanizado. (LATENT LEAD POISONING AMONG WELDERS OF GALVANIZED IRON MATERIAL.) *Med. y Seguridad del Trabajo* (Madrid) 10:60-3 (Jan.-Mar.), 1962.

Investigations were conducted on Pb intoxication among workers engaged in welding galvanized Fe or cutting it with an oxygen blowpipe. The high temperatures used volatilize the Pb (contained as an impurity up to 1.6%) and Zn fumes. Symptoms may therefore be due to either Zn or Pb poisoning, or both. The metals are absorbed by inhalation or ingestion, the former being the more dangerous route. The amounts of Pb in galvanized pipes and sheets were about 0.7 and 0.5%, respectively. The amount of Pb volatilized into the atmosphere from welding 1 m of galvanized Fe is 88 mg from pipes and 63 mg from sheets so that the Pb concentration in the air in a room of 16 m<sup>3</sup> with poor ventilation will be about 5.5 mg/m<sup>3</sup>, while the accepted standard is 0.15 mg. Dust on walls and clothing gave a Pb content of 0.38%. Pb was found in the urine of 75% of the workers who showed symptoms of intoxication. The following preventive measures are recommended: periodic urine analyses; use of materials containing small amount of Pb; better ventilation conditions; and the use of individual protective equipment. (From *Bulletin of Hygiene* 37: 1026-7, 1962).

- 2381** Catala Diez, J. (Manises (Valencia), Spain): Contribución al estudio y tratamiento de la intoxicación profesional por el plomo. (CONTRIBUTION TO THE STUDY AND TREATMENT OF OCCUPATIONAL LEAD POISONING.) *Medicina Española* 48:316-27 (Oct.), 1962.

A general discussion on occupational Pb poisoning is presented. The following aspects are considered: occupations or industries with risk of exposure; route of absorption; metabolism and action of Pb in the organism; diagnostic tests; general signs and symptoms of intoxication; treatment.

- 2382** Chiesura, P., and Brugnone, F. (Univ. Padua, Italy): Eliminazione urinaria di acido delta-aminolevulinico e di porfobilinogeno nel saturnismo professionale. (URINARY ELIMINATION OF DELTA-AMINOLEVULINIC ACID AND PORPHOBILINOGEN IN PROFESSIONAL LEAD POISONING.) Lavoro Umano 14, No. 11:507-17, 1962.

Average data (mg/day) for urinary excretion of ALA were determined in a group of 85 patients as follows: 7 cases of Pb poisoning with abdominal colic, 82.18; 6 cases of Pb poisoning without colic, 29.55; 20 workers of a storage battery plant with significant exposure to Pb but without signs of intoxication, 29.04; 13 workers not exposed to Pb but with previous Pb intoxication, 8.09; 10 subjects with no industrial Pb exposure, 2.10. A significant statistical correlation of ALA with coproporphyrin and with Pb content was noted. Porphobilinogen excretion was noticeably increased (av 5.92 mg/day). A prompt marked decrease of urinary ALA occurred with CaEDTA treatment in 13 cases.

- 2383** Cirksema, W.J., Deller, J.J., and Marcarelli, J.L. (Walter Reed Gen. Hosp., Washington, D.C.): ADULT CHRONIC LEAD INTOXICATION. REPORT OF AN UNUSUAL SOURCE. Archives of Environmental Health 4:183-9 (Feb.), 1962.

A case of nonoccupational chronic Pb intoxication, involving encephalopathy in an adult Negro male is reported. Confirmation of diagnosis was by elevated urinary coproporphyrin excretion (1483 µg/24 hr), urinary Pb (50 µg/100 ml), blood Pb (150 µg/100 ml) basophilic stippling. Analyses by polarography revealed in addition to Pb, high urinary Zn level (>1000 µg/100 ml). There was also hypochromic, microcytic anemia. Treatment with CaNa<sub>2</sub>EDTA brought recovery. Upon examination 1 mo after discharge, blood Pb was 1 µg and coproporphyrin 800 µg/100 ml.

History revealed pica (paper matches) in childhood and stammering which had increased with the years. His wife did not speak English, but it was established that he consumed excessive quantities of alcohol. His associates stated that he had recently exhibited increasing confusion and gross tremor of 1 mo duration. The source of intoxication was presumed to be due to the chronic use of Pb-containing locally produced untaxed whiskey. The author discusses the difficulty of diagnosis in such cases and emphasizes that this particular source of Pb be considered in the diagnosis of Pb intoxication with encephalopathy. (43 references.)

- 2384** Courville, C.B., Nusbaum, R.E., and Butt, E.M. (Cajol Lab. Neuropathol., Los Angeles Co. Hosp., Univ. California, Los Angeles): TRACE METALS AND THE BRAIN: THEIR CONTRIBUTION TO THE STUDY OF CERTAIN NEUROLOGICAL DISORDERS. Bulletin of the Los Angeles

Neurological Society 27:99-103 (Sept.), 1962.

The authors had found no correlation between cortical areas of known function and the amounts of trace metals in the tissue. Rather in the case of some metals, ie, Cu, Fe, Pb, the amounts are allied to the composition of the tissue (grey vs white matter).

To determine a base line for trace metal content (Pb, Fe, Mn, Cu, Zn, Mo, Co, Ag, Cr, Cd, Ba, and Sr) in basal ganglia, cortical areas and their afferent and efferent nerve fibers, blocks of brain were selected from adults 25-50 yr of age who did not show any gross structural changes. Some of the blocks taken from the 18 specimens showed little quantitative difference; therefore blocks were taken from 10 cases of severe burn deaths.

All evaluations were done by emission spectrochemical method. The demonstration of some toxic elements, ie, Pb and As in the brains of some individuals suggested possible ingestion of these metals rather than truly "normal" amounts of these substances in the brains. Earlier studies (Butler, 1952) reported up to 0.11 mg Pb/100 g fresh brain tissue and in cases of encephalopathy up to 1.4 mg/100 g (Kato, 1932). In 1 of the authors' cases of chronic Pb poisoning, 1.35 mg/100 g of dry tissue was found, and a "normal" of 0.31 ± 0.04 mg (unpublished). Of special interest to them was the variation in Pb content from one part of the brain to the other and the different concentrations in the symmetrical areas of the 2 hemispheres. The authors wonder whether some areas of the cortex have greater affinity for trace metals than others. This has been impossible to demonstrate, although the concentration of toxic metals in the brain tissues do appear to be increased in cases of poisoning.

- 2385** Craveri, A., Corsico, R., and Pozzi, U. (Univ. Pavia, Italy): (ACTION OF INOSINE ON THE ELIMINATION OF COPROPORPHYRINS AND δ-AMINOLEVULINIC ACID AND BEHAVIOR OF ERYTHROCYTIC PROTOPORPHYRIN IX.) Folia Med. (Naples) 45:1395-1404 (Dec.), 1962.

Treatment with inosine of patients with Pb poisoning did not result in any significant protective action or change in elimination of free erythrocyte protoporphyrin IX and δ-aminolevulinic acid. Within 4-6 days after treatment began, a significant increase in the elimination of coproporphyrins was frequently noted. (From Chemical Abstracts No. 59:10585, 1963)

- 2386** Danieli, G., Sangiorgi, F., and Masetti, G.P. (Univ. Bologna, Italy): Valutazione quantitativa dell'acido delta-aminolevulinico nel plasma e nelle urine nel corso di alcune eritropatie primitive e secondarie. (QUANTITATIVE DETERMINATION OF δ-AMINOLEVULINIC ACID IN THE PLASMA AND URINE IN THE COURSE OF SOME PRIMARY AND SECONDARY ERYTHROPATHIES.) Folia Medica (Naples) 45:853-65 (Oct.), 1962.

Studies were carried out on 142 patients, 28 of whom were suffering from Pb poisoning. All Pb patients showed an increase of ALA (33-152 µg%, controls 24 ± 4.6 µg%). In 26, urinary ALA ex-



cretion was increased (1.1-58 mg/24 hr, controls  $1.43 \pm 0.51$  mg/24 hr), and in 7, urinary excretion of porphobilinogen was increased (3.62-8.29 mg/24 hr, controls  $1.39 \pm 0.74$  mg/24 hr). Increased levels of ALA were observed also in cases of liver cirrhosis, uremia and hypochromic sideropenic anemia. (21 references)

- 2387** Dauphin, G., Perrin, P., Cordier, and Cazan (France): Un cas original de saturnisme d'origine alimentaire. (AN UNUSUAL CASE OF LEAD POISONING OF ALIMENTARY ORIGIN.) *Annales de Médecine Légale* 42:509-10, 1962.

A 38-yr-old man, with previous history of Pb poisoning which had been treated successfully for 2 mo with EDTA, was admitted to the hospital with abdominal colic. Clinical tests showed a subicteric state of the conjunctiva, a clear Burton line and a Pb concentration in the urine and blood of 350 and 2050  $\mu\text{g/l}$ , respectively. After the 1st treatment with EDTA administered intravenously as a dose of 1 g/day for 5 days, he showed a positive reaction for coproporphyrin and the urinary Pb level increased to 7400  $\mu\text{g/l}$ , and 3800 after the 3rd treatment. Occupational exposure to Pb could be excluded. However, the man was an avid wine drinker and it developed that the container in which he carried the wine had been painted with minium, leading to a Pb content in the wine of 2800  $\mu\text{g/l}$ .

- 2388** De Bruin, J.: (THE RELATIVE VALUE OF URINARY LEAD DETERMINATION FOR THE DIAGNOSIS OF LEAD POISONING.) *Ned. Tijdschr. Geneesk.* 106:2545-6, 1962.

Urinary Pb values in 36 patients ranged from 50-1560  $\mu\text{g/l}$ . Following administration of 2.65 g EDTA, urinary Pb values ranged from 1.3-32 mg. No correlation was found between these two sets of values, the latter only gives a clearer picture of the amount of circulating Pb ions in the blood. The diagnosis should be completed with blood counts and determination of coproporphyrin in urine. (From Chemical Abstracts 58:6121, 1963)

- 2389** DeTreville, R.T.P., Wheeler, H.W., and Sterling, T. (Ethyl Corp.; Univ. Cincinnati, O.): OCCUPATIONAL EXPOSURE TO ORGANIC LEAD COMPOUNDS. THE RELATIVE DEGREE OF HAZARD IN OCCUPATIONAL EXPOSURE TO AIR-BORNE TETRAETHYLLEAD AND TETRAMETHYLLEAD. *Archives of Environmental Health* 5:532-6 (Dec.), 1962.

Concentrations of Pb in the atmosphere of the work area and in the urine of 21 workers who had been employed for 2 yr in the manufacture of TEL, were compared with corresponding results obtained from the same workers while they were employed for 12-18 mo in the manufacture of TML. Average concentrations of Pb during exposure to TEL and TML, respectively, were as follows: atmosphere of work area, 0.0015, 0.043 mg/ft<sup>3</sup>; urine, 0.09, 0.10 mg/l. Concentrations of Pb in the blood and urine of 50 workers engaged in the manufacture of TEL were compared with results obtained from 50 workers engaged in the manufacture of TML. Average concentrations of Pb in the TEL- and TML-groups were respectively: urine, 0.09, 0.10 mg/l; blood, 0.041,

0.045 mg/100 g. Data on blood pressure, blood elements and specific gravity of the urine for TEL- and TML-workers are also tabulated.

It is concluded that the actual hazard from the occupational absorption of TML from the air is no greater, and may actually be less, than that which is associated with similar periods of exposure to corresponding concentrations of TEL.

- 2390** DiVito, G. (Univ. Pavia, Italy): Metodi per il dépistage del saturnismo nei lavoratori esposti al rischio specifico. (METHODS FOR THE DETECTION OF WORKERS EXPOSED TO THE RISK OF LEAD POISONING.) *Lav. Umano* 14, No. 7:334-41, 1962.

Diagnostic tests for the detection of Pb poisoning are reviewed. The most important tests are the red blood cell count with basophilic stippling and urinary coproporphyrin determination. Techniques used for these 2 examinations and for the determination of ALA are described. (From *Excerpta Medica*, Sect. 17, 9:Abstr. No. 1493, 1963)

- 2391** Duchesnay, G. (France): Intoxications saturnines chroniques. (CHRONIC LEAD INTOXICATION.) *Cahiers R.M.F.* 76:391-2 (May), 1962.

The various causes and manifestations of chronic Pb intoxication, the metabolism of Pb, and the various laboratory procedures for the diagnosis of Pb poisoning are described for the practicing physician. The most valuable diagnostic tool is the blood test for anemia and stippled erythrocytes (SE). Anemia is moderate ( $\sim 3.5$  million red cells) and hypochromic. Three methods for the counting of SE are used: (1) Number/million red cells (according to Duvoir, the normal limit is 10/100,000 red cells); (2) number/microscopic field (less precise), normal limit: 1-5/10 fields; and (3) number/100 leukocytes (method of Feil, officially used in France since 1948), normal limit: 10/100. However, stippled cells are not specific for Pb intoxication as they also occur in other conditions.

In normal individuals, blood levels are not confined to low values (30-50  $\mu\text{g/ml}$ ). Urinary levels can attain values of 60  $\mu\text{g/l}$  under the influence of chelating agents, indicating pathologic Pb exposure. Blood Pb levels can be elevated without pathologic signs or, vice versa, can be normal in the presence of pathologic change. Urinary coproporphyrin levels  $>1000$   $\mu\text{g}$  augur in favor of Pb poisoning;  $<700$   $\mu\text{g}$ , the possibility of infectious jaundice, alcoholic cirrhosis, a malignant blood disorder or intoxication by other substances (sulfonamides, barbiturates, aniline, etc) must be considered.

Blood urea levels permit the assessment of renal injury. The reevaluation of laboratory tests and, in cases of doubt, tests to exclude extrarenal causes, and the importance of azotemia in the determination of the role of Pb intoxication in renal damage are described. Clinical signs of Pb intoxication such as Burton's line, neurologic signs, diminished tendon and optic nerve reflexes and hypertension, and the usual complaints of Pb poisoning including the abdominal syndrome, constipation, asthenia, dyspepsia, pallor, etc, and therapy by chelation with EDTA and 2 EDTA derivatives are discussed.

- 2392** Dumont, G., and Dérobert, L.: Sur un cas de saturnisme alimentaire. (LEAD POISONING OF ALIMENTARY ORIGIN.) Ann. Med. Leg. 42, No. 1:79-82, 1962.

A case of Pb intoxication due to a bottle pourer is reported. Basophilic stippling was especially high. (From Excerpta Medica, Sect. 17, 8:Abstr. No. 2732, 1962)

- 2393** Dynnik, V.I.: KIDNEY FUNCTION IN CHRONIC LEAD POISONING. Nauchnye Trudy, Ukrainskiy Nauchno-Issledovatel'skiy Institut Gigieny Truda i Profzabolevanii 29:56-62, 1962.

The kidney function was studied in 94 patients with chronic Pb poisoning. Albumin, casts, erythrocytes and kidney epithelium were found in the urine; frequently, polyuria, nycturia and reduction of the coefficient of clearance were observed. The renal disturbances increased with the degree of poisoning. Determination of the urea coefficient, Anbar constants and renal plasma flow allows evaluation of the degree of the kidney changes and can be used in the diagnosis of Pb poisoning. (From Referativnyi Zhurnal, Khimiya 1963: Abstract No. 161284; Chemical Abstracts 61:8810, 1964)

- 2394** Fatzer, R. (Wädenswil, Switzerland): Chronische Bleivergiftung und Arteriosklerose. (CHRONIC LEAD INTOXICATION AND ARTERIOSCLEROSIS.) Vierteljahrsschrift für Schweizerische Sanitäts-offiziere 39: 119-26 (Nov.), 1962.

Based on a review of earlier literature the author concludes that arteriosclerosis in cases of Pb intoxication is caused by (1) spastic hypertonia, (2) thickening of the vascular walls due to Pb deposits and (3) unknown factors caused by the effect of Pb on the metabolism. (72 references)

- 2395** Forssman, S.: État actuel de la silicose et du saturnisme. (THE PRESENT STATUS OF SILICOSIS AND LEAD POISONING.) Paper presented at the 3rd International Congress of Prevention of Occupational Hazards, Paris, 1961. Concours Médical 84:1783-9, 1962.

A review on the diagnosis and treatment of Pb poisoning using EDTA and DTPA and BAL is presented.

- 2396** Fritze, E., and Di Blasi, W. (Med. Clinic, Bochum, Germany): Herzaneurysma nach Bleivergiftung. (HEART ANEURYSM AFTER LEAD INTOXICATION.) Internationales Archiv für Gewerbepathologie und Gewerbehygiene 19:340-52 (June), 1962.

The case of a female physician which by Haubrich in 1947 and Carstens in 1949 had been certified as a heart aneurysm following an acute Pb intoxication and as such was recognized by the insurance, is critically reviewed. Pb intoxication was caused by eating applesauce which had been cooked in a pan previously used for pouring Pb on New Year's Eve according to custom. The 24-yr-old woman developed colics and diarrhea which disappeared within 10 days, and complained of cardiac discomfort following physical stress. An X-ray picture taken 2 yr later was interpreted as showing heart aneurysm although the electrocardiogram was normal. An operation, performed 15 yr after the alleged Pb

intoxication had taken place, revealed a tumor between heart and thoracic wall which was diagnosed as a thymoma. The patient died at the age of 42 due to metastasis and heart failure. The autopsy findings are described in detail; no heart aneurysm and no indications of Pb poisoning were found. The authors point out that whether or not an acute Pb intoxication had existed could not be decided. (12 references.)

- 2397** Gaon, J., Griggs, R.C., Vasiljević, M., and Alibegović, S.: (INVESTIGATION OF CHRONIC ENDEMIC NEPHROPATHY IN YUGOSLAVIA. I. LEAD AS POSSIBLE ETIOLOGIC AGENT. Acta Med. Yugoslavia 16, No. 3-4:346-53, 1962.

Studies on 31 patients with kidney disease and 11 controls, after administration of EDTA, were described. The Pb level in blood and urine was normal before and after EDTA and there was no significant difference in Pb excretion between the 2 groups. The studies provided no evidence that Pb acted as an etiologic agent. (From Bulletin of Hygiene 38:1286, 1963)

- 2398** Gel'fon, I.A. (USSR): COMPARATIVE CHARACTERISTICS OF PROTEIN FRACTIONS IN BLOOD SERUM IN CERTAIN INDUSTRIAL INTOXICATIONS. Promyshlennaya Toksikologiya i Klinika Profzabolevanii. Zabolevanii Khimicheskoi Etiologii (Moscow: Gos. Izd. Med. Lit.) Sb. 1962:237-8.

The protein fractions in blood serum were studied in 92 workers exposed to Pb. In cases of pronounced Pb poisoning the total proteins and  $\gamma$ -globulins were decreased. (From Referativnyi Zhurnal, Khimiya 1964: Abstract No. 61254; Chemical Abstracts 61: 11234, 1964)

- 2399** Gemke, G.R. (East-Kazakhstan Regional Dept. Health, USSR): K voprosu o narusheniyakh funktsional'nogo sostoyaniya limfaticheskikh sosudov pri svintsovoi intoksikatsii. (DISORDERS OF THE FUNCTIONAL STATE OF LYMPHATIC VESSELS WITH LEAD INTOXICATION.) Trudy Instituta Kraevoi Patologii, Akademiya Nauk Kazakhskoi SSR 10: 132-43, 1962.

As determined on 104 patients with various degrees of Pb poisoning, considerable disturbance of the functional condition of lymphatic vessels was demonstrable in the lymphangiogram. In all forms of poisoning, as compared with controls, an increase of functioning vessels was observed, as manifested in the increase of the central plateau of the lymphangiogram. The latter are shown for 4 cases with legends briefly stating clinical findings and tables comparing arterial pressure, pulse rate, nemoglobin, stippled cells and dimensions of the plateau.

- 2400** Gemke, G.R. (Inst. Regional Pathol., Acad. Sci. Kazakh SSR): O narusheniyakh simmetrii arterial'nogo davleniya u lits, kontaktiruyushchikh so svintsom. (CHANGES IN THE SYMMETRY OF ARTERIAL PRESSURE IN INDIVIDUALS EXPOSED TO LEAD.) Trudy Instituta Kraevoi Patologii, Akademiya Nauk Kazakhskoi SSR 10:144-52, 1962.

In 1959, 518 Pb workers exposed to Pb were seen

in the author's Institute, 451 of them <40 yr, and of the remaining 19 >50 yr. They had been in contact with Pb up to >5 yr; 292 were essentially healthy, 93 exhibited somatic illness, 36 showed excessive absorption, 55 had mild intoxication, and 40, one of moderate degree. By applying Umask's test, a pronounced disturbance of the symmetry of arterial pressure in brachial and temporal blood vessels was observed, which pointed to dystonia of arterial pressure.

- 2401** Gervais, M.J. (Viviez, France): La prévention médicale du saturnisme dans une usine de zinc électrolytique. (THE MEDICAL PREVENTION OF LEAD POISONING IN AN ELECTROLYTIC ZINC FACTORY.) Montpellier Medical 61:12-27 (Jan.), 1962.

The author describes his experience in the surveillance of workers of a Zn extraction plant at Viviez. This is the only plant in France in which Zn is extracted electrolytically, employing 1000 workers, and which processes 40% of the total Zn produced in France. The sources of hazards of Pb intoxication in this process are caused by the presence of 2-3% Pb in the ore as impurity, and by the reaction of sulfuric acid on the Pb-containing mineral in the industrial process.

In discussing the medical program, first outlined are the various factors (advanced age, alcoholism, poor hygiene, systemic and particularly renal deficiencies) that may influence the individual susceptibility of the worker to Pb poisoning. According to French regulations, in jobs involving Pb risk, no men should be hired who are predisposed to Pb poisoning due to renal and liver diseases, arterial hypertension, and disorders of the blood and central or peripheral nervous system. Complete pre-employment examinations (including X-rays) are done at Viviez. In the periodic examinations, the frequency of which, as prescribed by law, the author considers to be the minimum, the surveillance of the renal condition is given particular attention. As a result of these examinations, workers are placed in 3 categories: those to be removed from exposure, those to be watched, normal subjects. The principal signs and symptoms of Pb poisoning as reported in the literature, are discussed in detail.

In agreement with other authors, the Pb line is absent in frank Pb intoxication, while it seems sometimes to be present in cases without any pathologic signs. The author has seen it rarely, probably because of better preventive measures and better oral hygiene among workers. He has never seen Gubler's tumor and parotid hypertrophy. Concerning the neurologic signs, the ones to be given particular attention are latent pareses of fingers, especially of extensors, and muscular cramps and myalgias which occur frequently in Pb-exposed workers and are often improperly designated as rheumatism. True Pb colic is encountered more rarely now than earlier reported; in the past 2 yr the author has seen no typical case of it, although some of the newer workers exhibited transient attacks. Caution is expressed concerning the diagnosis of anemia by stating that this can be done only on a basis of knowledge of pre-exposure values rather than by accepting an absolute number of red cells and hemoglobin values. The presence of baso-

philic stippling of erythrocytes is considered as the most important indication of Pb intoxication in spite of the limitations of this test.

The leukocytic formula is not considered to be of much value as a test. The author considers the urinary coproporphyrin test to be one easily made on large numbers of workers, and does it routinely on all workers. Because of the variations encountered in blood-Pb levels in relation to current occupational exposure to Pb, and difficulty in analysis, this test is believed to be of little practical interest in industry except from the point of view of etiology of the disease and in medicolegal cases. Urinary Pb determination is of still less practical interest because it is influenced by the condition of the kidney, by the diet, and because Pb fixed in tissues is eliminated only periodically. For these reasons and because of difficulties in analysis, it is not done at Viviez, although interest in the EDTA-challenge test is expressed. In spite of its limitations, the blood-urea test is considered to give indication of low tolerance to Pb; also that the worker is to be watched and possibly removed from exposure.

Following a review of the literature of the use of EDTA in the treatment of Pb poisoning from which the author concluded that it is most effective "and entirely devoid of toxicity," he has used this drug in the plants of Viviez since 1958 on 20 workers at doses of 4-6 tablets of 0.25 g daily, either 5 days per week or continuously for 20-30 days. At the beginning and end of each treatment a differential blood count, blood urea and albuminuria tests were done. Urinary coproporphyrin was determined to follow the course of treatment.

- 2402** Ghislandi, E., and Foà, V. (Univ. Milan, Italy): Su tre casi di intossicazione subacuta da piombo-tetraetile. (THREE CASES OF SUBACUTE TETRAETHYL LEAD INTOXICATION.) Medicina del Lavoro 53:547-57 (Aug.-Sept.), 1962.

Three cases of TEL intoxication in workers 21-40 yr old, employed in the industrial manufacture of TEL were discussed. The symptoms and the course of the intoxication were typical of TEL intoxication. Two of the cases did not show evidence of altered hepatic function; the 3rd case suffered from enlarged liver possibly attributable to alcoholism or other factors. Pb concentrations in the blood and urine were, respectively: 178, 110, 145 µg%; 330 and 445 on 2 successive days in one case, and in the others, 305, and 140 µg/24 hr. Coproporphyrinuria was determined only after EDTA, the values were: 150, 98, and 54 µg/24 hr.

Although the use of EDTA as a diagnostic test for abnormal Pb absorption is valuable, its effectiveness in treatment of TEL intoxication is questioned. (26 references)

- 2403** Gorbunova, N.V., and Atchabarov, B.A. (Acad. Sci. Kazakh SSR): Izmeneniya v gortani pri intoksikatsii svintsom. (LARYNGEAL CHANGES IN LEAD POISONING.) Trudy Instituta Kraevoi Patologii, Akademiyi Nauk Kazakhskoi SSR 10:167-79, 1962.

The authors examined 551 workers (most of them 20-40-yr-old males) of smelting, agglomeration and

refining installations of whom 43 suffered with chronic Pb poisoning and had been observed for 1-4 yr. The duration of exposure for all was 3 mo-20 yr and more. In addition, 85 workers not exposed to Pb were included in the study. Of the exposed group, 129 were essentially well; 148 were practically healthy but showed early signs of Pb poisoning; 247 with Pb poisoning which was mild in 134, moderate in 117 and severe in 23. The USSR Ministry of Health criteria for diagnosis of Pb poisoning were followed. Of the above patients, 114 (20.58%) showed laryngitis, 222 (40.5%) exhibited disorders of the motility of the larynx and 4 showed other disorders, 2 of them with laryngeal neoplasm. Healthy larynx was found in 208 (37.77%). Only 43 presented complaints of hoarseness, etc. The studies extended over the relationship of laryngitis to length of service and age, and disorders of laryngeal motility were separately considered in the entire working population, with the finding of such disorder in 57.35% (316 workers). The pathogenesis of the condition is attributed in part to "local" processes as a result of direct action of hazardous working conditions on the mucosa, and in part to the changes taking place in the body; specifically, the disorders produced in the motive function of the muscles controlling the larynx, as well as the effects on the central nervous system (paralysis of the laryngeal muscles).

- 2404** Gutniak, O., and Krawczyk, I. (Inst. Badań Jadrowych, Warsaw, Poland): Oznaczenie kwasu  $\delta$ -aminolewulinowego i porfobilinogenu w moczu. (DETERMINATION OF  $\delta$ -AMINOLEVULINIC ACID AND PORPHOBILINOGEN IN URINE.) *Polskie Archiwum Medycyny Wewnętrznej* 32, No. 12:1517-23, 1962.

A modification of the method by Mauzerall and Granick (1956), as developed by the authors, is described in some detail. In normal subjects and patients with porphyria cutanea tarda, porphobilinogen averaged 0.12 and 0.20 mg%, respectively, and  $\delta$ -aminolevulinic acid 0.33 and 0.34 mg%, respectively. The corresponding values in patients with lead poisoning were 0.20 mg% and a range of 0.53-4.50 mg%.

- 2405** Haeger-Aronsen, B. (Malmö Gen. Hosp., Univ. Lund, Sweden): FECAL PORPHYRINS IN PORPHYRIA ACUTA INTERMITTENS, PORPHYRIA, CUTANEA TARDA, AND INTOXICATIO PLUMBI. *Scandinavian Clinical and Laboratory Investigation* 14:397-402, 1962.

Coproporphyrin (CP) and protoporphyrin (PP) in the feces were determined quantitatively in 26 patients with porphyria acuta intermittens (PAI), 26 patients with porphyria cutanea tarda (PCT) and 32 workers in the Pb industry. Of the patients with PCT, all showed an increased excretion of CP, and 60% also showed an increase of PP excretion. The excretion of CP was higher than among the PAI patients and the ratio PP/CP was  $\approx$  1. Fecal excretion of porphyrins in the Pb workers was largely normal. The difference in the excretion patterns in the 3 groups were discussed. (25 references)

- 2406** Hartogensis, F., and Zielhuis, R.L. (Res.

Inst. Publ. Health Eng., The Hague; Netherlands Inst. Prev. Med., Leiden): HEALTH STANDARDS FOR LEAD CHROMATE DUST. *Annals of Occupational Hygiene* 5:27-36 (Jan.-Mar.), 1962.

The degree of exposure to Pb chromate dust and its effect on the organism was studied in 26 male workers from 2 of the 3 pigment factories investigated, who were not clinically ill and who had been almost exclusively exposed to chrome yellow. There was no clear correlation between Pb and Cr concentrations, but in the 2 where the above men were employed the ratio Pb/Cr was 6.2 and 5.5, respectively. Seven workers were exposed to  $<0.1$  mg Pb/m<sup>3</sup> (Group A), 5 to 0.1-0.2 (Group B), and 14 to  $>0.2$  (Group C). No correlation existed between symptoms or signs (exclusive of Pb line) and the degree of exposure, nor could a correlation be established between the medical data and the duration of the exposure. In contrast, laboratory data on hemoglobin (Hb), basophilia and coproporphyrin correlated significantly with the degree of absorption, determined at the same time period. In Group A and B, coproporphyrin levels deviated from the normal, and in Group C the trend was even more pronounced. Hb was clearly subnormal in Group C. Taking the Hb decrease as a criterion for establishing MAC values for Pb compounds, it is concluded that the MAC for Pb chromate should be 0.1-0.2 mg Pb/m<sup>3</sup>. The fact that the same MAC has been established for other Pb pigments, strongly suggests a similar toxicity of all Pb pigment dusts, soluble and "insoluble." (18 references)

- 2407** Hausmanowa-Petrusewicz, I., Emeryk, B., Sobkowicz, H., Wasowicz, B., and Tur, J.: Badania elektromiograficzne w otowicy. (ELECTROMYOGRAPHIC EXAMINATIONS IN LEAD POISONING.) *Polski Tygodnik Lekarski* 17: 1405-8 (Sept. 3), 1962.

Results are given of medical and neurological examinations of 43 patients suffering from Pb poisoning after exposure to Pb for 3 mo-35 yr. Muscular and neurologic disorders and in some cases peripheral neural damage were observed, but no toxic polyneuritis was found. The electromyograms revealed pathologic signs in only 15 patients. It was concluded that a relationship exists between the electromyograms (EMG) and the serum Pb concentration or the length of exposure to Pb. The EMG may be valuable for early diagnosis of peripheral nervous damage. (From Occupational Safety and Health Abstracts 1:470, 1963)

- 2408** Heilmeyer, L., and Clotten, R. (Univ. Freiburg/Br., Germany): PORPHYRIN METABOLISM IN ANEMIA. *Panminerva Med.* 4, No. 1: 350-2, 1962.

See Abstract No. 2266.

- 2409** Holmqvist, I. (Rönnskär Works, Bolidens Co., Skelleftehamn, Sweden): Laboratorieundersökningar vid periodisk besiktning av blyarbetare. (LABORATORY RESEARCH IN PERIODIC EXAMINATION OF LEAD WORKERS.) *Nordisk Medicin* 67:46-51 (Jan. 11), 1962.

The author reports on his experience of medical surveillance of workers of a Pb smelter. He examines critically the value of determining stip-

pled cells and of coproporphyrin in urine. In connection with routine determination of Pb in blood, he had examined groups of job applicants, transport workers, Cu workers, and of Pb workers, finding the average Pb content to be as follows, respectively, in  $\mu\text{g}/100\text{ ml}$ : 17.7, 28.0, 31.4, and 48.2. The value of various laboratory tests is discussed from the point of view of individual and of group prevention, as well as from that of working conditions. The limits set by him for the removal of the worker from exposure include blood Pb of  $>80\text{ }\mu\text{g}/100\text{ ml}$ .

- 2410** Holtzman, R.B. (Argonne Natl. Lab., Ill.): DESIRABILITY OF EXPRESSING CONCENTRATIONS OF MINERAL-SEEKING CONSTITUENTS OF BONE AS A FUNCTION OF ASH WEIGHT. *Health Physics* 8:315-9, 1962.

The author emphasizes the need for suitable standard units describing the concentrations of some chemical elements in bone since this is a nonhomogeneous tissue wherein characteristics may vary with age and locations. As an example, while there is evidence that  $^{210}\text{Pb}$  (RaD) is more or less uniformly distributed in the mineral phase, in cases where ingestion rates have changed over the lifetime of individuals, the distribution may not be uniform. The author demonstrates by applying various equations that, for mineral-seeking elements, the concentration should preferably be given in terms of the ash weight. This should not hamper calculation of radiation dose in fresh bone, for this is easily obtained from the ash value by use of an ash- to wet-weight ratio which is 0.4 for the whole skeleton. This is illustrated in a table giving calculated and measured distributions of Pb in the human body.

- 2411** Horiguchi, S., Asano, I., Hashimoto, K., Masuya, Y., Morioka, S., and Utsunomiya, T. (Osaka City Univ. Med. School, Japan): (LEAD POISONING AMONG THE WORKERS IN SCRAPPING OF OLD SHIPS.) *Journal of the Osaka City Medical Center* 11:327-33 (Dec.), 1962.

Pb poisoning developed among workers in Osaka harbor while they were scrapping old ships coated with Pb-containing paint. Medical examination of 322 workers from 21 factories showed that 20% of the men suffered from mild Pb poisoning. The Pb content of the air in the factories was  $6.18\text{ mg}/\text{m}^3$ . Several cases were treated with calcium ethylenediaminetetraacetate and thioctic acid. Measures for the prevention of Pb poisoning in the factories are proposed. (From authors' English summary)

- 2412** Horiuchi, K. and Miyake, S. (Osaka City Univ. Med. School, Japan): A SIMPLE SYNTHETIC DIAGNOSTIC METHOD OF LATENT OR MILD LEAD POISONING. *Osaka City Medical Journal* 8, No. 1:83-9, 1962.

In previous publications, the authors had presented a diagnostic method for the detection of latent or mild Pb poisoning, using the statistical discriminant function "Z" on 5 examination items. Since the determination of Pb in blood and urine is difficult in a routine laboratory, an attempt was made to limit the examination to a count of erythrocytes, and determinations of hemoglobin and urinary coproporphyrin. The usefulness of the method was tested

in several factories. The error of misclassification of normal healthy workers as Pb-poisoned cases was 2 in 204 or 1%. A nomograph to obtain quickly the value "Z" from the examination data has been devised.

- 2413** Horiuchi, K., Noma, H., Asano, I., and Hashimoto, K. (Osaka City Univ. Med. School, Japan): STUDIES ON THE INDUSTRIAL LEAD POISONING. AN EXPERIMENTAL STUDY OF LEAD INTAKE IN HUMAN BEINGS THROUGH THE RESPIRATORY TRACT. *Osaka City Medical Journal* 8, No. 2: 151-69, 1962.

A solution of 2 mg Pb acetate/ml of water was administered to 2 normal Japanese male adults through the respiratory tract, using a new inhalation apparatus. The particles of the inhaled mist were almost all smaller than  $5\text{ }\mu$  in diameter and 67% were smaller than  $1\text{ }\mu$ . The experiment was divided into 5 stages as follows: In the 1st stage, 1 mg Pb acetate/day was given for 61 days; in the 2nd stage 2 mg/day for 31 days, and in the 3rd stage, 2.5 mg/day for 50 days. In the 4th stage, Pb administration was discontinued for 42 days, and in the 5th stage, thioctic acid (60 mg/day, orally, for 20 days) and  $\text{CaNa}_2\text{EDTA}$  (a total of 10.16 g orally over 7 days and a total of 7.2 g intravenously over 5 days) were given for treatment.

The expired air and the saliva of the subjects as well as an acetic acid gargle used to dissolve any Pb that had remained in the mouth, were collected for Pb determination. The average Pb concentrations in the blood of the 2 experimental subjects and of a control subject during the 5 stages, were,  $\mu\text{g}/100\text{ g}$ , respectively: 44.06, 56.05, 61.8, 58.86, 46.77; 25.20, 23.62, 21.70, 23.87, 25.52. Urinary Pb excretion fluctuated from 26 to 962  $\mu\text{g}/\text{day}$  for the Pb subjects and from 10 to 234 for the control. Fecal Pb excretion of the Pb subjects gradually increased in the 2nd part of the 1st stage, reached a peak in the middle of the 3rd stage, and returned to normal about 10 days after discontinuation of Pb inhalation. The total amount of Pb excreted in urine and feces during the 3 experimental stages averaged 48 to 51% of the Pb intake (including 215  $\mu\text{g}/\text{day}$  from food and beverages). Thus, the amount of Pb stored in the organism in the inhalation experiment is about twice as large as that in oral administration. The number of red blood cells and hemoglobin content decreased. Reticulocytes, thrombocytes, erythroblasts and basophilic and polychromatic macroblasts increased, normochromatic normoblasts decreased, and the urinary coproporphyrins increased. Liver function tests revealed no abnormalities.

- 2414** International Labour Organisation: TRIPARTITE TECHNICAL MEETING FOR THE PRINTING AND ALLIED TRADES. PROTECTION OF WORKERS' HEALTH IN THE PRINTING AND ALLIED TRADES. Report III. Geneva, 1962, 67 pp.

Pb poisoning among typographers and rules governing the hygiene of premises and the personal hygiene of these workers are among the matters covered at this meeting. Three statistical studies are presented which confirm the low frequency and low degree of Pb poisoning in enterprises where satisfactory working conditions are maintained.

- 2415 Ivanov, K., Prodanov, P., Chelibonova, Kh., and Bozhkov, S. (Acad. Sci., Sofia, Bulgaria): *Súdurzhanie na olovo v kosite na khora i kosmite, resp. vulnata na goveda i ovtsa ot raiona na endemichniya nefrit po khorata.* (LEAD CONTENT IN HUMAN HAIR AND WOOL OF SHEEP AND CATTLE IN AREAS AFFECTED WITH HUMAN ENDEMIC NEPHRITIS.) *Izvestiya na Instituta po Sravnitelna Patologiya na Domashnite Zhivotni, Bulgarska Akademiya na Naukite* 9:275-83, 1962.

The examination of the Pb content in hair of 168 sheep and of 24 cattle in an endemic nephritis area, in non-endemic regions and in settlements near Pb mines as well as that of 37 people from an area with endemic nephritis showed the following:

There is no fixed relationship between endemic nephritis in man and the Pb content in wool of sheep from the same area (av 180.2 and 142.0  $\mu\text{g}\%$  in endemic and non-endemic areas respectively). The Pb content in sheep wool from areas adjacent to Pb mines and flotation installations is higher than in other areas (av 221.5  $\mu\text{g}\%$ ). The Pb content of cattle hair is on an average of 615.0  $\mu\text{g}\%$  and no differences were found between animals from the above endemic and non-endemic areas. The Pb content in hair of healthy people (766.6-1013.0  $\mu\text{g}\%$ ) and those suffering from endemic nephritis (380.0-1276.0  $\mu\text{g}\%$ ) from the endemic area does not exceed the normal limits reported in the literature. However, there appears to be a certain tendency towards higher Pb levels in hair of sick women.

The authors consider the examination of the Pb level in animal hair to be a convenient method for mass examination of Pb values.

- 2416 Jaulmes, P. (Montpellier, France): *Analyse toxicologique du sang en médecine du travail.* (TOXICOLOGIC ANALYSIS OF THE BLOOD IN INDUSTRIAL MEDICINE.) *Montpellier Médical* 61:9-11 (Jan.), 1962.

The determination of Pb in blood and urine constitutes an important tool in the diagnosis of Pb poisoning. In referring to a previously described method, the author points out that the following measures should be observed: (1) the glass vessel which is used must be free from Pb, washed with hot nitric acid and distilled water and dried so that the opening remains free of dust and Pb; (2) the arm of the worker should be washed with soap and dried with a cloth free of Pb dust; (3) the work should be carried out in a place free of Pb dust. The author does not concur in a threshold limit of 800  $\mu\text{g Pb/l}$  of blood beyond which Pb poisoning is considered proved, as set by the Social Security. A serious saturnism may be present at a lower Pb content in the blood and benign recent Pb intoxication at a higher blood concentration. The Pb level in blood versus that in urine, the age of the individual and the time of exposure should be considered. Pb poisoning is frequently contracted from soiled hands. Therefore, the importance of carefully washing the hands before eating cannot be overemphasized.

- 2417 Justin-Besançon, L., Lamotte-Barrillon, S.,

Lamotte, M., Grivaux, M., Remy, H., and Lamy, P.R. (Hosp. Cochin, Paris, France): *Forme polynévritique sensitive de saturnisme.* (SENSORY POLYNEURITIC FORM OF LFAD POISONING.) *Cahiers R.M.F.* 76:531-4 (Sept.), 1962.

A case of Pb poisoning in which a 40-yr-old man suffered from an unusually painful polyneuritis is presented. Pb poisoning was established on the basis of finding that the patient had been engaged in painting old boats with a protective coat of Pb oxide; on the basis of clinical examination, which showed the presence of Burton line, abdominal colics, diffuse pains in the extremities in addition to polyneuritis; and on laboratory tests that revealed that Pb contents in blood and urine were 1040  $\mu\text{g/l}$  and 240  $\mu\text{g/day}$ , respectively, basophilic stippling of erythrocytes (28 and 70/100 leukocytes, in 2 tests) and increased urinary coproporphyrins (2.5 mg/24 hr). Other laboratory findings excluded several conditions that had been considered as the cause of illness. The unusual form of the polyneuritis in this patient is pointed out and discussed. It involved all extremities, with extremely painful intermittent cramps, especially upon movement; there was no vasomotor or trophic disturbance, but upon exertion, fasciculations of certain groups of muscles and fine tremblings of extremities. After treatment with EDTA the Pb level in the blood returned to normal. However, the patient was readmitted to the hospital after 3 mo because of recurrence of polyneuritic pain which responded subsequently to the same treatment. The authors are concerned that since the neurologic signs fit neither into the classical picture of encephalopathy nor of the paralysis of extensors, the syndrome may not be recognized legally, except by medical experts, as a manifestation of Pb poisoning.

- 2418 Kar, A.: A SURVEY OF THE INCIDENCE OF LEAD POISONING AND THE ENVIRONMENTAL CONDITIONS IN LEAD PIGMENT MANUFACTURING FACTORIES IN WEST BENGAL. *Indian J. Indust. Med.* 8:21-31 (June), 1962.

This is a preliminary report of a survey undertaken by the Certifying Surgeon of Factories at the suggestion of the Chief Inspector of Factories, West Bengal, where there are 4000 registered factories in many of which Pb compounds are used. The processes are described, and certain data given for each one of 5 of the 7 factories where Pb pigments and compounds are manufactured. Tables include minimum, maximum and average values for atmospheric Pb concentrations and urinary excretion of Pb and porphyrins. The factory with the lowest values, where atmospheric concentrations varied to give an average value as high as 6 mg Pb/m<sup>3</sup>, was presumably a small modern factory. In the one with the highest values the average figure was 165 mg/m<sup>3</sup>. Washing facilities were generally inadequate. Symptoms of Pb intoxication were observed in 38-80% of the workers examined in each factory. Confirmatory clinical or laboratory findings of chronic Pb poisoning were found in 15-45% of workers with symptoms. Urgent improvements were considered necessary in at least 3 factories. (From Bulletin of Hygiene 38:19, 1963)

- 2419** Katsunuma, H., and Negishi, T. (Univ. Tokyo, Japan): ON THE TREATMENT OF RADIALIS-PARALYSIS FROM LEAD POISONING WITH ADENOSINE-TRI-PHOSPHATE. Japanese Journal of Experimental Medicine 62:149-61 (Apr.), 1962.

A case of Pb intoxication in a 24-yr-old man who worked for ~5 yr in a Pb refinery where the atmospheric concentration of Pb ranged from 0.2-0.3 mg/m<sup>3</sup>, is described. The patient suffered from paralysis of the muscles innervated by the radial nerve with considerable atrophy, anemia, and precipitation of Pb on the gums. Histologic examination of the affected muscles showed diffuse hyaline and waxy degeneration without any inflammatory lesion or bleeding. The electromyograph revealed low voltage, and a decrease in the frequencies of neuromuscular unit discharge. Treatment with CaNa<sub>2</sub>EDTA did not improve the paralysis. Following daily iv administration of 10 mg adenosine triphosphate for ~5 mo, the patient almost completely recovered from the paralysis. (34 references)

- 2420** Khadzhiolov, Kh. (Med. Inst. Sofia, Bulgaria): Profesionalno khrnichno otravayane s olovo u nas prez poslednite 11 godini (karakter, evolyutsiya i formi) s ogled na profilaktichni izvodi za praktika. (OCCUPATIONAL CHRONIC LEAD POISONING IN BULGARIA DURING THE PAST 11 YEARS (ITS NATURE, COURSE, AND TYPES) WITH A VIEW TOWARD ITS PREVENTION.) Nauchni Trudove Visshiva Meditsinski Institut Sofiya 41, No. 5:33-48, 1962.

A group of 270 (236 of them male) patients with Pb poisoning from various trades was observed over 11 yr. There were few cases with serious irreversible damage of the nervous, the hematopoietic and vascular or gastrointestinal systems. The most frequent initial complaints were fatigue, headache, paresthesia and dyspepsia, followed by abdominal colics and toxic anemia with basophilic stippling (BS) of the erythrocytes. The hemoglobin (Hb) content in 44 patients was <60% and in 51 >80%. Liver disturbances were observed in 10-20% of the patients, urobilinogen was found in the urine of 19.2%. Blood pressure was elevated in 9.9% of the workers <40 yr of age and in 6.6% >40 yr old. The gingival Pb line was present in 79.3%, BS in 40.2% and coproporphyrinuria in 33.3%. In mild cases, removal from exposure resulted in quick recovery. More serious cases which exhibited Hb <60%, paralyzes and liver and kidney damage, showed slow or incomplete recovery. Exacerbations sometimes developed years after removal from Pb exposure, due to Pb deposits in the organism which, when mobilized, led to increased Pb levels in the blood and urine. CaNa<sub>2</sub>EDTA is considered useful in prophylaxis and therapy. It is pointed out that even at the present time Pb concentrations in the air of workshops often exceed by 10-1000 times the MAC of 0.00001 mg Pb/l of air. (From author's English summary; 27 references)

- 2421** Kiseleva, A.M. (Central Inst. Sci. Physiotherapy, Moscow, USSR): Bioelektricheskaya aktivnost golovnog mozga u bol'nykh s asteno-vegetativnym sindromom vsledstvie

khrnichskoi intoksikatsii tetraetilsvint-som. (BIOELECTRICAL ACTIVITY OF THE BRAIN IN PATIENTS WITH ASTHENOAUTONOMIC SYNDROME FOLLOWING CHRONIC TETRAETHYLLEAD POISONING.) Zhurnal Nevropatologii i Psikhiiatrii 62:709-15, 1962.

The cerebral bioelectrical activity was studied in 17 patients suffering from an asthenoaautonomic syndrome due to chronic TEL poisoning. Three forms of EEG disorders were found: (1) mild unstable disorders limited to the appearance of slow irregular waves of low amplitude and isolated acute waves (7 patients); (2) changes in the form of bursts of electroactivity with the appearance on the EEG of paroxysms arising spontaneously from theta waves of high amplitude (3 patients); (3) diffuse disturbances of electroactivity in all parts of the type of desynchronization (3 cases) or of the hypersynchronization type of rhythms 14-22/sec (2) and theta rhythm 5-6/sec (1). The author attributes these disorders to circulatory disturbances by TEL which produce transient phenomena of ischemia and cerebral hypoxia, the same as secondary phenomena of necrobiosis of cerebral cells. (14 references)

- 2422** Klendshoj, N.C., and Burke, W.J. (Univ. Buffalo, N.Y.): DIAGNOSIS IN CHRONIC INDUSTRIAL POISONING. Journal of the American Medical Association 181:840-4 (Sept.), 1962.

Difficulties in differentiating between impairment of health due to exposure to chemicals and diseases caused by nonoccupational factors are discussed. The importance of the critical interpretation of laboratory data and physical findings, and the accurate determination of the factual environmental exposure in quantitative terms as well as in respect to concomitant exposure both on and off the job, is stressed. Exposure to Pb is given as one illustration of the 1st point: The presence of high concentrations of Pb in blood and urine in patients does not justify diagnosis of acute or chronic Pb poisoning unless other manifestations, ascribable to Pb, are present. The application of laboratory procedures in view of concomitant pathologic changes for the management of the patient is also illustrated by cases of kidney impairment in patients with Pb poisoning. In discussing the assessment of factual exposure, a case demonstrating the synergistic effect of exposure to Pb and alcoholism is presented. A patient with a history of severe alcoholism, who had been exposed to metal fumes (Zn, Cu, Mn, Pb), complained of nausea, chills, weakness, loss of appetite. Examination revealed coarse tremors of hands and feet, and enlarged liver. Urine showed 0.53 mg Zn, 80 µg Cu, and 0.16 mg Pb. Progressive agitation and disorientation with eventual shock was followed by renal failure with acidosis; this caused the mobilization of additional Pb from inert storage. Following treatment with CaEDTA the patient was discharged. The final diagnosis was a combination of alcoholism with delirium tremens and Pb intoxication exacerbated by acidosis. It is speculated how much of the total picture can be ascribed to each of these factors. While this is admitted to be an extreme instance, the concomitant and synergistic effect of alcohol is a common pattern in exposure to chemicals.



- 2423** Klyuchnikova, E.A., and Atchabarov, B.A. (USSR): Sostoyanie vkusovogo analizatora i izmenenie ego pod vliyaniem bal'neologicheskogo lecheniya u bol'nykh so svintsovoi intoksikatsiei. (CONDITION OF THE TASTE ANALYZER AND ITS MODIFICATION BY BALNEOLOGIC TREATMENT OF PATIENTS WITH LEAD POISONING.) Trudy Instituta Kraevoi Patologii, Akademiya Nauk Kazakhskoi SSR 10:153-66, 1962.

The authors observed in 96 patients with chronic Pb poisoning that disturbances of the sense of taste for sweet products most often was of hypergeusia (in 36.45%) and seldom of hypo- and para-geusia form, (5.2%), but for bitter products disturbances of the sense of taste occurred with equal frequency in all 3 forms and for acid and salty food, disturbances occurred less frequently than for sweet and bitter foods. After hot springs cure they observed significant changes toward normalization in the threshold of taste perceptibility. (12 references)

- 2424** Koch, C., and Serra, M. (Univ. Naples, Italy): Effetti dell'intossicazione da piombo tetraetile sugli apparati acustico e vestibolare. (THE EFFECTS OF TETRAETHYL-LEAD POISONING ON HEARING AND VESTIBULAR SYSTEMS.) Acta Medica Italica di Medicina Tropicale e Subtropicale e di Gastroenterologia 17:77-80 (April), 1962.

The authors wished to call attention to the possibility of disorders of the inner ear in chronic poisoning by tetraethyllead (TEL). They define chronic intoxication as that arising mostly from the gastroenteric or cutaneous absorption, and the acute, as one caused by the inhalation of TEL vapors.

Twelve workers engaged in the manufacture and handling of TEL, aged 26-45 yr, showing symptoms of a "slow" intoxication by TEL, who however were able to continue work, were selected for the study. Men >50 yr old, who might be affected by some loss of hearing due to age, were excluded. The symptoms had begun with anorexia, nausea, salivation, speech difficulty, gastric pain, diarrhea, followed by insomnia, faulty memory, headache, irritability, hypotension, at times bradycardia hypothermia. In addition, they were affected by impaired hearing and dizziness which led the authors to subject them to thorough otorhinolaryngologic examination. The nasal and pharyngeal mucosa showed only some hyperemia, at times edema. All men examined showed some loss of hearing and inner ear disorders of varying degree, depending upon exposure to TEL.

In 9 particularly, more or less severe loss of hearing was admitted, with difficulty in hearing sounds of high frequency. Audiometric and vestibular function were tested with modern apparatus. Audiograms showed a symmetrical perception curve that was almost normal to a frequency of 1000 Hz with a progressive fall from 2000 Hz on. Positive recruitment was found in 80%. Hearing damage varied from a minimum of 30% to a maximum of 70%, and was found to be of cochlear origin. Vestibular function tests showed the following: the Romberg test was positive in all cases, with uncertain gait (Babinski-Weil), increased reflex activity to

thermal and rotatory stimuli, no spontaneous nystagmus. Complete audiograms and results of vestibular function tests of 2 of the cases are shown.

The results are interpreted to mean that aside from causing disturbances of the nervous and digestive systems (including the liver), the hypotension in chronic TEL poisoning could produce the labyrinthine disturbances by poor circulation in this organ.

The authors conclude by saying that only few authors have reported hearing disorders in TEL poisoning. However, the study of cochleovestibular function could be of value, for in spite of working conditions, such cases are still seen by specialists.

- 2425** Konikova, G.S. (Inst. Hyg., Occup. Dis., Leningrad, USSR): Kholesterin i fosfolipidy krovi pri dlitel'nom vozdeistvii nekotorykh promyshlennykh yadov (svinets, serouglerod i benzol). (CHOLESTEROL METABOLISM IN PROLONGED EXPOSURE TO CERTAIN POISONS (LEAD, CARBON DISULFIDE, BENZENE).) Terapevticheskii Arkhiv 34, No. 8:96-101, 1962.

The metabolism of cholesterol and phospholipids was studied in 49 subjects with long exposure to Pb (20 males, 29 females). Total cholesterol was increased, total phospholipids were decreased. In persons showing signs of intoxication, the increase was more pronounced than in those who had no overt signs: In controls, total cholesterol was 175.8; in above 2 groups, 240.8 and 216.7 mg%, respectively. The ratios of total phospholipids to total cholesterol in the 3 above categories were:  $1.08 \pm 0.01$ ,  $0.83 \pm 0.05$ , and  $0.90 \pm 0.03$ . The authors conclude that the first stage of disturbed cholesterol metabolism is represented by a decrease of the stability of the bond between cholesterol and protein.

- 2426** Kósmider, S. (Silesian Med. Acad., Zabrze, Poland): THE INFLUENCE OF DISODIUM CALCIUM VERSENATE ON SERUM ALKALINE PHOSPHATASE ACTIVITY. Polskie Archiwum Medycyny Wewnetrznej 32, No. 11:338-43, 1962.

Since Ca disodium edathamil (EDTA) is being used extensively in the treatment of Pb poisoning and since it has been shown that EDTA may bind the trace metals contained in enzymes, an investigation on the influence of EDTA on the activity of blood serum alkaline phosphatase appeared to be of interest.

Ten healthy men, aged 28-44 yr, were injected intravenously with 2 g EDTA. Alkaline phosphatase activity was determined before and 1 hr after EDTA administration, using the Bodansky method (1933); the amount of inorganic P released from the substrate was measured by the method of Fiske-Subbarow (1958). In-vitro tests were carried out on the serum of 15 healthy subjects by adding to the serum EDTA solutions in concentrations ranging from  $10^{-4}$  to 1.0 M and determining the change of alkaline phosphatase activity. A statistically significant decrease of activity was found in both series of tests. The mechanism of this action was studied in vitro with the sera of 10 healthy subjects by adding Zn sulfate or Mg chloride in concentrations of  $10^{-2}$  to  $10^{-4}$  M to the prepara-



tion with EDTA. Measurements made after 1 hr's incubation showed that the Zn ions did not activate the alkaline phosphatase while Mg chloride markedly activated the enzyme. This suggested to the authors that EDTA inhibits serum alkaline phosphatase by attracting the Mg ions from the complex of phosphatase and by the formation of non-ionized compounds eliminated by the kidneys. The conclusion was drawn that in cases of Pb poisoning treated with EDTA, some trace metals - and particularly Mg - have to be added to replenish the deficiency caused by EDTA.

- 2427** Kośmider, S. (Silesian Acad. Med., Clinic Int. Dis., Zabrze, Poland): Znaczenie fosfatazy zasadowej surowicy w rozpoznawaniu i leczeniu przewlekłych zatruc zawodowych ołowiem. (ROLE OF SERUM ALKALINE PHOSPHATASE IN THE DIAGNOSIS AND TREATMENT OF CHRONIC OCCUPATIONAL LEAD POISONING.) Polskie Archiwum Medycyny Wewnętrznej 32:1101-7 (Sept.), 1962.

See Abstract No. 2569.

- 2428** Kośmider, S., and Petelenz, T. (Clinic Int. Med. Silesian Acad. Med., Zabrze, Poland): Zmiany elektrokardiograficzne u starszych osób z przewlekłym zawodowym zatruciem ołowiem. (ELECTROCARDIOGRAPHIC CHANGES IN ELDERLY PATIENTS WITH CHRONIC OCCUPATIONAL LEAD POISONING.) Polskie Archiwum Medycyny Wewnętrznej 32:437-42, 1962.

The electrocardiograms of 38 Pb poisoning patients, 46-65 yr old, with 2-40 yr exposure in several industries, were examined. A great portion of these patients showed signs of organic heart lesions. (From authors' summary)

- 2429** Koval'chuchenko, N.A. (USSR): Smertel'noe otravlenie produktami ognestrel'nogo zaryada. (FATAL POISONING BY FIREARMS DISCHARGE.) Sudebno-Meditsinskaya Ekspertiza 5, No. 1:55-6, 1962.

The case described is that of a physician, 36 yr old who was admitted to the hospital 12 hr after receiving a gunshot wound into the hip. He died 4 mo later with encephalopathy and severe anemia for which he had been treated with blood transfusions. Pb poisoning was considered as the cause because of finding stippled cells, Pb deposits in the wound area, and the anemia.

- 2430** Krylov, A.A., and Frumkin, B.Z. (S.M. Kirov Acad. War Med., Leningrad, USSR): K patogenezu anemii pri khronicheskoi intoksikatsii svintsom. (ON THE PATHOGENESIS OF ANEMIA IN CHRONIC LEAD INTOXICATION.) Terapevticheskii Arkhiv 34:95-6 (Nov.), 1962.

Modern concepts on the title subject are presented. A hypothesis of the role of autoimmune mechanisms in the occurrence of anemia is advanced. A case history of chronic Pb intoxication is described; the patient had a positive Coombs test at the height of the disease. Anti-erythrocytic antibodies disappeared after treatment with  $\text{CaNa}_2\text{EDTA}$ . The author is of the opinion that the autoantigens are metalloproteids which had formed due to blockage by Pb of the active groups of protein molecules in the blood and tissues.

- 2431** Lachnit, V., and Jellinger, K. (Univ. Clinic Vienna, Austria): Zur Problematik der Bleinenzephalopathie. (THE PROBLEM OF LEAD ENCEPHALOPATHY.) Wiener Zeitschrift für innere Medizin 43:507-14 (Dec.), 1962.

The syndrome of Pb encephalopathy is reviewed and 2 cases of chronic occupational Pb poisoning are described. One of the patients, aged 62 yr, had worked for 3 yr as a mixer in a synthetic plastics plant where he had handled large quantities of Pb stearate; the other one, 61 yr, had been occupied as a solderer for 13 yr. Urinary Pb excretion in the 2 subjects was 85-200 and 150-325  $\mu\text{g}/\text{l}$ , respectively. Patient 1 showed distinct signs of Pb encephalopathy whereas the neurologic disturbances in the 2nd case were attributed to vascular alterations caused by the advanced age of the patient. The latter also showed kidney damage. Both patients were treated with EDTA. Dosage was lowered for the 2nd patient. (70 references)

- 2432** L'Epée, P., Lazarini, H.-J., Dervillé, E., Clus, and Coursan, P. (France): 12 Cas d'intoxication professionnelle par l'arséniate de plomb apparus dans la même commune rurale. (12 CASES OF LEAD POISONING CAUSED BY LEAD ARSENATE OCCURRING IN THE SAME RURAL COMMUNITY.) Concours Médical 84:6533-6 (Dec.), 1962.

Twelve cases of occupational Pb poisoning are reported which occurred in the municipality of Labatut (Landes). The farmers involved used a mixture of Pb arsenate (0.350-0.500 kg) to make a 100-1 solution to spray their fruit trees. The precautionary measures recommended were neglected in 11 of these cases. Six of the cases are described in detail. Pb colics, changes in the blood, and renal damage (severe) were found in all of them. Other of the classical indications were far less often found: radial paralysis in 1; Burton's line in 2; arthralgia and myalgia in 4. In 3 cases parotid gland disorders were frequently noticed. The authors briefly discuss some medico-legal and industrial-medical aspects. They mention, in closing, to explain this epidemic of poisoning, that this is a region of large grape orchards, with grapes grown high so that one has to spray upward. The orchardists changed from Ca to Pb arsenate without inquiring beforehand about the hazards.

- 2433** Linari, F., Piccoli, G., Emanuelli, G., and Coscia, G.C. (Univ. Turin, Italy): Alcuni rilievi sul quadro funzionale renale ed urinario nel saturnismo. (RENAL AND URINARY FUNCTION IN LEAD POISONING.) Medicina del Lavoro 53:805-10 (Dec.), 1962.

The clearance of thiosulfate and p-aminohippuric acid (PAH) was studied in 18 patients in various stages of Pb intoxication, acute, subacute and chronic, and in the stage of excessive Pb absorption. The time of exposure in these subjects ranged from 2 mo-35 yr. Clearance values of PAH (renal plasma flux) and Na thiosulfate (glomerular filtration) ranged from 310-1629 and 53-190 cc respectively. The wide scattering of these values was attributed to the individual anatomical condition of the vessels and their vasomotor function-

ing. In a part of the cases, tubular dysfunction was suspected. The increased non-protein N in the blood may be caused also by an increased protein-breakdown. (7 references)

- 2434 McBride, W.W., and Proctor, E.C. (Dept. Health Commonwealth Pennsylvania, Harrisburg): LEAD POISONING IN DEMOLITION WORK. *Industrial Medicine and Surgery* 31:31-2 (Jan.), 1962.

A medical investigation was conducted following a report of 2 cases of Pb poisoning among workers engaged in cutting steel girders coated with several layers of Pb paint with a propane-oxygen torch, in a demolition of a rural bridge. A visit to the site, after learning that others had complained of feeling ill, showed 12 men engaged in torch cutting steel girders. Respirators were not provided, but in spite of the heavy fumes evolved, the workmen would not admit feeling ill. A sample of the paint contained 21.6% Pb. Breathing zone air samples showed a Pb content as high as 3.1 mg/m<sup>3</sup> of air. The general air 20 ft down wind from the worker contained 0.46 mg Pb/m<sup>3</sup> air. With some difficulty, the authors tracked down some of the former workers and discovered at least 7 cases of Pb poisoning with symptoms ranging from abdominal pains to extreme nervousness and anemia. Urinary Pb values ranged from 0.70-0.96 mg/l, increased stippled cells, and coproporphyrinuria were found. After collecting the evidence, the operation was temporarily suspended and orders given to control the hazard. The difficulty in diagnosis of occupational Pb poisoning and its occurrence in open air, under natural good ventilation conditions, is emphasized.

- 2435 Maksudov, N., and Talipov, Sh.T.: (PRELIMINARY EXAMINATION OF KIDNEY STONE COMPOSITION.) *Uzbeksk. Khim. Zh.* 6, No. 4: 88-90, 1962.

The chemical composition of kidney stones from 49 patients from 7 districts of Uzbekistan was studied by spectral analysis. The content of Si, Al, Ca, Na, K, Fe, Mg, P, Ba, Sr, Mn, Ti, Cr, Mo, Ag, Cu, Pb, Zn, Ce, La, and Zr was determined. Different results were obtained for stones from patients from different districts. Cr, Ti, La, and Ce were found in kidney stones for the first time. (From Chemical Abstracts 58:5758, 1963)

- 2436 Mann, T.S. (Western Infirmary, Glasgow, Scotland): LEAD INTOXICATION IN THE SURGICAL WARDS. *Scottish Medical Journal* 7:36-41 (Jan.), 1962.

A brief description is presented of 6 misdiagnosed cases of Pb intoxication in which all patients suffering from abdominal pain underwent unnecessary operation. In each case operative findings were normal and symptoms continued unchanged until diagnosis of Pb intoxication was made. Diagnostic and therapeutic aspects of Pb intoxication are reviewed.

- 2437 Mappes, R. (Inst. Forens. Med. Bochum, Westfalen, Germany): Die Zuverlässigkeit von Schnellmethoden zur Porphyrinbestimmung im Harn von Bleiarbeitern. (THE RELIABILITY OF RAPID METHODS FOR THE DETER-

MINATION OF PORPHYRIN IN THE URINE OF LEAD WORKERS.) *Zentralblatt für Arbeitsmedizin und Arbeitsschutz* 12:271-3 (Nov.), 1962.

The reliability of the methods of de Langen and Brugsch were spectrographically tested in 160 repeated determinations. In the range of 200-2000 µ/l, which is important for the purpose of prophylaxis, de Langen's method gives only very indefinite semi-quantitative results whereas Brugsch's method yields data of satisfactory accuracy.

- 2438 Markičević, A. and Beritić, T. (Inst. for Med. Research and Ind. Med., Zagreb, Yugoslavia): Četiri slučaja otrovanja olovom tetraetilom. (FOUR CASES OF TETRAETHYL-LEAD POISONING.) *Arhiv za Higijenu Rada i Toksikologiju* 13:311-7, 1962.

TEL poisoning was reported in 3 workers in an oil refinery who were occupied cleaning a tank from which ethylated gasoline had been removed 2 days before. The men, aged 31-35 yr, had been employed in the refinery for 5-8 yr. They worked 8 hr on the first day, apparently using a mask. The next day, they removed rust from the tank for 15 min without wearing a mask. Fifteen min after leaving the tank they suddenly felt weak and dizzy and later vomited. Laboratory findings were normal but some neurological disturbances such as tremors of the eyelids and fingers, were observed.

In the 4th case, a 35-yr-old man had worked for 3 yr as assistant driver in a storage place for gasoline. He was filling and emptying fuel tanks for 8-16 hr daily, in a poorly ventilated place. During the last 5 mo he had become irritable, had nightmares in his sleep or suffered from insomnia, was often nauseated and had lost weight. A diagnosis of chronic poisoning by TEL was established on the basis of Pb in blood (166.84 µg%) and in spinal fluid (99.1 µg%). Methods of treatment in TEL poisoning are discussed. Dimercaptopropanol (BAL) and CaNa<sub>2</sub>EDTA were used in the above case by the authors, but did not bring the expected improvement or excretion of Pb. Their cases reacted favorably to treatment with cyclobarbitol. The need for the strict observance of safety measures is emphasized.

- 2439 Masuya, Y. (Osaka City Univ. Grad. School, Japan): A STUDY ON THE IRON METABOLISM IN LEAD POISONING. I. SERUM IRON CONTENT OF LEAD WORKERS; II. SERUM IRON OF LEAD-POISONED ANIMALS; III. FATE OF <sup>59</sup>Fe ADMINISTERED TO LEAD-POISONED ANIMALS. *Osaka Shiritsu Daigaku Igaku Zasshi* 11: 257-62; 263-70; 271-7, 1962.

I. The serum Fe content was found to be higher in a group of Pb refiners than in a group of Pb oxidation workers. Most Pb workers, however (76% of the refiners and 91% of the oxidation workers), showed a serum Fe level which was comparable to that of healthy Japanese males (arithmetic mean, 113.2 µg/100 ml). There seemed to be no correlation between serum Fe content and the red cell count, Hb content and urinary CP excretion.

II. Compared with a control group, Pb-administered rabbits showed little weight gain. A gradual decrease in Hb content and increase in urinary coproporphyrin were observed. Stippled cells ap-

peared 3 days after administration of Pb at an irregular rate of appearance. No significant changes in white cell counts were observed in both control and Pb groups. Serum Fe and glutamic-oxalacetic transaminase reached maxima 2-3 wk after administration and returned to the initial value after discontinuation of the treatment.

III. Pb-poisoned mice were injected iv with Fe glucuronide labeled with  $^{59}\text{Fe}$ . The results showed the disappearance of  $^{59}\text{Fe}$  in plasma to be at a slower rate than in the control animals. The uptake of  $^{59}\text{Fe}$  in liver, spleen, and bone marrow was markedly suppressed as compared with controls. (From author's English summaries)

- 2440** Meachim, G. (Univ. Sheffield, England): THE INTERPRETATION OF ERYTHROCYTE STIPPLING IN LEAD WORKERS. *American Industrial Hygiene Association Journal* 23:245-8 (May-June), 1962.

Stippled cell counts were carried out over an average of 34.8 mo on 40 workers at a smelting plant in which all were exposed to a comparable risk of Pb fumes and dust. The blood films obtained were stained with methylene blue and examined by transmitted light. In 4 workers suffering from early symptoms of Pb poisoning such as tiredness and lack of appetite, stippled cell counts ranged from 2750-7000/million red cells (av 2417/million), showing an upward trend accompanied by the development of toxic symptoms. Hb in 3 was 3.8 g and in 1, 13.5/100 ml. In 36 workers free of any clinical signs of Pb poisoning, stippled cell counts showed an average of 244/million, with no persistent upward trend. Only in 3 cases the counts increased to within the range found in the 1st group. Because of variations in the individual susceptibility to the toxic action of Pb, it is not possible to set a stippled cell level for diagnosis of Pb intoxication. However, counts >2000/million, determined with the technique used above, are indicative of excessive Pb absorption.

- 2441** Mel'nikova, E.A., Parasenko, Z.G., and Artamonova, T.A.: (ALTERATIONS IN SERUM PROTEINS IN INDIVIDUALS WORKING WITH GASOLINE AND ETHYLATED GASOLINE.) *Nauchn. Tr. Kubansk. Gos. Med. Inst.* 1962, No. 19:77-83; *Chemical Abstracts* 61:6257, 1964.

See Abstract No. 2585.

- 2442** Moeschlin, S. (Med. Clinic, Mun. Hosp., Solothurn, Switzerland): Exogen bedingte toxische Veränderungen des Knochenmarks. (EXOGENOUS TOXIC BONE MARROW CHANGES.) *Schweizerische Medizinische Wochenschrift* 50:35-58 (Dec.), 1962.

The hematotoxic effect of Pb on erythropoiesis is discussed. By inhibiting porphobilinogenase, Pb inhibits the synthesis of porphobilinogen (PBG) which results in increased urinary excretion of ALA (from the normal amount of 2 mg/24 hr to 150 mg/24 hr). The determination of urinary ALA acid is therefore very important for an early diagnosis of Pb intoxication. Alterations in blood and bone marrow in chronic Pb intoxication are reviewed. Due to the inhibition of PBG synthesis, the number of erythroblasts increases and pathologic forms with basophil stippling of the cytoplasm

and deposits of unattached Fe may occur. Granulocytopoiesis is not affected. For therapeutic purposes, administration of  $\text{CaNa}_2\text{EDTA}$  in doses not exceeding 20 mg/kg/day is recommended. (28 references)

- 2443** Moore, M.T. (Univ. Pennsylvania, Philadelphia): HUMAN TOXOCARA CANIS ENCEPHALITIS WITH LEAD ENCEPHALOPATHY. *Journal of Neuropathology and Experimental Neurology* 21:201-18 (Apr.), 1962.

A fatal case of a 22-mo-old boy who had shown clinical symptoms of Pb encephalopathy is presented. Postmortem examination of the brain revealed evidence of invasion by infective 2nd-stage larvae of *Toxocara canis*. Chemical analysis for Pb showed 2.15 mg/100 g wet weight in kidney, 0.623 mg/l in urine, and 0.284 mg% in blood. The common and distinguishing features of the neurological disorders caused by Pb encephalopathy and by *Toxocara canis*, and their relationship to unhygienic habits of pica and geophagia in children are discussed. (38 references)

- 2444** Morduchowicz, N., and Slutzky, L. (Argentina): La gota saturnina. Presentación de una observación clínica. (SATURNINE GOUT. PRESENTATION OF A CLINICAL CASE.) *Dia Medico* 34:1776-8 (Sept.), 1962.

Saturnine gout develops generally in Pb workers within 5-10 yr after the beginning of Pb intoxication; the syndrome is similar to that of the common gout. The case of a 50-yr-old worker in a battery factory is described. The diagnosis of gout was established on the basis of X-ray studies of the feet and laboratory analyses of the urine.

- 2445** Muller, M., Fontaine, G., and Leleu, G., (with assistance from Vercouter, B.) (Inst. Leg. Soc. Med., Lille, France): Étude immuno-électrophorétique des protéines sériques dans le saturnisme professionnel. (IMMUNO-ELECTROPHORETIC STUDY OF SERUM PROTEINS IN OCCUPATIONAL LEAD INTOXICATION.) *Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale* 23:541-3 (Sept.), 1962.

By the use of micro-immuno-electrophoresis on agar method, the behavior of serum proteins was studied in 18 cases of Pb intoxication, 17 of which were of moderate degree, and 1 of Pb colic. All subjects were employed at an accumulator factory and had shown a variable degree of clinical signs of Pb intoxication (Burton's line), moderate anemia (3,700,000 red cells/ $\text{mm}^3$ ), and 30% or more stippled cells. Specific stainings of the various protein components and comparisons with normal human polyvalent antiserum revealed the presence of all normal protein constituents. Excess amounts of  $\gamma$ -globulin and transferrin were found in 2/3 of the cases and of haptoglobin in 1/2 of the cases.

- 2446** Murakami, S., Tanaka, T., Kato, C., Miyazawa, M., Takayama, E., Sakurada, T., Motoyasu, M., Watanabe, K., and Siokawa, Y.: (CLINICAL OBSERVATIONS ON PATIENTS WITH LEAD POISONING. ON 50 CASES IN A MASS OUTBREAK IN A CERTAIN FACTORY.) *Naika* 11: 1289-92 (June), 1962.

- 2447 Nurmaganbetov, E.K. (Kazakh Acad. Sci., USSR): Sostoyanie funktsii kory nadpochechnikov u bol'nykh so svintsovoi intoksikatsiei. (THE FUNCTIONAL STATE OF ADRENAL CORTEX IN PATIENTS IN THE COURSE OF LEAD INTOXICATION.) Trudy Instituta Kraevoi Patologii, Akademiya Nauk Kazakhskoi SSR 10:128-31, 1962.

The urinary excretion of 17-keto steroids and the results of the Thorn test were examined in 50 patients (20-40 yr old) with occupational Pb intoxication of varying degrees of severity, and in 20 controls. Mild poisoning was present in 20 with from 5-15 yr of exposure; medium type in 20 with 5-21 yr exposure, and severe in 10 with from 6-20 yr exposure. The amounts of steroids in the urine in mild, medium and severe intoxication and in controls were (mg/24 hr) 7.9, 6.52, 5.0 and 16.0, respectively. The Thorn test was negative in 60% of the patients. The author concludes that Pb poisoning causes a depression of adrenal gland function which parallels the severity of the disease.

- 2448 Öhlsson, W.T.L. (Central Hosp., Örebro, Sweden): PENICILLAMINE AS LEAD-CHELATING SUBSTANCE IN MAN. British Medical Journal 1:1454-6 (May 26), 1962.

Pb values in urine and blood of 8 patients who were treated for Pb intoxication with penicillamine ( $\beta$ - $\beta$ -dimethylcysteine) are tabulated. Some of the patients were also given a course of iv  $\text{CaNa}_2\text{EDTA}$  either before, during, or after a course of penicillamine. Others, before an oral course of penicillamine, were given benzylpenicillin in a dose of 2 mega-units for 4 days, first orally and then intramuscularly. The iv dose of penicillamine was 1-3 g in 500 mg saline, the drip taking 2-3 hr; the oral dose was 0.3-1 g. These daily doses were given for 2-5 days. No side effects were noted. Penicillamine caused increased urinary excretion of Pb, even with the small oral doses in mild cases where the blood Pb was low. The iv penicillamine caused urinary Pb values comparable to those caused by EDTA, and both together gave evidence of summation. Only a moderate extra increase was obtained by doubling or trebling the penicillamine as it did with EDTA. The penicillin itself caused increased urinary excretion of Pb, but only after the 1st dose. The 2nd dose increased the blood Pb content. As yet the implication of this increase is obscure.

- 2449 Paolino, W. (Univ. Turin, Italy): Acquisizioni e problemi nell'ambito dell'emopatia saturnina. (ACCOMPLISHMENTS AND PROBLEMS IN THE FIELD OF SATURNINE BLOOD DISEASES.) Archivio per le Scienze Mediche 109:23-32, 1962.

Clinical findings concerning the blood picture in Pb poisoning are reviewed and their implications are discussed. (27 references)

- 2450 Parigi, A., and Capellaro, F. (Univ. Turin; Mauriziano Hosp., Italy): Sul problema diagnostico e terapeutico degli esiti a distanza di pregressa intossicazione acuta da Pb. (THE DIAGNOSTIC AND THERAPEUTIC PROBLEM OF THE LATE SEQUELAE

OF PREVIOUS ACUTE LEAD POISONING.) Folia Medica (Naples) 45:293-300 (Apr.), 1962.

Fifty-six men, aged 32-58 yr, who had been removed from Pb exposure for at least 5 yr after having worked as Pb filers for an average of 4 yr, were studied. In 16 of this group (30%) there was evidence of hypertension and 13 (23%) showed albuminuria. Urinary coproporphyrin in 15 subjects ranged from 49-269  $\mu\text{g/l}$  with 8 of these cases  $>100 \mu\text{g/l}$  and urinary Pb excretion before and after iv administration of EDTA was 55-176 and 470-3275  $\mu\text{g/l}$ , respectively. It is concluded that workers, after cessation of Pb exposure, should be treated with EDTA in order to remove any stored Pb before it may produce any irreversible changes. (18 references)

- 2451 Parigi, A., and Giovanelli, E. (Ospedale Mauriziano, Turin, Italy): Sugli effetti collaterali del trattamento con  $\text{CaNa}_2\text{EDTA}$  per via orale. (SIDE EFFECTS OF ORAL TREATMENT WITH  $\text{CaNa}_2\text{EDTA}$ ). Lavoro e Medicina 16, No. 3:48-51, 1962

A group of 280 workers exposed to Pb were treated prophylactically with daily oral doses of 2.5 g  $\text{CaNa}_2\text{EDTA}$  for 1 wk, followed by 1 wk of rest, for 15 mo. The blood content of Fe, Cu, Na, K, cholesterol, transferrin, lipo- and ferroproteins, and prothrombin and coagulation time were determined. No alterations from corresponding data in controls were noted.

- 2452 Parigi, A., and Rasetti, L. (Univ. Turin, Italy): Azione del  $\text{CaEDTA}$  per via orale sul metabolismo dei precursori porfirinici nell'impregnazione saturnina. (ACTION OF ORALLY ADMINISTERED  $\text{CaEDTA}$  ON THE METABOLISM OF THE PORPHYRINIC PRECURSORS IN LEAD POISONING.) Lavoro e Medicina 16, No. 3: 44-50, 1962.

Urinary excretion of porphobilinogen,  $\delta$ -aminolevulinic acid (ALA), coproporphyrin and Pb, and free erythrocytic protoporphyrin and Pb in the blood were measured in 8 Pb-polishers weekly for 2 wk. During the 3rd wk, each man was given an oral dose of 2 g  $\text{CaNa}_2\text{EDTA}$  daily for 6 days, while tests were continued during this and the following 4 wk. Administration of  $\text{CaNa}_2\text{EDTA}$  produced a modest and not significant reduction of urinary porphobilinogen (av during wk 1, 2, 3 and 4, respectively, 8.02, 6.75, 5.18, and 4.7  $\mu\text{M}/24 \text{ hr}$ ), but a marked reduction of ALA (121, 143, 93, 106  $\mu\text{M}/24 \text{ hr}$ ). Erythrocytic protoporphyrin fluctuated (181, 322, 259, 218  $\mu\text{g}/100 \text{ cc}$  of red blood cells) whereas urinary coproporphyrin decreased by 50% (862, 1762, 625, 703  $\mu\text{g}/24 \text{ hr}$ ). Blood Pb showed slight insignificant variations (78, 92, 66, 71  $\mu\text{g}/100 \text{ cc}$ ) but urinary Pb excretion increased considerably (248, 503, 718, 563  $\mu\text{g}/24 \text{ hr}$ ). Based on their findings of a rapid reduction of the precursors of porphyrin the authors assume a direct action of EDTA on the metabolism of porphyrin. The effect of orally administered EDTA seems to vary somewhat because no reduction of the porphyrin precursors was found in 2 cases with high Pb absorption. Possibly, the dose of administered  $\text{CaNa}_2\text{EDTA}$  had been insufficient or the drug had been insufficiently absorbed.

- 2453** Pecora, L. (Univ. Naples, Italy): *Metabolismo delle porfirine e malattie professionali. (METABOLISM OF PORPHYRINS AND OCCUPATIONAL DISEASES.)* Medicina del Lavoro 53:29-35 (Jan.), 1962.

The biosynthesis and pathogenesis of porphyrins in Pb and other intoxications are reviewed. According to the author, disturbances in porphyrin metabolism are due to an increased synthesis of these pigments rather than to the blocking action of Pb. Porphyrins are capable of chelating Pb and of favoring its elimination. It is concluded that secondary disturbances of porphyrins have a common pathogenesis involving the activation of numerous enzyme systems connected with the synthesis of heme. (From author's summary; 39 references)

- 2454** Perol, R., Graveleau, J., Potter, M., and Morin, M. (Med. Serv. Foch Med.-Surg. Center, France): *Effets thérapeutiques de la D-pénicillamine dans trois cas de saturnisme. (THERAPEUTIC EFFECTS OF D-PENICILLAMINE IN THREE CASES OF LEAD POISONING.)* Semaine des Hôpitaux Paris 38:3342-7 (Oct. 26), 1962.

Three patients suffering from Pb intoxication were treated orally with penicillamine in doses of 150 mg every 4-8 hr, amounting to 450-900 mg/day, intermittently for 6-11 days. No untoward effects were noted. Urinary Pb excretion increased generally within a few hours after administration. Penicillamine appears to be a useful therapeutic agent in Pb intoxication though possibly not quite as effective as EDTA.

- 2455** Perry, H.M., Jr., Tipton, I.H., Schroeder, H.A., and Cook, M.J. (Washington Univ., St. Louis, Mo.): *VARIABILITY IN THE METAL CONTENT OF HUMAN ORGANS.* Journal of Laboratory and Clinical Medicine 60:245-53 (Aug.), 1962.

Concentrations of essential (Mg, Ca, Mn, Fe, Cu, Zn, Mo) and nonessential metals (Sr, Ba, Al, Ti, V, Cr, Ni, Ag, Cd, Sn, Pb) in organs of 110 Caucasoid and 40 Negroid Americans, >20 yr of age (~44 yr) from 8 metropolitan areas, who had no evident disease prior to their sudden accidental deaths, were determined and compared with values obtained from analyses of materials of 100 foreign adult subjects from 8 different geographical areas, >20 yr of age, many of whom had been chronically ill. In the tabulation of data, the highest and lowest 10% of individual concentrations were discarded. The absolute concentrations given were the resulting values for the 10th and 90th percentiles, and 80% ranges were ratios of 90/10th percentiles. For the essential metals, the 80% range of concentrations was usually <3.5 and almost always <7.0; for the nonessential, >7 and often >14. These ranges were equally valid for the US healthy subjects, and similar but somewhat larger for the foreign chronically ill group. The Pb concentrations, in  $\mu\text{M/g}$  tissue ash, were as follows respectively in the US and foreign adults: liver, 0.29-1.2 and 0.14-1.4; kidney, 0.21-1.1 and 0.077-0.72; lung, 0.062-0.68 and 0.077, 0.75; aorta, 0.17-1.4 and <0.02-0.16; heart, <0.2-0.087 and <0.02-0.26; spleen, 0.033-0.43 and 0.023-0.48; brain, <0.02-0.19 and 0.02-0.20. The median con-

centration of Pb in organs of 10 infants who died in St. Louis at <1 mo of age was 0.10  $\mu\text{M}$  Pb/g of tissue ash in kidney.

- 2456** Peters, A., de Wyn, J., and Renaud, M.: *ERYTHROCYTES WITH BASOPHILIC GRANULATIONS IN THE ABSENCE OF LEAD POISONING.* Rev. Med. Nancy 87:37-46, 1962.

Pb is known to convert coproporphyrin III into protoporphyrin. The stippling and granulation in red cells in thalassemia and other conditions possibly involve a similar mechanism of chemical change in products of hemoglobin. (From Chemical Abstracts 56:14835, 1962)

- 2457** Pettinati, L., Gribaudo, C., Coscia, G.C., and Saracco, C. (Univ. Turin, Italy): *Aspetti dell'eliminazione del piombo nel saturnismo durante trattamento con versenato. (ASPECTS OF THE ELIMINATION OF LEAD IN SATURNISM DURING TREATMENT WITH EDTA.)* Folia Medica (Naples) 45:89-104 (Feb.), 1962.

Pb elimination in the urine, feces, gastric juice and bile were determined before and after treatment with CaEDTA in 5 subjects, 3 of whom were suffering from Pb colic, 2 of extensive Pb absorption and 1 of chronic Pb lesions. EDTA was administered iv in a single dose of 1.8 g in 3 cases. In another case, a single iv dose of 1.8 g was followed, after 2 wk, by 3 additional consecutive iv doses, and in a 4th case the iv dose of 1.8 g was followed, after 5 days, by 3 daily oral doses of 2.5 g each. Before treatment Pb values in the feces were higher than in the urine; after iv administration of EDTA Pb values in the feces decreased while the urinary Pb levels increased. In the only case treated orally there was evidence of increased elimination of Pb both in the urine and feces. Elimination of Pb in the gastric juice following iv administration of EDTA increased after a very short time, while Pb elimination in the bile was only slightly influenced by the chelating agent. (19 references)

- 2458** Pettinati, L., Gribaudo, C., and Rasetti, L.: *(ORAL AND INTRAVENOUS VERSENATE IN THE THERAPY OF CHRONIC LESIONS CAUSED BY LEAD.)* Minerva Medica 53:2092-7 (July), 1962.

Five patients, suffering from cardiovascular, nervous, or renal lesions caused by chronic Pb intoxication, were given orally 2.5 g EDTA/day for 4 days, followed by a single iv dose of 1.5 g EDTA. Pb excretion in urine reached levels 3 times as high as those determined before oral treatment and then dropped on the 2nd day. Following the iv injection of EDTA Pb levels were 5 times as high as those before treatment. The findings indicated that EDTA is a useful therapeutic agent in treatment of chronic Pb intoxication, and that the iv route is more effective. No unfavorable reaction was observed under either form of EDTA administration. Although the degree of effectiveness of EDTA therapy is conditioned by renal function, this therapy is recommended even in cases of serious renal impairment.

- 2459** Pettinati, L., Rasetti, L., and Gribaudo,

C. (Univ. Turin, Italy): Sul problema clinico del saturnismo da ritenzione di piombo. (THE CLINICAL PROBLEM OF LEAD INTOXICATION BY THE RETENTION OF BULLETS.) *Minerva Medica* 53:1216-18 (Apr.), 1962.

On the basis of the authors' experience in the University Hospital, they believe that the retention of Pb splinters or projectiles rarely produces clinical signs of intoxication. Only one out of 7 subjects seen by them showed symptoms indicative of Pb poisoning and he and 1 other patient had elevated Pb levels in the blood. These findings were not accompanied by significant increases of copro- or protoporphyrin nor by the appearance of stippled erythrocytes. The absence of toxic effects is explained by the fact that Pb is present in the tissues in coarse particles embedded in fibrous tissue and in this state is not absorbed.

- 2460** Posner, A.: (Manhattan Eye, Ear, and Throat Hosp., N.Y.) GLAUCOMA CAUSED BY EXPOSURE TO TETRAETHYLLEAD GASOLINE. *Notes on Ophthalmology*. Eye, Ear, Nose and Throat Monthly 40:853, 855 (Dec.), 1961; 41:57-8 (Jan.), 129-30 (Feb.), 1962.

Russian studies on the relation between TEL poisoning and the occurrence of glaucoma are discussed. Two of a series of articles by A.E. Shevalev and Z.M. Skripnichenko (1947-59) are reviewed in detail. The author states that while he has been successful in producing glaucoma in animals by sanguinarine, pilot studies with TEL injected into rabbits have been inconclusive. Among 800 cases of primary glaucoma seen in his private practice, only 3 patients had been found whose glaucoma might have been related to prolonged exposure to TEL. Two of them had been attendants in a gasoline station and the 3rd one was a research chemist in a gasoline plant.

- 2461** Prpić-Majić, D., Šarić, M., Beritić, T., and Kersanc, E. (Inst. Med. Research, Zagreb, Yugoslavia): Učinak različitih terapijskih doza kompleksa EDTA na kliničke i laboratorijske znakove trovanja olovom. (EFFECT OF VARIOUS THERAPEUTIC DOSES OF THE EDTA COMPLEX ON CLINICAL AND LABORATORY SYMPTOMS OF LEAD POISONING.) *Arhiv za Higijenu Rada i Toksikologiju* 13:29-43, 1962.

A group of 19 patients (12 men and 7 women, average, 38 yr) with Pb poisoning were treated with an infusion of ethylenediaminetetraacetate (EDTA) in 5% glucose. (The cause of poisoning was occupational in 9, and Pb-glazed dishes in 10.) Daily doses, divided into 2 equal parts in the morning and afternoon, ranged from 2.4 to 24 g. urinary excretion of Pb, Pb level in the blood, number of basophilic stippled cells and urinary coproporphyrin were determined in the course of therapy. Special attention was paid to possible nephrotoxic effects of the drug. Best results were obtained by administration of daily doses of 2.4-4.8 g EDTA for 2-3 days with 5-7-day intervals between treatments. The gradual introduction of unusually large doses of EDTA is explained by the favorable experience gained with such large doses in the treatment of a patient with severe Pb encephalopa-

thy. Although there is no ground for the need of a larger daily EDTA dose - at least judging by laboratory data on Pb elimination and Pb blood values - the absence of any toxic side-effects in the course of treatment is deemed significant. Even symptoms indicative of kidney lesions before treatment was begun proved to be no contraindication for the administration of EDTA. (21 references)

- 2462** Rasetti, I., Gribaudo, C., and Concina, E. (Univ. Turin, Italy): Segni ematochimici e loro correlazioni nella intossicazione da piombo. (BIOCHEMICAL CHANGES OF THE BLOOD AND THEIR CORRELATION IN LEAD POISONING.) *Lavoro Umano* 14, No. 4:171-80, 1962.

The study comprised 42 cases of occupational Pb poisoning, hospitalized in the Institute of Internal Medicine, University of Turin, over a period of 5 yr; 26 were in the state of acute poisoning with Pb colic and anemia, and the 16 cases of chronic poisoning showed evident damage of the nervous, cardiovascular, and renal systems. The men ranged in age from 20-60 yr and had been exposed to Pb from 2 mo to 40 yr. The data examined, and shown separately in tables for acute and chronic poisoning, included the time elapsed since exposure, type of work, number of erythrocytes, reticulocytes, and stippled red cells, urinary coproporphyrin, red-cell protoporphyrin, Pb in blood and urine. Correlations sought were as follows: red-cell protoporphyrin to reticulocytes, to red cells, and to blood-Pb; red cells to blood-Pb; reticulocytes to red cells.

In chronic poisoning, no correlation was demonstrable among the constituents examined. In the acute phase, the only relationship found was an inverse one between the number of reticulocytes and of red cells. While there was no correlation between the latter and the levels of Pb in blood, a characteristic decrease in red cells was evident when the blood-Pb exceeded 100 µg%.

The following results are pointed out; even in moderately severe chronic poisoning there is often no anemia. Furthermore, the number of basophilic stippled erythrocytes does not permit a definite diagnosis of Pb poisoning, particularly of the acute type, nor does it give an indication of the gravity of the poisoning. It is emphasized that all available tests should be carried out before a diagnosis of Pb poisoning is established.

- 2463** Rasetti, L., and Parigi, A. (Univ. Turin, Italy): L'acido δ-amino-levulico serico ed urinario nell'intossicazione saturnina. (SERUM AND URINARY δ-AMINOLEVULINIC ACID IN LEAD POISONING.) *Folia Medica (Naples)* 45:480-90 (June), 1962.

Blood and urine tests were carried out on 20 Pb-filers. Average values in blood were as follows: hemoglobin, 78; red blood cells, 4,040,000; Pb, 195 µg%; protoporphyrin, 231 µg%; coproporphyrin (CP), 3.5 µg%; urobilinogen, 13.5 µg%; ALA, 83 µg%. Basophilic stippling was found in only 10 subjects. Average values in urine were (µg/24 hr): CP, 586; ALA, 189; PBG, 1.89; Pb, 299. The coefficient of variance for ALA in plasma was 37% as compared to 73% for CP in urine, 49% for PP and

40% for Pb in blood or urine. Significant correlations were found between ALA levels in plasma and free PP, plasma ALA levels and urine ALA levels and urine Pb levels. It is concluded that the determination of ALA in blood constitutes a simpler and relatively more precise method for diagnosis of Pb intoxication than that of the determination of Pb in blood and urine.

- 2464** Roche, L., Lejeune, E., and Riedweg (France): Résultats d'une enquête effectuée à l'hôpital Edouard-Herriot concernant la fréquence de la pathologie toxique et professionnelle. Organisation d'un centre de pathologie toxique. (RESULTS OF AN INVESTIGATION CONDUCTED AT THE EDOUARD-HERRIOT HOSPITAL CONCERNING THE FREQUENCY OF TOXIC AND OCCUPATIONAL DISEASES. THE ORGANIZATION OF A TOXIC DISEASE CENTER.) Proceedings of the Society of Industrial Medicine of Lyon. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 23:386-8 (June), 1962.

An investigation on the frequency of occupational diseases conducted in 1959 at the Edouard-Herriot hospital among approximately 5000 patients showed that 112 cases were due to intoxications and occupational diseases, among which there were 5 cases of Pb poisoning.

- 2465** Romakhov, A.A. (Acad. Sci. Kazakh SSR): K voprosu o zaderzhke aerosolov svintsa v organizme cheloveka pri dykhanii. (RETENTION OF INHALED LEAD AEROSOLS IN THE HUMAN ORGANISM.) Trudy Instituta Kraevoi Patologii, Akademia Nauk Kazakhskoi SSR 10:95-9, 1962.

On the basis of actual atmospheric conditions in Pb works in Chimkent, Ust-Kamenogorsk and Lenino-gorsk, the authors constructed a model for statistical evaluation of the retention of Pb aerosols in the body of workers. The concentrations in the shops ranged from 20.02 down to 0.040 mg Pb/m<sup>3</sup>; the largest concentrations, 10.11-20.02, were not characteristic of exposure for they occurred during repair work directly at the siphon trap of the exhaust system. As tabulated, the average per cent retention of Pb on the basis of inhaled and exhaled Pb was calculated to be 45.3% from 14.48 mg/m<sup>3</sup> inhaled and 7.91 exhaled, down to 11.1% from 0.063 and 0.056 respectively. By assuming that if a workman at average physical effort exchanges during the workshift 7200 l. air containing 0.0005 mg Pb/l, 3.6 mg Pb would reach his lung. At this concentration, ~20% Pb is retained, which would correspond to 0.72 mg Pb. As the concentration rises, a greater percentage is retained.

- 2466** Rossi, A. (Univ. Naples, Italy): Il comportamento dello zinco sierico nell'intossicazione cronica da piombo. Nota preventiva. (CHANGES OF SERUM ZINC LEVELS IN CHRONIC LEAD POISONING. A PRELIMINARY NOTE.) Bollettino della Società Italiana di Biologia Sperimentale 38:1006-7, 1962.

The serum Zn levels in 10 normal subjects were 129-147 µg%. In 25 out of 28 cases of Pb intoxication,

the Zn levels were increased, in 3 cases normal, and in 2 cases decreased. In rabbits with experimental Pb intoxication, the Zn levels were only slightly increased after 30 days, but increased to pathological levels in 9 out of 10 animals later.

- 2467** Rossi, A., and Fondarcaro, S. (Univ. Naples, Italy): Il comportamento dello zinco sierico nell'intossicazione cronica da piombo umana e sperimentale. (THE LEVEL OF SERUM ZINC IN CHRONIC SATURNISM IN MAN AND EXPERIMENTAL ANIMALS.) Folia Medica (Naples) 45:1281-8, 1962.

Ten controls, 28 subjects with diagnosed Pb poisoning and 10 rabbits poisoned by daily oral administration of 2 ml of 10% Pb acetate for 60 days were studied. Zn and Pb in the blood, free erythrocyte protoporphyrins and urinary coproporphyrins were determined. In almost every case there was evidence of an increased Zn level in the blood which, however, was not proportional to the extent of Pb intoxication. (35 references)

- 2468** Rotta, C., Parigi, A., and Brusca, A. (Univ. Turin, Italy): Importanza della percentuale di piombo nelle leghe Pb-Sn sul suo assorbimento. Nota II. Data clinici. (INFLUENCE OF THE LEAD CONTENT OF Pb-Sn ALLOYS ON LEAD ABSORPTION. II. CLINICAL DATA.) Lavoro Umano 14:748-54 (Dec.), 1962.

A group of 36 men engaged in Pb filing an alloy containing 97% Pb plus 3% Sn for 3 mo, then for the same period, an alloy of 75% Pb plus 25% Sn, was studied. The number of red blood cells, hemoglobin content, number of punctate basophils, Pb level in blood, and urinary coproporphyrins were determined and compared. The data show clearly that health conditions are greatly improved when the alloy with the lower Pb content is used. The authors advise that alloys containing not more than 75% Pb be used.

- 2469** Rubino, G.F. (Univ. Turin, Italy): Intossicazione da Pb e metabolismo delle porfirine. (LEAD INTOXICATION AND PORPHYRIN METABOLISM.) Lavoro e Medicina 16:41, 1962.

The effect of Pb on the porphyrin metabolism is both direct and indirect. The indirect effect, based on the hemolytic action of Pb, produces a considerable increase of the porphyrin metabolism, while the direct effect manifests itself mainly by an inhibition of δ-aminolevulinic dehydrase. (From Medicina del Lavoro 54, No. 8-9:609 (Abstracts) 1963)

- 2470** Rubino, G.F. (Univ. Turin, Italy): THE ROLE OF LEAD IN PORPHYRIN METABOLISM. Panminerva Medica 4:340-4 (July-Aug.), 1962.

The porphyrin metabolism was studied in a group of 42 patients, half of them cases with acute symptoms of Pb intoxication or such in which acute symptoms had just subsided, the other half consisting of cases in which exposure to Pb had been discontinued long ago but which showed irreversible vascular changes. The porphyrin metabolism was abnormal in all of them though the severity

of the changes (increased urinary coproporphyrin and increased blood protoporphyrin) was different. In 11 cases the porphyrin and ALA contents of blood and bone marrow were determined. In vitro experiments with erythrocytes from normal and Pb-poisoned adults indicated that the increased coproporphyrin excretion and increased blood protoporphyrin content in Pb poisoning cannot be attributed to the direct action of Pb but rather to an inhibiting effect on the biosynthesis of heme whereby the greatest inhibition involves the synthesis of porphobilinogen from ALA and the incorporation of Fe by protoporphyrin. Assuming the concentration of Pb in the human body never to exceed 250  $\mu\text{g}\%$ , the active in vivo inhibiting Pb concentration is estimated to correspond to the in vitro effect of  $10^{-6}$  to  $10^{-5}$  M, which are concentrations capable of partially inhibiting ALA dehydrase and iron chelatase.

- 2471** Rubino, G.F., Rasetti, L., and Giarrusso, P. (Univ. Turin, Italy): EFFECT OF GLYCINE ADMINISTRATION ON  $\delta$ -AMINOLAEVULIC ACID AND PORPHOBILINOGEN EXCRETION IN LEAD POISONING. *Panminerva Medica* 4:388-9 (Sept.), 1962.

Two patients with Pb poisoning were given a single dose of 50 g glycine. Before and during the test, the urine was collected every hour over the following 8 or 11 hr, and every 6 or 12 hr until 48 hr after administration. No statistically significant increase in the excretion of ALA or porphobilinogen (PBG) was noted; uro- and coproporphyrin excretions also did not vary appreciably. The findings confirmed to the authors the hypothesis that Pb inhibits the transformation of ALA into PBG rather than the synthesis of ALA from glycine.

- 2472** Saita, G.: Malattie causate da piombo, leghe e composti. (DISEASES CAUSED BY LEAD, LEAD ALLOYS, AND COMPOUNDS.) Collections of Monographs of INAIL, No. 33, 107 pp.

The following problems associated with Pb intoxication are reviewed: toxicity of Pb; route of absorption and elimination; normal and pathological levels in various body fluids; porphyrin metabolism; criteria for diagnosis and prognosis; therapy; laboratory techniques. A bibliography of 185 references concludes this publication. (From *Medicina del Lavoro* 53:745 (Abstracts), 1962)

- 2473** Salamone, L. (Univ. Palermo, Italy): Modificazione emocoagulatorie in alcune tossicosi industriali. (ALTERATIONS IN BLOOD COAGULATION IN SOME INDUSTRIAL INTOXICATIONS.) *Medicina del Lavoro* 53:36-44 (Jan.), 1962.

The modifications in thromboplastin and prothrombin activities observed in cases of Pb and other industrial intoxications are reviewed. The mechanism of action of the toxic agents, coagulation tests for their differentiation, and the various drugs used for therapeutic action are discussed. (51 references)

- 2474** Šarić, M., Beritić, T., and Mimica, M. (Inst. Med. Res., Zagreb, Yugoslavia):

Slučaj teške olovne encefalopatije u odrasla čovjeka izliječen kompleksnom. (A CASE OF SEVERE ENCEPHALOPATHY IN THE ADULT TREATED WITH COMPLEXING AGENTS.) *Arhiv za Higijenu Rada i Toksikologiju* 13, No. 2:107-13, 1962.

The course and treatment of severe Pb encephalopathy in a farmer is described. The source of poisoning as learned from his wife was Pb-contaminated wine which he consumed in large quantities; shortly before his illness he had several times drunk wine that had been heated in earthenware containers. The diagnosis was based on the course of the illness, symptoms at hospitalization and laboratory findings (among them, Pb in blood, 225  $\mu\text{g}/100$  ml). The encephalopathy was accompanied by cachexia and quadriplegia. Treatment with large doses of EDTA was successful.

- 2475** Schepers, G.W.H. (Wilmington, Del.): THE MINERAL CONTENT OF THE LUNG IN CHRONIC BERYLLIOSIS. *Diseases of the Chest* 42:600-7 (Dec.), 1962.

Spectrographic analysis for Pb, among other trace elements, in the lungs of 20 cases of chronic berylliosis showed an av 63  $\mu\text{g}$  Pb/g (range 5.4-157,  $\text{SD} \pm 51$ , coefficient of variation 81%). The deviation from normal and sarcoidotic values was 1,680 and 1400%, respectively. (17 references)

- 2476** Seghizzi, P., Straneo, G., and Andreuzzi, P. (Univ. Pavia, Italy): Primi segni pletismografici nelle vasculopatie periferiche professionali. (EARLY PLETHYSMOGRAPHIC SIGNS IN OCCUPATIONAL PERIPHERAL VASCULAR DISEASES.) *Atti della Società italiana di Cardiologia* 22, No. 2:268-70, 1962.

The study involved 21 cases with occupational disease, among them 2 patients with Pb poisoning, a typographer and a varnisher. Collateral circulation was noted in one of these patients; the other one showed a sympatheticotonia combined with an organic lesion. The tests indicated that plethysmography may reveal serious vascular damage and may be useful in the early diagnosis of some occupational hazards.

- 2477** Stanković, D. (Inst. Public Health, Belgrade, Yugoslavia): Kritički osvrt na značaj laboratorijskih metoda ispitivanja u ranoj dijagnostici saturnizma. (CRITICAL REVIEW OF LABORATORY TESTS USED IN THE DIAGNOSIS OF EARLY LEAD POISONING.) *Medicinski Arhiv* 16:51-7 (Nov.-Dec.), 1962.

Exact interpretation of laboratory tests facilitates the diagnosis of early Pb poisoning. Blood changes such as an increase of stippled erythrocytes and of reticulocytes, polychromatophilia and hypochromic anemia are of considerable diagnostic value although they are no certain proof of Pb poisoning. An increased Pb level in the blood does not prove the presence of Pb poisoning nor does it indicate the degree of intoxication. The presence of Pb in urine and feces indicates Pb absorption but does not confirm the diagnosis of Pb poisoning nor give data on its intensity. Determination of urinary coproporphyrin is very important.



ant for an early diagnosis because an increase of urinary coproporphyrins occurs prior to the appearance of humoral and clinical signs. However, the increase of urinary coproporphyrins is not specific for Pb poisoning and must be evaluated in combination with other humoral and clinical changes. A diagnosis of Pb poisoning should be based mainly on clinical symptoms and if these disagree with laboratory findings, the clinical signs should be given priority. (From author's French summary) (41 references)

- 2478** Stanković, D. (Ind. Hyg. Center, Sarajevo, Yugoslavia): Prilog proučavanju dijagnostičke vrednosti laboratorijskih testova u otkrivanju početne olovne intoksikacije. (THE DIAGNOSTIC USEFULNESS OF LABORATORY TESTS IN DETECTING LEAD POISONING.) Medicinski Glasnik 16:407-9 (Sept.), 1962.

The following tests were evaluated statistically (Student test) in 67 workers, 23-57 yr old, exposed to Pb for 4 mo-2 yr: Hemoglobin, erythrocytes, reticulocytes, stippled cells, porphyrins, leukocytes, differential counts, including basophil leukocytes.

- 2479** Stanković, D. (Inst. of Hyg., Sarajevo, Yugoslavia): (CONTRIBUTION TO THE STUDY OF EARLY MANIFESTATIONS IN OCCUPATIONAL LEAD POISONING.) Srpski Arhiv za Celokupno Lekarstvo 90:1141-9 (Dec.), 1962.

A group of 67 founders, exposed for 1 mo to Pb concentrations of 0.5-24.4  $\mu\text{g/l}$  air, was studied. No significant deviations from the normal were noted for hemoglobin, stippled erythrocytes and coproporphyrin during the period of exposure, while reticulocytes increased markedly. The conclusion was drawn that an increase of reticulocytes presents an early sign of the toxic action of Pb at a stage where no other objective or subjective signs exist. Early Pb intoxication is characterized by marked changes of the red blood cell count, stippled erythrocytes, reticulocytes and coproporphyrin. However, there is no significant reduction of hemoglobin, since the anemia is usually only moderate. In manifest Pb poisoning, all laboratory tests show deviations from the normal values and subjective and objective signs and symptoms are present. The arterial pressure does not change during the early period of development of Pb poisoning, during Pb absorption and in the early period of Pb intoxication. (From author's French summary)

- 2480** Stanković, M., Petrović, Lj., and Poletić, D. (Inst. Public Health, Belgrade, Serbia): A CONTRIBUTION TO THE LABORATORY DIAGNOSTICS OF EARLY SATURNISM. Arhiv za Higijenu Rada i Toksikologiju 13:189-94, 1962.

The dicalcium salt of  $\text{Ca}_2\text{EDTA}$  (3 doses of 1 g each in the course of 1 day) was administered orally to 8 healthy persons, 29 printers without clinical manifestations of Pb poisoning and 18 Pb smelters with distinct symptoms of Pb poisoning. Average urinary Pb excretion (mg/24 hr) in these 3 groups was  $0.117 \pm 0.043$ ,  $0.236 \pm 0.101$ , and  $2.476 \pm 1.233$ , respectively. The conclusion is drawn that, in a diagnostic test, subjects with

urinary Pb excretion exceeding 0.340 mg/24 hr (after oral treatment with 3 g  $\text{Ca}_2\text{EDTA}$ ) may be suspected of Pb poisoning. The test was given also to a group of 8 workers who, after removal from Pb exposure for about 5 yr, were considered as medically rehabilitated and fit to return to their jobs. In this group, urinary Pb excretion, at 24 hr after the first dose of  $\text{Ca}_2\text{EDTA}$ , ranged from 0.336-0.843 (av 0.482) mg/24 hr, which indicated that the workers were not ready to return to their previous jobs.

- 2481** Stovbun, A.T., Yatsyuk, M.D., Pomarenko, V.I., and Yakovleva, L.S.: (DATA ON THE TRACE ELEMENT COMPOSITION OF HUMAN MILK AND VARIOUS MODIFICATIONS OF COW MILK.) Nauk. Zap. Ivano-Frankivs'k. Med. Inst. 1962, No. 5:38-9.

A spectral method was used to determine Cu, Mn, Ni, Zn, Pb, Sn, Fe, and Mo in women's milk and in milk products for children. During the first days of lactation Cu content in women's milk was higher than in cow milk, while Fe and Ni contents were higher than in mature milk. Whey contained large amounts of Cu, Ni, and Zn but Fe content in cheese and cream was 5-7 times higher than in whey. Cow milk contained 10 times more Cu and 2 times more Fe than ion-exchanged milk. (From Ref. Zh., Biol. Khim. 1963, Abstr. No. 20F1529; Chemical Abstracts 60:8422, 1964)

- 2482** Taveira, M. (Univ. Brazil, Rio de Janeiro): (INTOXICATIONS OF DENTAL AND PHARMACEUTICAL INTEREST OCCURRING IN THE CHEMICAL INDUSTRIES.) Med., Cir., Farm. 301: 249-58, 1962.

Untoward effects from Pb, Hg, Bi, HF,  $\text{SO}_3$ ,  $\text{H}_2\text{SO}_4$ , Cd, Tl, and P are reviewed as these affect the buccal mucosa, salivary glands, teeth, and bones, on the one hand, and the chemical and toxic signs encountered on the other hand. (From Chemical Abstracts 58:13048, 1963)

- 2483** Tilis, A.Yu., Vengerskaya, Kh.Ya., and Stepovaya, N.E. (Uzbek Inst. Sanit. Hyg., Occup. Dis., Tashkent, USSR): Diagnosticheskoe znachenie velichiny koeffitsienta nedookisleniya pri vozdeistvii tyazhelykh metallov. (DIAGNOSTIC SIGNIFICANCE OF INCOMPLETE OXIDATION IN THE ACTION OF HEAVY METALS.) Gigiena Truda i Professional'nye Zabolevaniya 6, No. 3:30-4, 1962.

In individuals exposed to Pb the oxidation processes remain unchanged for a certain time. However, as manifestations of poisoning progress, the amount of incompletely oxidized products, excreted in the urine, increases. This phenomenon is an important criterion in assessing the clinical condition of these patients. (From authors' English summary)

- 2484** Tolot, F., Jaquis, Genevois, M., Soubrier, R., and Bresson, J.-R. (Inst. Ind. Med., Lyon, France): Emploi des chélateurs "per os" dans le traitement et la prophylaxie d l'intoxication saturnine. (THE USE OF CHELATING AGENTS "PER OS" IN THE TREATMENT AND PROPHYLAXIS OF LEAD

POISONING.) Proceedings of the Society of Industrial Medicine at Lyon. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 23:376-9 (June), 1962.

The efficacy of oral administration of CaEDTA was tested in 2 patients suffering from occupational Pb intoxication with colics and anemia, who had been previously treated with iv injections of CaEDTA, and 2 Pb welders who did not show any overt signs of intoxication. A dose of 2 g CaEDTA was administered orally on the first 5 days of the week for 6 wk. Urinary Pb excretion was measured every 5th day and the data obtained were tabulated. Oral administration of CaEDTA is recommended for use in cases of convalescence from Pb intoxication, following a course of iv injections, and as a preventive measure in workers exposed to Pb.

- 2485** Udenfriend, S. (Natl. Heart Inst., Bethesda, Md.): FLUORESCENCE ASSAY IN BIOLOGY AND MEDICINE. New York, Academic Press, 1962, pp. 302-7.

The fluoremetry of porphyrins and its value in diagnosis of Pb poisoning is included. Urinary coproporphyrin and erythrocytic protoporphyrin levels observed in Pb poisoning are listed as 500-3000 µg/day and 200-2000 µg/100 ml of cells, respectively, while the levels for normals are 100-300 µg/day for males and 45-275 µg/day for women, and 20-50 µg/100 ml of cells, respectively.

- 2486** Veliev, B.A. (Kazakh Acad. Sci., USSR): K voprosu lecheniya bol'nykh so svintsovoi intoksikatsiei kompleksami i vitaminom B<sub>12</sub>. (COMPLEXONS AND VITAMIN B<sub>12</sub> IN TREATMENT OF LEAD POISONING.) Trudy Instituta Kraevoi Patologii, Akademiya Nauk Kazakhskoi SSR 10:198-205, 1962.

Twelve patients with Pb poisoning were given complexing agent CaNa<sub>2</sub> 1,2-diaminocyclohexanetetraacetate, and 14 received CaNa<sub>2</sub>EDTA. Both drugs were administered iv in 20 ml of a 10% solution, once or twice daily, for 3 days, followed by 3 days of rest. Four such 6-day cycles were used. A 3rd group of 17 patients received CaNa<sub>2</sub>EDTA plus 100 units of vitamin B<sub>12</sub> intramuscularly every other day. In most patients of group 1 and 2 intestinal pains were relieved after the 1st injection but returned after 1-1.5 hr in a lesser degree. Gradually, appetite returned, pains in bones disappeared, weight increased and blood pressure became normal. Urinary Pb excretion increased and the blood picture improved. Treatment in groups 1 and 2 seemed to be equally effective; use of vitamin B<sub>12</sub> added to the curative effect of CaNa<sub>2</sub>EDTA.

- 2487** Veliev, B.A. (Kazakh Acad. Sci., USSR): Opyt lecheniya bol'nykh so svintsovoi intoksikatsiei tiiosul'fatom natriya. Predvaritel'noe soobshchenie. (EXPERIMENTAL TREATMENT OF LEAD POISONING PATIENTS WITH SODIUM THIOSULFATE. (PRELIMINARY REPORT.)) Trudy Instituta Kraevoi Patologii, Akademiya Nauk Kazakhskoi SSR 10:206-11, 1962.

The therapeutic effect of Na thiosulfate was test-

ed in 22 patients (19-45 yr old, 21 men, 1 woman, who had been exposed to Pb 3 mo-12 yr), suffering from Pb intoxication. The drug was administered iv (30% sterile solution) in doses of 20 ml 1-2 times daily. Immediately after administration of the drug, pains in the abdomen diminished and on the 5-6th day or in some cases on the 10th day they completely ceased. Erythrocytoporphyrinuria and painfulness of the liver diminished in the majority of the cases. The antitoxic function of the liver, judging by the excretion of hippuric acid, was also improved and restored to normal in individual cases. However, the constituents of the blood did not return to normal.

- 2488** Veliev, B.A. (Kazakh Acad. Sci., USSR): Izuchenie gemoliticheskogo svoistva syvotki krovi bol'nykh s anemiei pri svintsovoi intoksikatsii. (STUDY OF THE HEMOLYTIC PROPERTY OF THE BLOOD SERUM OF LEAD-INDUCED ANEMIA PATIENTS.) Trudy Instituta Kraevoi Patologii, Akademiya Nauk Kazakhskoi SSR 10:230-9, 1962.

The sera from 18 patients with Pb anemia of varying degree and of 3 healthy donors were studied. A thermolabile hemolytic protein factor was present in Pb poisoning patients which in vitro hemolyzed its own and donor erythrocytes. Biophysical changes in the erythrocytes of the patients and of the donors occurred more rapidly and more intensively in patient sera than in controls. The vitality of erythrocytes in their own serum was lower in patient sera than in donor sera. (From author's summary)

- 2489** Warren, H.V. (Univ. British Columbia, Canada): DOES GEOLOGY HOLD A KEY TO BETTER HEALTH? GEOLOGIC-EPIDEMIOLOGIC STUDIES SHOW INTRIGUING RELATIONSHIP. Mining Engineering 14:41-5 (July), 1962.

Trace elements in man, rock, soil and vegetal matter were discussed. The author then cites Allen-Price's (1960) epidemiological studies on cancer in West Devonshire, England, which showed a striking difference of the cancer rate in various parishes. Allen-Price stated that the water supply was the only difference that could account for this. Millman (1957) whose paper apparently had not been known to Allen-Price, reported that he found an anomalously high content of Pb, Hg, Sn, Cu and Zn in trees and soil of this area and that high Pb concentrations occur in twigs and leaves growing in the proximity of Pb-Zn deposits. Howe (1961) also reported clearly varying epidemiologic patterns for some types of cancer and other diseases and implicated Pb, Zn and polluted water in the causation of gastric cancer. Presently made studies of Devonian rocks show a high Pb content in rocks and soils, a wide variation in the content of Pb and other metals in different facies and lower Pb contents in Cretaceous rocks of Sussex. A carcinogenic action of Pb has first been mentioned by Zollinger (1952). Since then other workers have found that large doses of Pb will induce renal cancer in rats.

- 2490** Wilcocks, C.: CIDER AND LEAD POISONING - AN EIGHTEENTH-CENTURY INVESTIGATION. Health Horizon 1962:31-4(Summer).

The author recalls Sir George Baker's Essay Concerning the Cause of the Endemic Colic of Devonshire, published in 1767. The colic was, in fact, Pb poisoning and was traced to the use of Pb in the troughs and presses employed in the manufacture of cider. Pb poisoning of a similar nature has been reported in Britain and elsewhere in very recent years and can be related to the increasingly popular practice of domestic wine-making. Such a case is cited in a man who employed an old earthenware crock, the glaze of which contained Pb. What seemed to be a surgical abdominal emergency proved to be a case of Pb poisoning. (From Bulletin of Hygiene 37:1246, 1962)

- 2491** Williams, J.D., Matthews, G.A., and Judd, A.W. (Dept. Clin. Path., West Herts.; St. Paul's Hosp., Hemel Hempstead, England): ORAL CALCIUM DISODIUM VERSEDATE IN TREATMENT OF LEAD POISONING. British Journal of Industrial Medicine 19:211-5 (July), 1962.

Eight Pb workers, 34-60 yr old, who had been exposed to Pb from 3 mo-12 yr and showed an excessive Pb absorption, were treated orally with 4 g  $\text{CaNa}_2\text{EDTA}$ /day in divided doses for 7 days. Before treatment Pb values ranged from 1.0-170  $\mu\text{g}/100\text{ ml}$  in blood, 140-940  $\mu\text{g}/\text{l}$  in urine; coproporphyrin, 1+-4+, and stippled cells, 1800-56,000/million. Following treatment the total Pb excretion in urine ranged from 7.6-23.8 mg, av 14.32 mg Pb/man. In 7 cases hemoglobin level rose an av of 1.0 g%; stippled cell count was lower in 4 cases and higher in 4. Pb levels in blood fell in 5 patients, remained the same in 1, and rose in 1. No side effects were noticed and symptomatically the improvement was marked. (20 references)

- 2492** Zielhuis, R.L., and Hartogensis, F. (Inst. Prev. Med., Leiden, Netherlands): Die Beziehungen zwischen der Exposition und der Gefährdung in bleiverarbeitenden Betrieben. (RELATIONS BETWEEN EXPOSURE AND HAZARD IN PLANTS HANDLING LEAD.) Staub 22, No. 11:435-9, 1962.

During the period from 1956-1959 a technical and hygienic study was made in 3 Dutch pigment factories, comprising about 180 workers. In a table various exposures (0.00-0.65 mg Pb/m<sup>3</sup> of air) were correlated with data for hemoglobin, coproporphyrin excretion and stippled cells. A definite relation was found between atmospheric Pb concentration and the clinical data. A Pb concentration of 0.1 mg/m<sup>3</sup> of air was considered as the MAC. No Pb hazard exists as long as the coproporphyrin level is <1.5 according to the scale of Donath. Values of 1.5-2.5 indicate increased Pb exposure and levels >2.5 indicate a hazardous Pb exposure. Pb chromate dust has about the same toxicity as other Pb pigment dusts.

### 1963

- 2493** Abdel-Ghaffar, Y., Sherif, Y.A., El-Massry, Z.H., and Barsoom, K.A. (Ain-Shams Univ., Cairo, Egypt): LEAD ENCEPHALOPATHY: CASE REPORT. Journal of the Egyptian Medical Association 46:965-8, 1963.

A case of Pb encephalopathy in a 19-yr-old worker

in a Pb factory is described. During his 10-hr workday, he attended to the smelting of alloys and manipulation of pipes, etc. After an exposure for 18 mo the patient began to complain of abdominal colics, constipation and headache; his gums showed a blue line. After an attack of convulsions a provisional diagnosis of Pb encephalopathy was made. The man was given 10 ml 10% Ca gluconate iv every 6 hr and 2 ml dimercaptopropanol (BAL) im every 4 hr for 3 days. The urine was found to contain 480  $\mu\text{g}$  Pb/l, spinal fluid 28  $\mu\text{g}/100\text{ ml}$  and blood 124  $\mu\text{g}/100\text{ ml}$ . Ten weeks later the Pb content of spinal fluid and urine had dropped to 14  $\mu\text{g}/100\text{ ml}$  and 96  $\mu\text{g}/\text{l}$ , respectively.

Attention is drawn to the fact that encephalopathy was present in this case although the neurological examination had not shown any evidence of unilateralization. The effectiveness of the treatment with BAL was pointed out.

- 2494** Aitbaev, T.Kh., Aldanazarov, A.T., and Beglova, T.G.: (CHANGES IN BLOOD MUCOPROTEINS DUE TO LEAD POISONING.) Materialy 1-oi (Pervoi) Resp. Nauchn. Konf. po Vopr. Gigiena Truda i Prof. Zabolevani, Karaganda, Sb. 1963:88-9.

The content of serum mucoid was 2.8% lower and the content of sialic acids 8.1% lower in 124 patients with chronic Pb poisoning without aggravation as compared with Pb workers without symptoms of poisoning. The corresponding figures for patients with aggravation were 8.5 and 6.3%, respectively. The mucoid content in the blood of patients with chronic Pb poisoning varied. Thirty dogs with experimental Pb poisoning also had a low content of sialic acid in the blood serum. (From Referativnyi Zhurnal, Farmakologiya, Toksikologiya 1964, Abstr. No. 6.54.314; Chemical Abstracts 62:12357, 1965)

- 2495** Alexeieva, Z., Batolska, A., Kostov, Moseva, N., and Celebiev, V. (Sofia, Bulgaria): La cure d'eau sulfureuse dans l'intoxication par le plomb et par le mercure. (TREATMENT WITH SULFUR-CONTAINING WATERS IN LEAD AND MERCURY POISONING.) In Union des Sociétés de Sciences Médicales, Société d'Hygiène: Premier Congrès National d'Hygiène et de Sécurité du Travail. Rapports et Résumés des Travaux (First National Congress of Industrial Health. Abstracts of Papers). Bucharest, 1963, p. 47.

A 20-day treatment consisting of 8-12 baths at 37° and the consumption of 1-1.5 l of S-containing mineral water was prescribed to a group of 80 workers with abnormal absorption of, or intoxication by, Pb and Hg. At the end of the cure, subjective symptoms and clinical manifestations were obviously improved. There was an increase of red blood cells, a decrease of stippled red cells and a return to normal of the number of reticulocytes, urinary porphyrins, Pb level in blood and urine, liver function, gastric motility, etc. Best results were obtained in subjects in the stage of abnormal absorption or early intoxication. Treatment with S-containing waters for the prophylaxis and treatment of poisoning by heavy metals is recommended.

- 2496** Alexeieva, Z., and Moseva, N. (Sofia, Bulgaria): La valeur diagnostique de la méthode polarographique de dosage du plomb dans le sang. (THE DIAGNOSTIC VALUE OF THE POLAROGRAPHIC DETERMINATION OF LEAD IN BLOOD. In Union des Sociétés de Sciences Médicales, Société d'Hygiène: Premier Congrès National d'Hygiène et de Sécurité du Travail. Rapports et Résumés des Travaux (First National Congress of Industrial Health. Abstracts of Papers). Bucharest, 1963, p. 36-7.

Studies on 66 workers exposed to Pb or with Pb intoxication in different clinical stages showed that manifest clinical symptoms are preceded by an increase of the Pb level in the blood. Simultaneously, reticulocytosis and urinary porphyrins appear. There is a relation between the level of Pb in blood and urine. The investigations revealed that the determination of Pb in the blood is useful for early diagnosis of Pb poisoning before manifest clinical symptoms occur.

- 2497** Anatovskaya, V.S. (Inst. of Occup. Hyg. and Prof. Diseases, Khar'kov, Ukrainian SSR): Lechenie unitiolom bol'nykh s khronicheskoi intoksikatsiei svintsom pod kontrolem sul'fgidril'nykh grupp belkov krovi. (UNITHIOL THERAPY OF PATIENTS WITH CHRONIC LEAD POISONING BY CONTROL OF THE SULFHYDRYL GROUPS OF BLOOD PROTEINS.) Gigiena Truda i Professional'nye Zabolevaniya 7:19-23 (Aug.), 1963.

In the past decade a number of drugs containing S in the form of reactive sulfhydryl groups, have been used in intoxications by poisons attacking the sulfhydryl groups of the organism. Drugs of this type include British Anti-Lewisite (BAL) and unithiol (sodium 2,3-dimercaptopropanesulfonate) which was synthesized by the Ukrainian Scientific Institute of Sanitary Chemistry. Unithiol is readily soluble in water, exhibits powerful antidotal activity and being nontoxic, is well tolerated.

In the course of several years, 104 workers, 27-48 yr old, of various trades (typographers, storage-battery plant employees, etc), suffering from chronic Pb intoxication, who had been admitted to the clinic of the Ukraine Scientific Institute of Industrial Hygiene and Occupational Diseases (Kharkov), were treated with one of the unithiol preparations. Generally, they had exhibited the usual signs of poisoning, with 15.3% of them showing moderately severe intoxication, and the remaining being afflicted with the milder form. The more severe forms of intoxication were characterized essentially by abnormal blood counts, and disturbances of the gastroenteric and central nervous systems; decreased liver and kidney functions were also observed. Pb line and Pb pallor were observed only infrequently. The blood and urine showed increased concentrations of Pb and increased coproporphyrinuria was found. Analyses of the blood for free sulfhydryl groups showed decreased content in all, corresponding to the degree of intoxication (the variations ranged down to averages of 47.5 mm (as measured by polarographic waves) as against a normal of 60.9 mm). The symptomatology of moderately severe and mild

chronic poisoning, including indices of sensory disorders (auditory, visual, tactile) is discussed at some length.

The patients were treated with 20-25 im injections of 5 ml of a 5% solution of unithiol once or twice daily. No undesirable effects were noted. After the first 3-5 injections, pains (abdominal, joint, of extremities, headaches) greatly diminished, and finally disappeared. Elimination of Pb increased, the cellular and chemical components of blood, including the sulfhydryl groups, returned to normal.

The author concludes that unithiol is an effective therapeutic agent in Pb poisoning. Combined treatment with symptomatic agents such as group-B vitamins, glucose, and others, is considered.

- 2498** Ankerst, H., and Weimer, G. (Hamburg, Germany): Gefahren bei der Arbeit mit toxischen Emailrohstoffen und Hilfschemikalien. (HAZARDS IN WORK WITH TOXIC RAW MATERIALS FOR ENAMELS AND AUXILIARY CHEMICALS.) Glas-Email-Keramik 14, No. 4:124-6 (Apr.), 1963.

Hazards in the enamel industry, particularly those caused by such toxic raw materials as quartz, compounds of Pb, Ba, As, Sb and Zn, mordants and other additives, are discussed. The Pb compounds used are minium, Pb carbonate and Pb silicate. The lethal dose of Pb is between 11 and 27 g, but daily inhalation of 1 mg Pb will cause the so-called "Pb disease" which is characterized by colics, muscular pain, paralysis and liver damage. Although Pb compounds have been largely eliminated as raw materials in the enamel industry and precautionary measures are taken where they are still applied, their complete exclusion should be accomplished. The introduction of Pb-free majolica shows that this is feasible.

- 2499** Baker, G.: SIR GEORGE BAKER AND LEAD POISONING. Medical Science 14:113 (Oct.), 1963.

This is a brief account of Sir George Baker's analysis of "Poitiers colic" in Devonshire to be actually Pb poisoning. An excerpt from his report in 1767 in the Medical Transactions of the College of Physicians of London, telling of his discovery that the cider that had caused the illnesses had been made in Pb-lined presses or stored in a Pb cistern, is included.

- 2500** Basin, B. (Inst. Ind. Med., Lille, France): Le dosage de l'acide delta-aminolévulinique dans le saturnisme. (DETERMINATION OF  $\delta$ -AMINOLEVULINIC ACID IN LEAD POISONING.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 24:638-44 (July-Aug.), 1963.

Delta-aminolevulinic acid (ALA) and porphobilinogen in the urine were determined by chromatography. For 10 normal subjects the values found (mg/l) were  $1.8 \pm 1.2$  and  $1 \pm 0.5$ , respectively. In 24 workers of a battery factory, who appeared to be in good health and without clinical signs of Pb poisoning, the urinary content of ALA ranged from 5-46 mg/l, while porphobilinogen was about normal, the highest value being 3 mg/l. Also, the number of basophilic stippled cells was still in the nor-

mal range while the concentration of ALA was already increased. It is pointed out that the determination of urinary ALA is an important biologic test for the diagnosis of Pb poisoning.

- 2501** Bastenier, H. (Univ. Brussels, Belgium): *Considérations sur le diagnostic et le traitement du saturnisme d'origine professionnelle. (CONSIDERATIONS ON THE DIAGNOSIS AND TREATMENT OF OCCUPATIONAL LEAD POISONING.)* Acta Clinica Belgica 18: 144-51, 1963.

The clinical picture of occupational Pb poisoning has been undergoing considerable changes. Due to improvement of hygiene and sanitary education, cachexia, encephalopathy and severe anemia have practically disappeared, Pb colics are becoming less violent. The diagnosis of Pb poisoning is now based essentially on such nonspecific phenomena as the presence of stippled red blood cells and urinary coproporphyrin and the specific sign of increased Pb levels in the blood and urine. A normal adult ingests daily an average of 0.35 mg Pb of which 10% is absorbed by the intestine, and inhales an average of 0.04 mg of which 30-40% is retained and rapidly absorbed. This results in a Pb concentration in the blood of 10-70 µg/100 ml, with 80 µg being considered as the upper limit.

Workers exposed to Pb often have Pb levels of 80-140 µg/100 ml blood without showing detectable signs of intoxication. Clinical signs are frequent at Pb levels of 150-500 µg/100 ml blood and they are always present at values >500 µg. In serious cases such as encephalopathy with coma, Pb concentrations in blood may be ≥1500-2000 µg. As for urinary Pb, clinical signs are rare at Pb levels <150 µg/l, frequent at 150-500 µg and usual at Pb concentrations >500 µg/l of urine. However, normal Pb levels in blood and urine do not guarantee the absence of Pb absorption. For this reason, it may be essential to investigate whether Pb has been absorbed by the bones, by mobilizing any Pb which may be present by injection of EDTA at doses of 0.1 ml/kg body weight, using a 10% solution. Subsequent urinary Pb excretion of <300 µg/l within 3 and 6 hr indicates the absence of any latent Pb absorption. Subjects eliminating 300-1000 µg, without demonstrating clinical signs, should be subjected to observation, while higher values point to established or latent Pb poisoning. Urine samples should not be taken later than 6 hr after EDTA administration as 90% of the effect of the chelating agent occurs in the first 6 hr. The chelation test cannot be used in the presence of severe renal insufficiency. Since EDTA possesses some toxicity of its own, it is recommended not to exceed doses of 50 mg/kg body weight/day which should be administered in 2 iv perfusions over a period of 1 hr each. After 5-7 days, the treatment should be interrupted for 1-2 weeks. Oral administration of EDTA causes a less pronounced increase of urinary Pb excretion than iv injection. Other chelating agents which may be administered orally, such as penicillamine, are being studied.

- 2502** Batolska, A.: (CARBONIC ANHYDRASE IN OCCUPATIONAL LEAD POISONING.) Nauchni Trudove, Nauchno-Izsledovatel'ski Institut

Okhrana Truda Professional'nye Zaboljavanija 10:55-9, 1963.

In a study on 81 Pb workers, the activity of carbonic anhydrase decreased as the general physical condition of the men, due to the Pb poisoning, deteriorated. Depression of the activity of carbonic anhydrase by Pb poisoning had been previously demonstrated in vitro. (From Abstracts of Bulgarian Scientific Literature, Medicine and Physical Culture 6, No. 4:32, 1963; Chemical Abstracts 62:9684, 1965)

- 2503** Berjak, J. (Johannesburg, South Africa): *CLINICAL ASPECTS OF AN OUTBREAK OF METALLIC POISONING AT BY-PRODUCTS LTD.* Proceedings of the Mine Medical Officers' Association 43:7-11 (May-June), 1963.

An outbreak of heavy metal poisoning during which 14 cases were admitted to the Crown Mines hospital, caring for cases from By-Products Ltd., is described. The men (almost all smelters) had various complaints, mostly of abdominal nature. Ten showed a Pb line, 9 anemia, 12 basophilia. Ten had urinary porphyrins in excess of the normal level. Because of lack of facilities, Pb in blood could not be determined; for the same reason, urinary Pb could be determined in only 3 cases. Treatment consisted of rest and good food; in 3 cases EDTA was administered. After discharge from the hospital the patients were kept on light work for 30 days and after re-examination were returned to normal duty.

- 2504** Bosshard, R. (Swiss Accident Insurance Board, Lucerne): *Die medizinischen Aspekte der neuen Verordnung über die Verhütung von Berufskrankheiten vom 23. Dezember 1960. (THE MEDICAL ASPECTS OF THE NEW DECREE ON THE PREVENTION OF OCCUPATIONAL DISEASES OF DECEMBER 23, 1960.)* Zeitschrift für Unfallmedizin und Berufskrankheiten 56:180-90, 1963.

The author discusses the rights and limitations of SUVA (Schweizerische Unfallversicherungsanstalt) in issuing and enforcing directives to the industry concerning the technical and medical prophylaxis and supervision of workers in hazardous occupations. The new directive of special interest in this discussion makes it obligatory for industries dealing with hazardous substances, such as dust (quartz, asbestos), Pb, Hg, benzene and its homologues (toluene, xylene) C disulfide, tri- and perchlorethylenes, tar, pitch and similar materials, ionizing radiation, aromatic amines, and work under air pressure, to provide medical examinations for workers and, if deemed necessary by the physician, to effect removal of the exposed worker from the hazardous site. SUVA has the right to control employment of workers in hazardous industries, as well as to retain those insured workers who are no longer in hazardous occupations under its surveillance because of possible long-range effects of past exposure. The medical history of workers at the time of employment, age of worker, type and extent of exposure, type and frequency of laboratory and physical examinations (blood, urine, cystoscopy, X-rays, pregnancy, etc) MAC values, etc, are all factors to be considered in carrying out the new directive.

As expressed in this article, it is the purpose of SUVA to maintain a flexible but effective supervisory program of employment, prevention and rehabilitation with the greatest possible adaptation to the needs of the individual workers, the present state of medical science and the circumstances prevailing in the various industries and/or occupations involved.

- 2505** Brigatti, L., Parigi, A., and Varetto, L.: Il comportamento delle transaminasi in soggetti esposti al rischio saturnino. (THE BEHAVIOR OF TRANSAMINASE IN SUBJECTS EXPOSED TO LEAD.) *Medicina Sociale* 53: 1268, 1962; *Medicina del Lavoro* 54:231 (Abstracts), 1963.

See Abstract No. 2378.

- 2506** Byczkowska, Z., and Antczak, K. (Działu Clin. Inst. Med. Pracy, Łódź, Poland): Wartość testu chelatonowego - plumburii prowokowanej w diagnostyce ołowicy. (THE VALUE OF THE CHELATION TEST IN PROVOKING URINARY EXCRETION OF LEAD IN THE DIAGNOSIS OF LEAD INTOXICATION.) *Medycyna Pracy* 14, No. 3:211-22, 1963.

The correlation between spontaneous Pb excretion in the urine, the results of the chelation test and clinical symptoms were studied on 82 patients suffering from Pb poisoning. The patients were divided into 3 groups: (1) subjects exposed to Pb up to the moment of hospitalization; (2) subjects who had been removed from Pb exposure for at least several months prior to hospitalization; (3) a group of individuals with irregular exposure. The results of the administration of 1 g CaEDTA, led the authors to conclude that indication for this test be limited to individuals who excrete spontaneously >100 µg Pb/24 hr and who reveal positive signs of Pb intoxication, an increase of coproporphyrin, and basophilic stippling. In the 2nd part of the study the chelation test was applied to 107 out-patients, 86 of whom were exposed to Pb. The results indicated that a simplified test (urine collection every 8 hr) may be employed in the out-patient department. The manner of calculating the data from the 8-hr test to the 24-hr period was discussed. (From authors' English summary)

- 2507** California, State of, Department of Public Health, Bureau of Occupational Health: OCCUPATIONAL DISEASE IN CALIFORNIA ATTRIBUTED TO PESTICIDES AND OTHER AGRICULTURAL CHEMICALS. Report by Goldy D. Kleinman, 1963, 30 pp.

Pb arsenate is one of a number of agricultural chemicals which are hazardous to farm workers. During 1963, of a total of 1031 reported cases in California, 8 were attributable to Pb or arsenic compounds. Of these, 4 showed systemic poisoning, 1 each a respiratory or skin condition, and 1 was unspecified.

- 2508** Capellaro, F., Gaido, P.C., and Alliod, R. (Univ. Turin, Italy): (POSSIBILITY OF TREATING SATURNISM BY VERSENATE BY THE ORAL ROUTE.) *Minerva Medica* 54:474-7, 1963.

A group of 28 workers (18-58 yr old), of whom 12 showed initial signs of Pb absorption, 8 were in the acute phase (colic), and 8 exhibited irreversible signs of poisoning (especially kidney and nervous system disorders) gave the following laboratory findings (means) before oral treatment with 1 g CaEDTA/day: Pb content in blood of 40-130 µg%, urinary Pb of 75-570 µg%, red cell protoporphyrin of 71-699 µg%, and coproporphyrinuria of 67-2515 µg/24 hr. Urinary Pb increased in the 1st group from 144.9 to 566.2 µg%, reaching its maximum in 2 days, and then fell to 131.6 µg% in 6 days. In more serious cases where Pb colic was present the same treatment caused a rise of urinary Pb from 410 µg% to 1172.5 µg% in 1 day and a drop to 352.6 µg% in 6 days. In the chronic cases, the rise of urinary Pb was from 99.3 to 323.7 µg% in 1 day, followed by a drop to 127.5 µg% in 6 days. (17 references)

- 2509** Chalmers, J.N.M., Whitehead, T.P., and Massey, P.M.O. (Birmingham, England): INCIDENCE OF LEAD POISONING AMONGST BADGE ENAMELLERS. *Journal of Clinical Pathology* 16, No. 4:389-90, 1963.

A risk of Pb poisoning among badge enamellers comes from the habit of "mouth pointing" of the implements used. The enamel frit which is applied with a spatula or pen contains ~42% Pb and is partially soluble in 0.1N HCl whereby 10 mg of the white powder yield ~100 µg Pb in solution after 1 hr incubation at 37°C. In an investigation in Birmingham, of 223 women questioned, 18% admitted to regular "mouth pointing" with the spatula and 40% said they did it occasionally or rarely. Thirty-five percent of the group who admitted to regular "mouth pointing" had hemoglobin values <12 g/100 ml and 20% of them showed excess urinary porphyrins. Of this group, 17.5% showed stippling of the erythrocytes. Among those who said they never put the spatula or pen in their mouths, only 10.5% had hemoglobin values <12 g/100 ml and none had excess urinary porphyrins. Four girls admitted to the hospital were treated with daily oral doses of 900 mg penicillamine which increased urinary Pb excretion to up to 2500 µg/day.

- 2510** Charukchiev, D.: (INTERNAL (TISSUE) AND EXTERNAL RESPIRATION IN PATIENTS WITH SILICOSIS AND SILICOTUBERCULOSIS.) Nauchni Trudove, Nauchno-Izslodovatelski Institut Ohrana Truda Professional'nye Zaboljavanija 10:93-100, 1963.

The O metabolism was studied in 130 individuals, and the oxidation coefficients and some indices of external respiration in patients with silicosis and silicotuberculosis. The tissue-oxidation processes were depressed in ~53% of the 72 patients studied. Workers employed in Pb-Zn and rare-metal mines showed a stronger suppression of internal respiration than patients working in coal mines. The author suggests that evaluation of the results of such tests may aid in establishing early diagnosis and performance of silicotic patients. (From Abstracts of Bulgarian Scientific Literature, Medicine, Physics and Culture 6, No. 4:32, 1963; Chemical Abstracts 62:9685, 1965)

- 2511** Chiesura, P., and Brugnone, F. (Univ.

Padua, Italy): Acido delta-aminolevulinico nel siero e suoi rapporti con l'eliminazione urinaria in soggetti con intossicazione da piombo. ( $\delta$ -AMINOLEVULINIC ACID IN THE SERUM AND ITS RELATION TO THE URINARY ELIMINATION IN SUBJECTS INTOXICATED BY LEAD.) *Medicina del Lavoro* 54:88-94 (Feb.), 1963.

The concentrations of ALA in the serum was determined in 20 normal subjects and in 41 subjects either Pb-intoxicated or exposed to considerable amounts of Pb and showing a raised level of urinary ALA. The average concentration of ALA in serum in normal subjects was 7.95  $\mu\text{g}\%$ ; in individuals intoxicated by Pb or exposed to Pb, serum concentration of ALA was raised, the increase being usually directly proportional to the increase observed in urinary excretion. In almost all cases investigated, the concentration index of urine to plasma (U/P) for ALA was very close to the U/P value for creatinine.

It is concluded that ALA is excreted by glomerular filtration, with only a slight tubular reabsorption. The rise in urinary ALA concentration is secondary to the increased plasma level. Hence, the level of serum or plasma ALA is as valid an index of the degree of Pb absorption as the urinary value. In practice, however, urinary ALA determinations are still preferred because the method is more accurate and the results are evaluated more easily.

**2512** Chiesura, P., Brugnone, F., and Selmi, G. (Univ. Padua, Italy): L'intossicazione da stearato di piombo nella fabbricazione di materie plastiche. (INTOXICATION DUE TO LEAD STEARATE IN THE PRODUCTION OF PLASTICS.) *Lavoro Umano* 15, No. 3:114-22, 1963.

With expanding production, the incidence of Pb poisoning in the plastics industry has been increasing. A study was therefore designed to examine workers of a plastics factory in which Pb stearate was used as a stabilizer. Over a period of 2 yr, observations were carried out on 10 men without exposure to Pb and 36 men, average age 34 yr, who had been occupied in weighing Pb stearate and mixing it with polyvinyl chloride. All men were given a complete clinical examination, including determination of red blood cells, hemoglobin content and urinary coproporphyrin; in addition, urinary  $\delta$ -aminolevulinic acid (ALA) was estimated in 26 men and in some of them, erythrocytic protoporphyrin was also measured. In 9 men the tests were repeated after they had been removed from Pb exposure for sometime. Atmospheric Pb was also determined at the most important work places. A notable finding in the 10 controls was a moderate increase of erythrocytic protoporphyrin in 3 individuals to 109, 130 and 117  $\mu\text{g}/100$  cc of red blood cells, respectively. Findings in the 36 Pb-exposed workers included typical colic in 4 with anemia, abdominal pain and stasis (12 each), dyspeptic disorders and Burton's line (3 each), elevated arterial pressure in 4, and enlarged liver in 19. Although the findings did not reveal unequivocally a particularly dangerous action on the liver, they are considered generally suspicious. Urinary coproporphyrin averaged 786  $\mu\text{g}/$

1, ALA (in 21 of the group) 18.5 mg/l. Nine men re-examined 1 yr or less after ceasing work, showed a decrease in urinary coproporphyrin from 953-104  $\mu\text{g}/\text{l}$  and urinary ALA was on the average 7.9 mg/l, whereas erythrocytic protoporphyrin was still slightly elevated (average 391  $\mu\text{g}/100$  cc). Atmospheric Pb at the mixing places was 5.46 mg/m<sup>3</sup> and 8.3 mg/m<sup>3</sup> where the weighing was done, while the air in the environment of the controls contained a maximum of 0.4 mg Pb/m<sup>3</sup>.

The conclusion was drawn that the use of Pb stearate as stabilizer in the plastics industry presents a definite hazard. The need of preventive measures was emphasized, particularly in view of the constant growth of this industry.

**2513** Choi, H. (Catholic Inst. Ind. Med., Korea): RESULT OF PHYSICAL EXAMINATION OF LABORERS IN KOREA. (REPORT 2) INTOXICATION CAUSED BY LEADED (AUTOMOBILE) GASOLINE IN RUBBER GOODS FACTORIES. *Bulletin of Korean Industrial Medicine* 2:23-32 (Sept.), 1963.

Gasoline containing tetraethyllead (TEL) is used in Korea for many industrial purposes; very frequently it serves as a solvent.

A survey of rubber shoe factories revealed crowded working conditions, with 50-200 female workers in poorly ventilated rooms (usually at benches  $\sim 10$  m long with 5-7 women on each side, 1-1.5 m apart) with open cans of rubber glue containing 50-70% Pb-gasoline close-by. The workers apply the glue with small wooden spoons to pieces of rubber, then join these; their hands are sometimes dirtied with the glue. It is estimated that the intake of Pb-gasoline/worker during an 8-hr day is 400-600 cc. A total of 814 women, 18-47 yr old (av 25.6 yr), with 2-mo to 2-yr exposure, were selected for this survey, 257 women in other departments of the factory, not using Pb-gasoline, serving as controls. On the basis of interviews, the ratio of frequency of manifestations on the part of the nervous system in acute TEL intoxication in the 2 groups were: insomnia, 14.3-1.2%; bad dreams, 41.4-17.5%; talkativeness, 20.9-4.3%; state of anxiety, 18.4-5.0%; dizziness, 48.6-35.8%; tremor, 8.7-4.6%; headache, 42.3-2.1%; nausea or vomiting in the morning, 21.7-5.4%; hallucination, 10.9-3.1%; and diplopia, 11.7-2.7%. Three or more of these symptoms occurred in a single person at a ratio of 52.2-15.2%; 5 or more symptoms, 27.6-4.7%; 7 or more, 17.8-1.2%. Marked anemias were found in 26 women with 8 or more symptoms. Most cases were characterized by anisocytosis or microcytosis, lymphocytosis and eosinophilia; basophilic stippling was not seen, and there were few cases of hypotension. No significant differences in weight were found. Determination of specific gravity of blood in 1977 rubber plant workers was compared with 4599 workers of other industries; the ratio of those having specific gravity of  $<1.052$  was 12.5-26.3%-1.1-5.0%. The author surmises that the above findings are attributable to a slowly developing chronic intoxication, causing marked blood changes. The mental manifestations disappeared after removal from work for 1-1.5 mo, and reappeared upon resumption of work, after 1-2 mo.

Similar signs, though few, were found among painters who handled for a long time paint diluted with Pb-gasoline, and in workers who cleaned ma-

chine parts with Pb-gasoline for a number of years.

- 2514** Corsi, G.C., Brugnone, F., and Danieli, A. (Univ. Padua, Italy): Effetti dell'esposizione al piombo tetraetile sull'eliminazione di acido 5-idrossindolacetico. (EFFECTS OF EXPOSURE TO TETRAETHYLLEAD ON THE ELIMINATION OF 5-HYDROXYINDOLEACETIC ACID.) *Minerva Medica* 54, No. 82:3097-9, 1963.

Daily elimination of 5-hydroxyindoleacetic acid was studied in 43 workers of a tetraethyllead (TEL) plant, who had been exposed to TEL for 1 mo to 23 yr, and in 38 not so exposed, aged 20-60 yr. Daily elimination in the controls ranged from 2.85-8.60 mg (mean,  $5.19 \pm 12.50$ ; a mean of  $4.35 \pm 3.37$  was found for a group of 8 subjects tested over a period of 7 successive days), while for the 43 TEL-exposed subjects, mean elimination was  $3.82 \pm 9.74$  mg/24 hr. Individual values for urinary 5-hydroxyindoleacetic acid, porphyrin and Pb are listed in a table. The authors point out that the mean elimination of 5-hydroxyindoleacetic acid is smaller in TEL-exposed than in control subjects and that workers having a close contact with TEL excrete the smallest amounts. This finding agrees with results obtained in animal experiments (L. Galzigna et al, *Medicina del Lavoro*, in press) indicating that TEL affects the metabolism of tryptophan at the stage of 5-hydroxyindoles even in the early stage of Pb poisoning. Since the slight variations between urinary excretion of 5-hydroxyindoleacetic acid in healthy and TEL-exposed subjects may be emphasized by administration of 5-hydroxytryptophan, determination of this acid may be an early diagnostic criterion for TEL intoxication before alterations of the nervous system occur.

- 2515** Corsi, G.C., and Galzigna, L. (Univ. Padua, Italy): Transaminasi sieriche nell'intossicazione umana e sperimentale da piombo tetraetile e da piombo. (SERUM TRANSAMINASE IN HUMAN AND EXPERIMENTAL INTOXICATION BY TETRAETHYLLEAD AND LEAD.) *Lavoro Umano* 15, No. 8:364-7, 1963.

Since the activity of serum transaminase is known to reflect even a slight organic damage, a study was undertaken of the behavior of glutamic-oxalacetic (SGOT) and glutamic-pyruvic transaminase (SGPT) in the blood serum of man and animals in tetraethyllead (TEL) and Pb poisoning. The human studies involved 7 patients who had been exposed to TEL for 2 mo to 22 yr, with symptoms of incipient intoxication or increased urinary Pb and porphyrins, 3 with signs of subacute TEL poisoning and 4 with acute Pb poisoning. Animal experiments were done with 4 groups of adult male rabbits weighing 2.5-3 kg each. Group 1 (8 rabbits) was given daily im injections of 10 mg/kg TEL in a solution of 95% ethanol; Group 2 (8 rabbits) received 100 mg TEL/kg/day; Group 3 (4 rabbits) was injected with 50 mg/kg/day of a solution of neutral Pb acetate and Group 4 (5 rabbits), serving as controls, was treated with 1 cc 95% ethanol. Blood was collected 3, 6 and 9 days after the first injection. Transaminase activity was determined by the method of Reitman and Frankel and expressed in Wroblewski units (UW). Normal values for SGPT and SGOT in man ranged from 5-35 and 10-

40 UW, respectively. None of the patients showed any significant increases in either of the transaminases. In rabbits also, whatever differences were found in the average values were not significant statistically. Although SGOT was increased in 6 of the 16 TEL-poisoned rabbits, the increase was considerable only in 2 of these animals of which one showed a simultaneous increase of SGPT.

- 2516** Coscia, G.C., Perrelli, G., and Meo, G. (Univ. Turin, Italy): Aspetti dell'eliminazione fecale ed urinaria del piombo in due casi di intossicazione da stearato di piombo. (FECAL AND URINARY ELIMINATION OF LEAD IN TWO CASES OF INTOXICATION BY LEAD STEARATE.) *Folia Medica* 46:1125-30, 1963.

According to recent statistics,  $\sim 1/3$  of all cases of Pb poisoning are caused by stabilizers added to plastics, in this instance Pb stearate. This compound may enter the organism by inhalation or by way of the digestive tract. In the latter case, the Pb easily combines with the gastric HCl. The signs of poisoning by Pb stearate correspond essentially to those produced by the inorganic Pb compounds. Normohypochromic anemia and gastro-duodenitis are observed; however, alterations of the vascular and peripheral nervous systems are rarely seen. Liver damage may occur when the atmospheric concentration to which workers are exposed is high. Exposure to Pb stearate differs from that of inorganic compounds in that Pb accumulates predominantly in the gastroenteric tract. This was investigated in 2 subjects, 1 showing Pb absorption and the 2nd Pb colic, who received iv 1.8 g  $\text{CaNa}_2\text{EDTA}$  on the 11th day, and on the 1st and 11th day of observation, respectively. Urinary and fecal Pb excretion were determined daily over a 16-day period. In case 1, fecal Pb was up to 10 times that of urinary Pb until EDTA was administered when fecal Pb decreased from 2850-650  $\mu\text{g}/24$  hr and urinary Pb increased from 310-1850  $\mu\text{g}/24$  hr. In case 2, after the 1st EDTA dose, urinary Pb increased from 500-13,500  $\mu\text{g}$ , and after the 2nd EDTA dose from 720-5000  $\mu\text{g}/24$  hr, while fecal Pb, after having been 8400  $\mu\text{g}$  on the 4th day, decreased on the 11th and 12th day to 4500 and 3000  $\mu\text{g}/24$  hr, respectively. The results suggest that, particularly in case 1, Pb localized principally in the digestive tract. The usefulness of treatment with EDTA is considered to be confirmed.

- 2517** Courville, C.B. (Office of the Coroner-Medical Examiner, Los Angeles, Calif.): FORENSIC NEUROPATHOLOGY. X. COMMON CHEMICAL, METALLIC, AND METALLOID POISONS. *Journal of Forensic Sciences* 8:481-502 (Oct.), 1963.

Pb is one of the more common industrial poisons affecting the nervous system, and is perhaps the most important metal from the viewpoint of frequency with which it affects the central and peripheral nervous system. There were 3 deaths due to Pb poisoning in the period from 1950 through 1955. A number of Pb hazards are listed, signs and symptoms of acute and chronic Pb poisoning are briefly discussed, and a typical case of chronic Pb poisoning in a 63-yr-old painter is



described. An essential part of his work over the 40 yr had been to squeeze continually a large lump of Pb putty in his hand. A rash, believed to be due to sensitivity to paint thinner, developed on his hands and face 5 yr before his death in 1954. In 1953, when he began having episodes of abdominal pain, vomiting, headaches, dizziness, followed later by complaints of pain and weakness in his arm, a diagnosis of Pb neuropathy and myelopathy was made. Findings of the postmortem examination of the brain are described in some detail.

- 2518** Crepet, M., Chiesura, P., Austoni, M., and Scandellari, C. (Univ. Padua, Italy): La ferrocinetica nell'intossicazione umana da piombo. (IRON KINETICS IN HUMAN LEAD POISONING.) *Minerva Medica* 54:3047-53 (Oct. 13), 1963.

Although autoradiographic examination of the fixation of Fe has been done on animals, this technique has not yet been applied to human subjects. Five men suffering from occupational Pb poisoning were chosen for this investigation of whom 4 had been exposed only for 2-6 mo; one had worked in a storage battery plant for 8 yr. The tests were carried out after the men had been removed from work for ~10 days. None of the men had been subjected to any therapy except for antispasmodics. Plasma volume and the radioactivity in the areas of the liver, spleen, sacrum, and in erythrocytes were calculated by the method of Huff et al after injection of radioactive Fe ( $^{59}\text{Fe}$ ) at a dose of 0.5  $\mu\text{Ci/kg}$ ; the determination of the exchange of Fe was done according to Pollycove and Mortimer, and Sharney et al, and of Fe in blood according to Heilmeyer and Ploetner. Urinary and red-cell porphyrins,  $\delta$ -aminolevulinic acid and porphobilinogen in urine were also measured. All data, including clinical findings, were tabulated. The erythrocyte volume was markedly reduced in all cases; the plasma volume was reduced in one case and within normal limits in the other 4 cases; blood Fe was increased to 140-180  $\mu\text{g}\%$  in 4 men and slightly reduced (80  $\mu\text{g}\%$ ) in the fifth. Plasma clearance time which is indicative of Fe exchange, did not deviate much from the normal. The survival time of erythrocytes, which reflects the rate of erythropoiesis, was decreased by 37-69% in the cases with increased blood and total plasma Fe, and by 70-72% in the 2 cases with little or no increase in blood Fe, suggesting to the authors that the reduction of survival time of erythrocytes depends to a certain degree upon the availability of circulating Fe. Bone marrow activity declined in 4 and was unaffected in the fifth. Liver activity was retarded in 1 instance while the curve showed a normal amplitude in the other 4, in 2 of whom the decline in radioactivity was slower than normal. Splenic activity showed some slight changes similar to that of the liver. Analysis of the data concerning the Fe volume involved revealed an increased hemolysis and a retardation of hemoglobin synthesis and regeneration of circulating cells.

The following conclusions were drawn: Pb anemia is produced by hyperhemolysis and defective hemoglobin formation; these factors may act together or individually; in the stage of regression the anemia is characterized by hyperplasia and eryth-

ropoietic hyperactivity.

- 2519** Crutcher, J.C. (Veterans Administration Hosp., Atlanta, Georgia): CLINICAL MANIFESTATIONS AND THERAPY OF ACUTE LEAD INTOXICATION DUE TO THE INGESTION OF IL-LICITLY DISTILLED ALCOHOL. *Annals of Internal Medicine* 59:707-15 (Nov.), 1963.

The clinical manifestations and results of therapy of 27 patients having had 32 episodes of Pb intoxication due to ingestion of whiskey distilled in Pb-containing apparatus are reported. In the majority of cases, symptoms appeared 1 or 2 days after an episode of drinking. In 7 patients, Pb encephalopathy manifested by convulsions, coma and increased protein in the cerebral spinal fluid was observed. One of these patients died because Pb poisoning was not diagnosed and no therapy was instituted. Signs and symptoms involving the central nervous and gastrointestinal system, hematologic data and coproporphyrin values are tabulated. A hypochromic anemia on peripheral smear, moderate to marked basophilic stippling both in the bone marrow and in peripheral blood, and an occasional direct positive Coombs' test were the major hematologic findings. The gastrointestinal symptoms of nausea, vomiting and abdominal pain associated with constipation were of sufficient magnitude to cause surgical exploration in 3 of the patients. Treatment consisting of iv administration of CaEDTA dissolved in 5% glucose resulted in the excretion of extremely high quantities of Pb. All patients responded well to therapy and no toxic effects were observed.

- 2520** D'Alonzo, C.A., and Pell, S. (E.I. du Pont de Nemours and Co., Wilmington, Del.): A STUDY OF TRACE METALS IN MYOCARDIAL INFARCTION. *Archives of Environmental Health* 6:381-5 (Mar.), 1963.

The trace metals Ni, Mo, B, Zn, Ag, Pb, Mn, Fe, Mg, Si, Ti and Al were analyzed by spectrography in sera drawn from 20 hospital patients within 24 hr after admission for myocardial infarction (MI) and compared with sera from 20 controls matched to the patients by age and sex. Of the infarction patients, 19 showed abnormally high and highly significant levels of Ni, while this was found in only 4 of the controls. The infarction patients also showed significantly higher serum levels of Mo and B; a suggestion of higher Zn levels in the patients was also found. Differences between the 2 groups in the levels of the other trace metals were well within the limits of sampling error. The concentrations of Pb in 17 MI patients were either not detected or <1-2 ppm, and 1-15 ppm in 3. The controls fell into the 1st category. Pb was in the group of metals showing no significant differences between patients and controls.

- 2521** D'Antuono, G., Orlando, E., and Raffi, G.B. (Univ. Bologna, Italy): Valutazione della frazione non precipitabile del piombo urinario. (EVALUATION OF THE NON-PRECIPI-TABLE FRACTION OF URINARY LEAD.) *Giornale di Clinica Medica* 44:657-67 (July), 1963.

The Pb content in urine was determined in 15 per-

sons with usual (normal) exposure to Pb, 20 workers exposed occupationally to Pb but showing no clinical or laboratory signs of intoxication, and in 20 subjects with clinical signs of chronic Pb intoxication. Determinations were made by using Cholak's (1948) coprecipitation method which measures only the precipitable form, and by the method of Bessman et al (1955) which permits the estimation of both precipitable and nonprecipitable Pb. In the normal subjects, the nonprecipitable fraction was negligible, while in the Pb-exposed individuals, the total quantity of urinary Pb was constantly higher than the precipitable fraction. The nonprecipitable fraction increased as the total urinary Pb excretion increased. The following values were obtained for total, precipitable and nonprecipitable Pb, respectively, in  $\mu\text{g}/\text{l}$ : normal, 49, 47, 2; with increased Pb absorption, 127, 100, 27; in chronic Pb poisoning, 300, 204, 96.

The authors conclude that determination of the nonprecipitable fraction could be of great usefulness in the recognition of excessive exposure and of one threatening Pb poisoning.

- 2522 David, A. (Occup. Dis. Clinic, Prague, Czechoslovakia): Cytochemické vyšetření kostní dřevě u otravy olovem. (CYTOCHEMICAL EXAMINATION OF BONE MARROW IN LEAD POISONING.) *Casopis Lékařů Ceských* 102, No. 3:69-72 (Jan.), 1963.

Cytochemical analysis of normoblasts in chronic Pb poisoning confirmed older findings concerning the presence of ribonucleic acid in the basophilic stippling and an increase of non-hemoglobin Fe. The tests also revealed a new finding, ie, the presence of polysaccharides with a positive PAS reaction. This polysaccharide differed partly from glycogen and was usually in granular form. It had no relation to the basophilic stippling but occurred more frequently in sideroblasts and was found also in many erythrocytes. Supravital staining with Janus green and neutral red caused a partial increase of mitochondria, particularly of vacuoles in normoblasts which stained with neutral red. (From author's English summary)

- 2523 Dellepiane, B. and Cabella, G. (Univ. Genoa, Italy): L'indagine elettromiografica in medicina del lavoro. (ELECTROMYOGRAPHIC FINDINGS IN OCCUPATIONAL MEDICINE.) *Folia Medica* 46:777-90 (Oct.), 1963.

The application of electromyography in occupational medicine and particularly in chronic poisoning such as by Pb is discussed. Three cases of chronic Pb intoxication are briefly described in which electromyography was used as a diagnostic test.

- 2524 Diggs, D.R., Hesselberg, H.E., Ludwig, J. H., and Maga, J.A. (E.I. du Pont de Nemours & Co., Inc., Wilmington, Del.; Ethyl Corp., New York, N.Y.; US Pub. Health Serv.; California State Dept. Pub. Health, Berkeley): PROGRAM FOR THE SURVEY OF LEAD IN THREE URBAN COMMUNITIES. *Journal of the Air Pollution Control Association* 13: 228-32 (May), 1963.

Objectives and methods are presented for a 1-yr

cooperative program established to survey Pb in the atmosphere of selected urban areas and in the blood and urine of selected population groups. Aerometric stations for sampling Pb have been established at 20 fixed sites within Philadelphia, Cincinnati, and Los Angeles. Subjects from the above cities, with no known industrial exposure to Pb, with as wide an age range as possible, who had lived in the survey areas for at least 5 yr, have been selected. It is the purpose of this study to test whether the general population or segments of the population are exposed to detectable hazards from atmospheric Pb.

- 2525 Dingwall-Fordyce, I., and Lane, R.E. (Nuffield Dept. Occup. Health, Univ. Manchester, England): A FOLLOW-UP STUDY OF LEAD WORKERS. *British Journal of Industrial Medicine* 20:313-5 (Oct.), 1963.

The causes of death among workers known to have been exposed to Pb were studied. Information was obtained from a group of companies who made available the records of their pension fund and from a large battery plant which provided details of men who had died during their employment. There were 425 pensioners (between 1926 and 1960; eligibility requirement: 65 yr of age and not <25 yr service) of whom 184 had died, and 153 deaths occurred among an unknown number of employed men who had not yet reached pensionable age. A significant excess of deaths from all causes was found among those pensioners who had been exposed to the greatest Pb hazard (urinary Pb values 100-250  $\mu\text{g}/\text{l}$  for last 20 yr (it is noted that in the past these have not infrequently exceeded 250  $\mu\text{g}/\text{l}$ )). The excess of deaths could not be attributed to malignant neoplasms but there was evidence that heavy exposure to Pb was associated with an increased incidence of deaths from cerebrovascular diseases. There are, however, indications that this danger may have been reduced in recent years.

- 2526 Dynnik, V.I.: O funktsional'nom sostoyanii pochek pri khronicheskikh svintsovykh intoksikatsiyakh. (THE FUNCTIONAL CONDITION OF THE KIDNEYS IN CHRONIC LEAD POISONING.) In *Gigiena i fiziologiya truda, proizvodstvennaya toksikologiya, klinika profzabolevanii*. (The Hygiene and Physiology of Labor, Industrial Toxicology, and Clinical Aspects of Occupational Diseases.) Gosmedizdat Ukr. SSR, Kiev. 2:274-8, 1963.

Kidney function was studied in 116 patients with chronic Pb poisoning, of which 99 were light cases and 17 of intermediate severity. Urea clearance rate, Anbar constant, filtration of creatinine and blood flow through the kidneys were determined and urine analyses were made. Kidney function was disturbed fairly often whereby the frequency and degree of disturbances increased with the severity of poisoning. With mild Pb poisoning, the urea clearance rate was decreased in 52 patients, the Anbar constant increased in 43 of 93, the blood flow through the kidneys decreased in 37 of 90; canalicular filtration was decreased in 25 of 90 subjects and canalicular reabsorption of water in 4 of 14 patients so tested. (From Referativnyi Zhurnal Otd. Vypusk Farmakol. Toksikol. 1964, No. 20:54, 285; Biological Abstracts 46:Abstr. No. 52599, 1965)

- 2527 Efe, S. (Istanbul Univ., Turkey): Satürnizmde delta-aminolevülinik asidin klinik değeri. ( $\delta$ -AMINOLEVULINIC ACID IN LEAD POISONING.) Türk Tıp Cemiyeti Mecmuası 29, No. 10:584-92, 1963.

The excretion of  $\delta$ -aminolevulinic acid (ALA) was determined by the method of Mauzerall and Granick. The groups examined were 63 normal subjects not exposed to occupational Pb, 18 men with manifest signs of Pb poisoning, 71 with latent saturnism, and 17 asymptomatic persons exposed to Pb. The normal averages found were: ALA, 2.37 mg daily; Pb in blood, 0.04 mg/100 ml, and in urine, 0.05 mg/l. The excretion of ALA increased as the excretion of Pb in urine increased. In 3 workers, 1 of whom had been exposed to Pb for 20 days and the other 2 for 10 days, a 5- to 10-fold increase of urinary ALA was found, but none of the other typical subjective or objective signs. In manifest poisoning coproporphyrin excretion was parallel to that of ALA; no increase in porphobilinogen was observed. Administration of  $\text{CaNa}_2\text{EDTA}$  was followed by a temporary increase in Pb excretion and a decrease of ALA excretion.

Analysis of the urine of several members of a family with acute porphyria revealed large amounts of ALA, coproporphyrin and porphobilinogen. The author suggests that an increase of ALA should be considered as the most reliable and earliest sign of Pb poisoning. Treatment with  $\text{CaNa}_2\text{EDTA}$  should be continued until the level of ALA has returned to normal. The pathogenesis of the increase of urinary ALA in Pb poisoning is discussed.

- 2528 Emmerson, B.T. (Brisbane Hosp., Australia): CHRONIC LEAD NEPHROPATHY. THE DIAGNOSTIC USE OF CALCIUM EDTA AND THE ASSOCIATION WITH GOUT. Australasian Annals of Medicine 12:310-24 (Nov.), 1963.

In this investigation, an attempt has been made to distinguish between primary chronic glomerulonephritis, primary chronic pyelonephritis, primary renal gout and renal disease secondary to gout, as well as primary chronic Pb nephropathy, and also to determine the incidence of association of clinical gout. The following groups of patients were selected for study: (1) 19 control subjects who had neither hypertension nor gout and no clinical evidence of significant past Pb absorption; the Pb content in the skull bone was known to be normal in 8; (2) 22 patients with chronic Pb nephropathy, 18 of whom have definite histories of Pb poisoning in childhood and 4 had a Pb etiology for the renal disease as inferred from an elevated Pb content of skull bone and a history of childhood Pb poisoning; (3) 23 patients whose renal disease had causes other than Pb; (4) 9 patients with a history of industrial Pb exposure varying from acute industrial Pb poisoning to recent or remote asymptomatic Pb exposure; (5) 16 patients with chronic renal failure of uncertain cause. Twenty-four-hour urine specimens were collected before and after iv infusion of 1 g of  $\text{CaEDTA}$  in 250 ml of a 5% aqueous solution of glucose. The absolute increase in Pb excretion due to  $\text{CaEDTA}$  was termed as the EDTA Pb excretion. Urinary Pb excretion in the controls ranged from 0.01-0.04 mg/24 hr (with a single level of 0.06 mg) before, and from 0.09-0.64 mg after the administration of EDTA. The 8 patients of this

group with the greatest EDTA Pb excretion had also the greatest urine volumes (2400 ml/day). In Group 2, urinary Pb excretion before and after EDTA was 0.01-0.07 and 0.64-2.51 mg/24 hr, respectively. The greater the degree of renal failure, the more prolonged and the greater was the EDTA Pb excretion. One subject with a high Pb content in the skull displayed impaired urine-concentrating ability as the only evidence of renal insufficiency; her EDTA Pb excretion was only 0.80 mg and not at all prolonged. In Group 3, 19 of the 23 patients had EDTA Pb excretion in the same range as the controls, while 4 (3 of whom suffered from polycystic disease of the kidneys) had elevated EDTA Pb excretion. These results emphasize that an increased EDTA Pb excretion does not necessarily mean that Pb caused the renal disease in this case. The 9 subjects of Group 4 had urinary Pb excretion in the control period varying from 0.01-0.25 mg/24 hr while the EDTA Pb excretion ranged from 11 mg after severe and recent exposure down to 0.58 mg when Pb exposure had been slight and distant in time.

The results obtained for these 4 groups suggest that the EDTA Pb excretion provides a reliable method of separating patients with normal and excessive past Pb absorption, even in the presence of renal disease. The separating line appeared to be at  $\sim 0.6$  mg, and patients with an EDTA Pb excretion of  $< 0.6$  mg/24 hr were shown as having renal disease due to causes other than Pb. In the 16 patients of Group 5, EDTA Pb excretion exceeded 0.6 mg. In 7 of them, abnormally high Pb contents in the skull gave evidence of excessive past Pb absorption; 5 probably had suffered excessive but unrecognized Pb absorption. Of the remaining 4 of this group, 3 had severe hypertension and nephrosclerosis. No pattern of response was detected for the Pb content in blood after treatment with EDTA. The values for the EDTA Pb excretion in relation to previous Pb exposure and disease is represented in a diagram. Furthermore, a statistical analysis of the results for the EDTA Pb excretion in relation to renal function and Pb content of bone is included. An attempt to determine directly the effect of renal insufficiency on the EDTA Pb excretion failed due to limitations in the methods of EDTA estimation. Of the 33 patients in this study, suffering from chronic Pb nephropathy, 16 had acute attacks of gout.

In the patients with chronic renal disease and normal past Pb absorption, only 1 in 18 showed any suggestion of gout. This shows that gout occurs much more frequently in chronic Pb nephropathy than in other types of chronic renal disease. During the present investigation, no deterioration of renal function directly attributable to administration of 1-g doses of  $\text{CaEDTA}$  was observed. The chief toxic effect of  $\text{CaEDTA}$  to be noted was the development of postural hypotension in patients with severe renal disease, especially those already receiving hypotensive agents.

- 2529 Emmerson, B.T., and Lecky, D.S. (Brisbane Hosp., Australia): THE LEAD CONTENT OF BONE IN SUBJECTS WITHOUT RECOGNIZED PAST LEAD EXPOSURE AND IN PATIENTS WITH RENAL DISEASE. Australasian Annals of Medicine 12:139-42 (May), 1963.

The Pb content of bone was determined in normal subjects, all of whom were living when bone was obtained, and who could not recall any significant past Pb exposure. Skull bone was chosen because previous investigations by Henderson and Inglis in 1957 had shown that the Pb content of this bone was consistently elevated in chronic Pb nephropathy, and that such levels were high enough to provide a differentiation from the normal. The accuracy of the method of Pb determination was  $\pm 0.1$  mg for Pb concentrations ranging from 0.1-3.0 mg/100 g and  $\pm 0.2$  mg for those from 3.0-6.0 mg/100 g moist bone. Although there is a considerable difference between the Pb content of the inner and outer tables of the skull, the result of a single specimen or the average of 2 portions of bone has been taken in this study as representative of the whole bone. The Pb content of skull bone was studied in 3 groups of patients: (1) 18 persons, 17-56 yr, with normal renal function and no clinical evidence of significant past Pb exposure; (2) 13 patients with renal disease, but no clinical evidence of significant past Pb exposure; (3) 10 patients with chronic Pb nephropathy. In Group 1, Pb contents of portions of the skull bones and mean standard deviations for the inner and outer table were, respectively, in mg/100 g, 0.7-4.6,  $2 \pm 1.1$ ,  $2.1 \pm 1.1$ . In 7 patients of Group 2, the Pb content of the inner and outer tables and standard deviations were  $1.0 \pm 0.5$  and  $1.1 \pm 0.5$ , respectively; in 6 patients of this group, the Pb content of a full-thickness portion of occipital bone was  $1.4 \pm 0.6$  mg/100 g; in 11 patients, the Pb content of rib bone (4th and 5th rib in the mid-axillary line) was  $1.1 \pm 0.8$  mg/100 g. These figures, being well within the normal range, show that renal failure does not result in accumulation of Pb in bone. In Group 3, the occipital skull bone contained 4.6-17.8 mg Pb/100 g (mean 8.8), the mean Pb content of the inner and outer tables was 8.5 and 9.0 mg/100 g, respectively. The Pb content of the rib bone in 5 cases was 2.1-11.1 mg (mean 4.6)/100 g, and of the tibial bone in 4 cases 3.6-16.8 (mean 8.3).

- 2530 Faulkner Hudson, T.G. (Univ. Bristol, England): SOME HEALTH HAZARDS IN METAL MAKING. Transactions of the Association of Industrial Medical Officers 12:114-23 (Jan.), 1963.

Among the hazards discussed, the problem of Pb poisoning as an occupational hazard and the diagnosis of Pb intoxication are stressed. Three recommendations are made for prevention of Pb poisoning: (1) repeated studies of the working environment, (2) regular examination of the exposed workers; (3) education of employees and instructing them about the risks and the preventive measures. If one biochemical test only is being used in supervising Pb workers, it should be the estimation of hemoglobin. Considering that many Pb workers are strenuously employed for >38 hr/wk and that not every man will at all times be entirely fit, the recent raising of the threshold limit to 200  $\mu\text{g Pb/m}^3$  may seem unwise.

- 2531 Faye, C.L. (Soc. Ind. Med. Hyg., Paris, France): Saturnisme alimentaire. Étiologie imprévue et exposition professionnelle

au plomb. (DIETARY SATURNISM. UNFORESEEN ETIOLOGY AND OCCUPATIONAL EXPOSURE TO LEAD.) Proceedings of the Society of Industrial Medicine and Hygiene. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 24:545-6 (June), 1963.

A 30-yr-old man, who was in the employ of a storage battery industry (5 yr), was found to have increased counts of stippled cells which increased in spite of transfer to work without exposure to Pb. A search for the cause, it was found that at home vinegar was kept in a bottle with a stopper cap from Pb. The vinegar thus became a suspension of Pb acetate when the bottle was shaken. This was confirmed by analysis (however, the Pb value was not reported). The man, his wife and daughter showed no other effects than a greatly increased count of stippled red cells. The blood count became normal within 2 wk after consumption of this vinegar had been discontinued.

- 2532 Flinn, R.H., Brinton, H.P., Doyle, H.N., Cralley, L.J., and Harris, R.L., Jr., Westfield, J., Bird, J.H., and Berger, L.B. (US Public Health Service; Bureau of Mines): SILICOSIS IN THE METAL MINING INDUSTRY. A REVALUATION, 1958-1961. US Public Health Service Publication No. 1076, 1963, 238 pp.

The study was an outgrowth of hearings before the Committee on Education and Labor, House of Representatives, 84th Congress, although in 1954 a revaluation of the prevalence of silicosis in the metal mining industry was begun by reviewing compensation and other records of official agencies to determine the magnitude of the silicosis problem. At the start of the 1958-61 study, it was not known whether the present prevalence of silicosis was among miners who had significant exposure before dust control practices were instituted in the mid-30's, or was due to lack of application of these controls, or to inadequate standards.

Environmental conditions were studied in 67 underground mines employing ~20,500 persons (>50% of the working population of underground metal mines in the US). The medical study included employees from 50 of these mines and a large number of U mines (22 of the mines with a total of 4281 workers were in the Pb-Zn-Ag commodity group). While the study as a whole deals with a thorough investigation of exposure to dust and its silica content with emphasis on the prevalence of respiratory diseases, history of Pb and Hg poisoning was also considered. A past history of Pb poisoning was reported by 82 miners; in 21, the Pb-poisoning episode had occurred before they were employed in metal mining and had been caused by such tasks as spraying orchards, painting, making storage batteries, and welding and cleaning gasoline tanks. Considering only men working at mines which were producing Pb, 26 reported Pb poisoning in their past experience. This is a prevalence of 0.7% Pb poisoning in contrast to 14% of Utah metal miners surveyed in 1939. The decrease is attributed to many factors, among them a change in the ore mined (more sulfide and less carbonate ore which is more likely to cause Pb poisoning). A breakdown of the

cases by years showed that cases of Pb poisoning still develop, although  $\sim 2/3$  of the mines revealed no workers with a history of Pb poisoning.

In the overall findings, the incidence of silicosis among metal mine workers was much more influenced by the silica content of the dust than by the type of commodity produced. Excluding the Fe and Pb-Zn mines with low free silica exposure, the total crude rates of silicosis in the various mines were much the same (4.8% in Pb-Zn mines). Time of exposure was influential. In no group of mines did men with <10 yr exposure show as much as 1% silicosis; in the 10-19 yr group 3.1% for Pb-Zn mines; however, in the 20-29 yr group the Pb-Zn mines showed 12.7%, compared with up to 7.8% in Cu and Fe groups, although the other commodity and U mines showed up to 27.5%.

In the 30-yr or more group, the Pb-Zn, U and other mines had also higher prevalence of silicosis (close to 30%) than the Fe and Cu mines ( $\sim 20\%$ ). At mines with low free silica, silicosis was minimal even with longest time of exposure (2.5% for Fe and 2% for Pb-Zn mines).

Numerous recommendations are included in the report as generally applicable to the underground metal mining industry, including continuance of medical and environmental studies by the Public Health Service and Bureau of Mines at  $\sim 5$ -yr intervals, maintenance of dust monitoring programs, controls, and medical and educational programs by industries.

- 2533 Fomina, L.I., and Aldanazarov, A.T.: IMMUNE CHANGES IN THE ORGANISM IN CASES OF SATURNISM. Materialy 1-oi (Pervoi) Resp. Nauchn. Konf. po. Vopr. Gigieny Truda i Prof. Zabolevanii, Karaganda, Sb. 1963:91. A study of 207 patients with repeated (2-6 times) Pb poisoning showed that 12 had fixed and free antierythrocyte autoantibodies in the blood. In 123 patients with a lower frequency of aggravations, fixed antierythrocyte autoantibodies occurred in 85% and free ones in 78%. Of 72 patients without aggravations, 19% had fixed and 9% had free autoantibodies. Thirty dogs had no antierythrocyte autoantibodies before poisoning, but they were found in all after Pb poisoning. A correlation was observed in the formation of autoantibodies in the blood and the development of Pb anemia. (From Referativnyi Zhurnal, Farmakol., Toksikol. 1964:Abstract No. 7.54.277; Chemical Abstracts 62:12357, 1965)

- 2534 François, J., and Evens, A. (Natl. Univ. Gent, Belgium): De beroepsintoxicaties van het oog. (OCULAR MANIFESTATIONS OF OCCUPATIONAL POISONING.) Belgisch Tijdschrift voor Geneeskunde 19:512-6 (May), 1963.

In discussing occupational exposure to toxic substances which may lead to ocular disorders, the author begins with those seen in Pb poisoning.

One of the consequences of chronic intoxication by Pb is the so-called Pb amaurosis. After a period of colics, constipation and arthropathy, the worker notices intermittent sensations of a haze before the eyes which may result in complete blindness. Aphasia and deafness may also result. When the photomotor reactions of the pupil in

the fundus of the eye remain normal, the patient regains his vision within 1-14 days. Vasodilators, particularly amyl nitrite, are helpful in releasing the spasm in the occipital zone. Less favorable are the prospects in the case of retrobulbar neuritis which may lead to bilateral scotoma and in turn to an optical atrophy. This development, in 10% of the cases, results in total blindness. All oculomotor nerves may be affected in Pb poisoning, as well as the intrinsic musculature, with mydriasis and lowered accommodation.

- 2535 Franke, W. (Dept. of Occupational Med. and Ind. Hygiene at Lower Saxony, Germany): Die heutige Bedeutung und das klinische Bild der Bleivergiftung aus der Sicht des Gewerbearztes. (THE PRESENT SIGNIFICANCE AND CLINICAL FORM OF LEAD POISONING FROM THE STANDPOINT OF THE INDUSTRIAL PHYSICIAN.) Medizinische Welt 44:2229-34 (Nov.), 1963.

This paper was presented at a symposium on Pb for general, industrial and governmental physicians in Lower Saxony. A diagram is shown which indicates that the incidence of Pb poisoning in that section of the country had decreased between 1951 and 1955 but had considerably increased from 1958 to 1961. Pb mines and storage battery plants were mainly responsible for the increase. The development of Pb poisoning, the toxicity of Pb in the human organism and symptoms of Pb poisoning are discussed. Of 148 patients examined by the author in a large Pb industry during the war, 73% had a Pb line; 63.5%, gastrointestinal colics; 54%, pallor; 94% an increase of stippled basophils. The men had an average of 3.5 million erythrocytes and their hemoglobin was between 60 and 70%. It was noted that 106 of the patients had become ill after 4 mo work, and only 4 men had worked longer than 1 yr. A case of fatal poisoning due to Pb encephalopathy is described.

The most convenient test for diagnosis of Pb poisoning is based on the count of stippled erythrocytes; other tests are the presence of urinary coproporphyrin III (threshold value 20  $\mu\text{g}$ ), decrease of hemoglobin, and Pb concentrations in the blood  $>40 \mu\text{g}$ .

The author discusses at some length the value of blood-Pb determination, first stating that the German industrial physicians consider this to be of limited diagnostic importance. He then correlates the blood-Pb values obtained on 777 patients with the number of stippled cells (using Koelsch's formula), so that occasional stippling (1-3/50 fields) corresponds to 44  $\mu\text{g}$  blood-Pb, up to a massive number of stippled cells ( $>50/50$  fields) corresponding to 93  $\mu\text{g}$  blood-Pb. A correlation of these 2 factors with coproporphyrinuria is also found. Therefore, in the author's experience,  $>40$  stippled cells/50 fields, secondary anemia, a coproporphyrin excretion  $>50 \mu\text{g}$  and a Pb content in the blood  $>90 \mu\text{g}$  are indicative of excessive Pb absorption. It is pointed out that blood-Pb determinations be done only by experienced analysts. The same caution is expressed concerning urinary Pb analyses. These are pertinent in a survey of Pb risk of a group of workers. Useful therapeutic agents in Pb poisoning are spasmolytic drugs, vitamin-B<sub>12</sub> preparations, Ca compounds, Na citrate and more recently, EDTA.

In summary, periodic stippled cell counts and coproporphyrin tests are considered sufficient routine measure for the surveillance of workers at risk; blood and urinary Pb determinations are required for doubtful cases, such as the medicolegal cases and reinstatement in hazardous operations.

- 2536** Freed, C.C. (Johannesburg, South Africa): LEAD POISONING. Proceedings of the Mine Medical Officers' Association 43:1-7 (May-July), 1963.

The Pb hazard in a factory treating Au- and Ag-bearing by-products is described. The material coming into the factory is separated into lots for the most suitable treatment. Rich material is fed into the reverberatory pan furnace together with litharge or galena, containing 85% Pb, for smelting. Such a "bath charge" is dropped into the furnace about every 6 hr and the furnace is slagged approximately every 3 hr. After the last charge has been slagged, the furnace is cooled down to ~900°C and the Pb bullion run into molds; the main charge contains 17.3% Pb, the slag 4.6%. Since Pb vaporizes at 500°C, Pb fumes evolve during the process. Fine material is dealt with in the sinter plant. The sintering process (sinter charge and sinter produced contain 4.8 and 5.7% Pb, respectively) is the most dangerous part from the point of view of Pb hazard. Pb fumes are also produced in the blast furnace and cupellation process.

All employees (106 Bantu and 24 white man) working in this plant are medically examined every 3 mo; urinary coproporphyrin determinations are made monthly. The colorimetric test used is graded from 1-6, with 4 being a threshold level. At and above this level, Pb line, hypochromic anemia and increased punctate basophils are found. There were 17 cases of Pb poisoning in the factory in August-September, 1962; 1 among them apparently developed an acute psychosis and may have suffered from Pb encephalopathy. Surveys revealed that 70% of the Bantu workers showed evidence of high Pb absorption and that 23% of these had overt Pb poisoning, whereas Pb poisoning was diagnosed in only 1 white worker and Pb absorption in 4. Pb colic is best treated by iv administration of Ca gluconate. For serious intoxication such as Pb encephalopathy EDTA is recommended. The action of this chelating agent and its possible toxic effects are discussed. It is emphasized that nearly all Pb hazards can be controlled by engineering devices and industrial hygiene.

- 2537** Furlanello, F., Crepaldi, V., and Dal Palù, C. (Univ. Padua, Italy): Documentazione fonocardiografica ed interpretazione dei reperti stetoacustici negli stati anemici. (PHONOCARDIOGRAPHIC DOCUMENTATION AND INTERPRETATION OF THE STETH-ACOUSTIC FINDINGS IN ANEMIC STATES.) *Minerva Cardioangiologica* 11:604-11 (Oct.), 1963.

The studies were carried out on 10 patients, 7 male and 3 female, 17-46 yr old, who presented a chronic anemia of various types. The anemia was due in 5 cases to hemolytic anemia; in the others, respectively, to lymphatic leukemia, essential hypochromic anemia, to Pb poisoning, etc. All cases were

studied during the recovery stage after antianemia therapy. In addition to the phonocardiogram, the EKG was applied. The findings are described in detail and tabulated. (These are not related to the cause of the anemia.)

- 2538** Fyhrquist, F., Widholm, O., and Wegelius, O. (Maria Hosp., Helsingfors, Finland): Blyförgiftning inom personalen och preventiva åtgärder vid en ackumulatorindustri i Finland. (LEAD POISONING AMONG PERSONNEL AND PREVENTIVE MEASURES IN A STORAGE BATTERY FACTORY IN FINLAND.) *Social-Medicinsk Tidskrift* (Stockholm) 40:25-7, 1963.

Hemoglobin and stippled cell counts had been determined in routine blood analyses performed during 1953-1961, at 2- to 3-mo intervals, on the 70-110 workers employed in a storage battery plant. The data obtained from a total of 1034 analyses were compiled as follows: Period I, September 1953 to February 1954, at the end of which ventilators were installed (98 analyses); Period II, May 1954 to September 1957, at the end of which the plant was moved to a new location (550 analyses); Period III, December 1957 to May 1961 (386 analyses). No consideration was given to data on turnover among personnel, individual cases of Pb poisoning related to performing a certain task, sex, and age. A table of data compiled on 6 workers (5 male, 1 female) continuously employed through all 3 periods showed mean hemoglobin values of 61.6 and 67.1% during the 2 yr of Period I, respectively; 81.9-88.3% in II; 71.0-86.3% in III.

Assuming that anemia exists at hemoglobin values <12 g in man and 11.5 g in women, it was found that in Period I, 73% showed anemia and 14% basophilic stippling; in II, 5.4% anemia but 27% stippling; in III, 13% anemia and 10.6% stippling; both anemia and stippling were observed in 14.3, 3.9, and 4.5%, in the 3 periods, respectively.

It is concluded that the installation of ventilators had caused the decrease in anemia in Period II (stippled cell counts are not regarded as a specific sign or index of Pb poisoning). The slight increase in Period III is attributed to the workers' negligence, for many assumed that the new modern plant would provide automatic protection, and they disregarded personal protective measures. The importance of the latter under any conditions is stressed, as well as the significance of regular red blood cell counts in detecting signs of Pb intoxication.

- 2539** Gelinova, E., Stefkov, D., and Gelinov, Kh. (Mun. Hosp., Sofia, Bulgaria): Vurkhu dva sluchaya na podostro olovno otravyane ot khranitelni produkti. (TWO CASES OF SUBACUTE LEAD POISONING OF ALIMENTARY ORIGIN.) *Suvremenna Meditsina* (Sofia) 14: 36-9, 1963.

The cases of poisoning occurred in a man, 65 yr old, and his wife, 52 yr old, from drinking wine that had been stored in glazed containers. The description of the case reports includes results on blood Pb, which was from 300-400 µg%; among clinical findings were hemolysis and anemia (determined by Coombs' test). The patients were treated with EDTA.

- 2540 Germani, C. (Santa Maria and San Gallicano Hosp. Inst., Rome, Italy): Su alcuni aspetti terapeutici della idrossicobalamina in compo dermatologico. (SOME THERAPEUTIC ASPECTS OF HYDROXYCOBALAMINE IN THE DERMATOLOGICAL FIELD.) *Minerva Dermatologica* 38:243-9 (July), 1963.

A daily dose of 1000-2000 µg of hydroxycobalamine was administered iv or im for 10-60 days to 16 patients suffering from various forms of acute and chronic liver disorders, 10 of whom presented dermatitis. All patients showed a marked improvement subjectively and clinically after treatment. As confirmed by laboratory tests, liver function returned to normal and the accompanying skin disease also exhibited marked remission in all cases in which the liver disorder could be traced to a definite pathogenic factor. One of the patients, 35 yr old, was a typographer exposed to Pb for 12 yr. He had presented colics, anorexia, vomiting, digestive disturbances, asthenia, headaches. He exhibited diffuse tremors, muscular hypotrophy, jaundice, gingival Pb line, palpable liver (presence of dermatitis was not indicated). After treatment with 2000 µg HCA daily for 30 days (iv), a noteworthy improvement in liver function took place. (18 references)

- 2541 Glavatskikh, G.I., and Ermakov, V.V. (State Med. Inst., Chita, SSSR): TRACE ELEMENTS IN THE BRAIN OF MAN AND SOME DOMESTIC ANIMALS. *Biol. Rol Mikroelementov v Organizme Cheloveka i Zhivotn. Vost. Sibiri i Dal'nego Vostoka*, Akad. Nauk SSSR Sibirsk. Otd., Komis. po Izuch. Mikroelementov, Buryatsk. Kompleksn. Nauchn.-Issled. Inst., Tr. Konf., Ulan-Ude 1962 32-40 (publ. 1963).

A number of trace metals was determined spectrographically in various parts of the cerebrum and cerebellum and medulla oblongata of 9 men and 6 sheep. The average Pb concentration for the whole brain was found to be 0.47 ppm for man and 0.19 for the sheep. (From Chemical Abstracts 61:15109, 1964)

- 2542 Goldberg, A. (Univ. Glasgow, Scotland): THE ANAEMIA OF LEAD POISONING. In *Siderochrestic Anaemias*, Lisbon, Portugal, 1963. Proceedings of the 9th Congress of the European Society of Haematology (Lisbon) No. 2, Pt. 1:272, 1963.

Pb has a multifocal effect on erythropoiesis - on erythrocyte integrity, on haemoglobin synthesis particularly prior to and immediately after the formation of δ-aminolevulinic acid, at the stage of Fe incorporation and in globin synthesis; and possibly in erythroid proliferation.

When treatment is given with a Pb chelator, for example CaNaEDTA or penicillamine, these defects of erythropoiesis are corrected.

The study of Pb poisoning thus can serve as a model for the study of the mechanisms of other refractory anemias. (Author's abstract)

- 2543 Goldberg, A., Smith, J.A., and Lochhead, A.C. (Gardiner Inst., Glasgow, Scotland): TREATMENT OF LEAD-POISONING WITH ORAL PENICILLAMINE. *British Medical Journal* 1: 1270-5 (May 11), 1963.

The daily output of urinary and fecal Pb, urinary coproporphyrin (CP), ALA and Pb content in blood were determined in a pretreatment period of 7-12 days in 9 patients, aged 38-60 yr, suffering from chronic or subacute Pb intoxication. Seven of the men were oxyacetylene metal-burners working in a ship-breaking yard, one had worked in a battery factory for 15 yr and one had been making Pb ingots for only 6 wk. Cases 1 and 2 had 7-days' courses of 900 mg penicillamine/day, case 9 had 2 separate courses of 7 days each of 900 mg/day, cases 3 and 4 had 900 mg/day for 4 days followed by 1500 mg/day for another 4 days, cases 5, 6 and 7 had 1500 mg/day for 7 days, and case 8 who was sensitive to penicillamine was given 150-1200 mg/day in increasing doses over a period of 23 days. In each case the penicillamine was administered in divided doses 3 times/day. In all 9 patients there was a concurrent decrease of urinary CP, ALA and Pb concentration in the blood. A long-term trial was carried out starting 3 mo (cases 1 and 2) or 10 days (cases 3 and 4) after the end of the short term trial in which penicillamine was given at 300 mg/day for 3 wk and at 600 mg/day for the following 6 wk. A 5th man of the initial group received 600 mg/day for 4 mo. There was a persistent excretion of urinary Pb in all 5 subjects, urinary CP and ALA returned to normal levels, the hemoglobin level increased and the neurological and abdominal symptoms disappeared. The patient who had received penicillamine for 4 mo, though without symptoms, was found to have proteinuria. Oral penicillamine is recommended in treatment of Pb poisoning in daily doses of 600 mg for a period not exceeding 4 wk.

- 2544 Gontzea, J., Dumitrache, S., Rujinski, A., and Cocora, D. (Inst. of Med. and Pharmacol., Bucharest, Romania): Der Bedarf an Vitamin C bei Bleiarbeitern. (VITAMIN C REQUIREMENT OF LEAD WORKERS.) *Internationale Zeitschrift für Angewandte Physiologie einschliesslich Arbeitsphysiologie* 20:20-33, 1963.

A still unpublished investigation by Sporn and Dinu in 1962 of 1157 workers of various industries showed that the content of ascorbic acid in the blood of workers exposed to Pb, aniline, trinitrotoluene or superphosphates was distinctly lower than in workers of other industries. Gontzea and co-workers studied the metabolism of ascorbic acid in 25 workers of a battery plant who had been exposed to Pb for at least 5 yr. The effect of their exposure to Pb was measured by their urinary Pb excretion (av 132 µg/l) and by blood counts (4.4 millions erythrocytes mm<sup>3</sup>, 13.2 g% hemoglobin). The normal diet of these subjects provided ~80 mg vitamin C/day, which is an optimal amount for their caloric intake. At this diet the average level of ascorbic acid in their blood was 0.37 mg% and urinary excretion of ascorbic acid was 9.80 mg/l. In none of the subjects did urinary excretion after iv injection of 500 mg ascorbic acid reach the normal value of 40% of the injected amount. In order to define the vitamin C requirement of these men exposed to Pb, the diet was supplemented, at intervals of 2 wk, by 70, 120, and 150 mg vitamin C, respectively, and the effect of the loading test (iv injection of 500 mg vitamin C) was determined in each case. It was found that in order

to prevent hypovitaminosis and to keep the utilization of ascorbic acid at a normal 40% level, the diet of these workers must contain 150-200 mg vitamin C/day. (53 references)

- 2545 Conțea, I., Dumitrache, S., Rujinski, A., and Cocora, D. (Inst. Med. Pharmacy, Bucharest, Romania): La nécessité en vitamine C des travailleurs exposés au plomb. (THE NECESSITY OF VITAMIN C IN WORKERS EXPOSED TO LEAD.) In Union des Sociétés de Sciences Médicales, Société d'Hygiène: Premier Congrès National d'Hygiène et de Sécurité du Travail. Rapports et Résumés des Travaux (First National Congress of Industrial Health. Abstracts of Papers). Bucharest, 1963, p. 205-6.

The study which was carried out among workers of a storage battery plant showed that some men, expending 3500-4000 calories of energy/24 hr, had a deficiency of ascorbic acid although their intake of 60-100 mg vitamin C appeared adequate. This phenomenon indicates that Pb increases the requirement for this vitamin. The addition to the diet, for 2 wk each of 70, 120, and 150 mg of ascorbic acid, showed that men exposed to Pb needed at least 150 mg ascorbic acid, or twice as much as nonexposed personnel in occupations requiring the same cost of energy; also, that a daily intake of 200 mg was optimal for workers exposed to Pb.

- 2546 Grieco, B., and Scalingi, G. (Univ. Naples, Italy): Rischio di contaminazione col piombo tetrametile in una raffineria di petrolio. (THE RISK OF CONTAMINATION WITH TETRAMETHYLLEAD IN A GASOLINE REFINERY.) Folia Medica 46, No. 11:940-8, 1963.

In a refinery where TML is added to gasoline, the personnel exposed to the risks of absorption of the methyl fluid by inhalation and skin contact include the operators of the mixing apparatus, the analysts who test the octane number of samples of the mixed gasoline and the chemists. Preventive measures for the operators include full protective clothing, rubber boots and gloves, and respirators. All components of the fluid, ethylene dibromide and dichloride, toluene, as well as TML constitute hazards to operators and technical personnel.

Ten men, 37-57 yr old, of whom 3 were operators of the mixing apparatus, 3 analysts, and 4 chemists of a refinery in southern Italy, were observed over a period of 10 mo. All men had handled methyl fluid since 1960 and had earlier performed similar tasks in the addition of ethyl fluid to gasoline. Their total service extended over 8-12 yr. At 3-mo intervals, beginning with December 1962 the workers were subjected to a medical examination and the following laboratory tests: determination of levels of Pb in blood and urine, urinary coproporphyrins, free protoporphyrin in erythrocytes, liver function, examination of urine, azotemia, differential blood picture, and blood cholesterol. All data obtained were within normal ranges. It is pointed out that in working with TML no hazard exists when adequate preventive measures are observed; these must include good ventilation as well as personal protection.

- 2547 Groos, E., Sattler, E.L., and Stahlhofen, W. (Max-Planck-Institut für Biophysik, Frankfurt, Germany): (THE NATURAL  $^{210}\text{Pb}$  and  $^{210}\text{Po}$  CONTENT IN THE BONES OF HUMANS.) Atomkernenergie 8:32-3 (Jan.), 1963.

The average value of  $^{210}\text{Pb}$  activity in human bones was found to be  $1.1 \times 10^{-13}$  Ci/g of bone ash and  $3.2 \times 10^{-14}$  Ci/g of fresh weight. (From Nuclear Science Abstracts 17:Abstract No. 13957, 1963)

- 2548 Hanke, J. (Inst. Med. Pracy, Lodz, Poland): Proba oceny stopnia uszkodzenia ustroju na podstawie testow enzymatycznych (zasadowa i kwasna fosfataza, aldolaza, transaminaza szczawiooctowa i transaminaza pirogronowa. (EVALUATION OF THE DEGREE OF POISONING BY ENZYMATIC TESTS (ALKALINE AND ACID PHOSPHATASE, ALDOLASE, AND GLUTAMIC-OXALACETIC AND GLUTAMIC-PYRUVIC TRANSAMINASES).) Medycyna Pracy 14, No. 3:223-38, 1963.

The activity of several enzymes of the blood serum was studied in patients severely poisoned by various chemical agents. The activity of acid phosphatase was unchanged while that of alkaline phosphatase was slightly lowered. Aldolase, glutamic-oxalacetic and glutamic-pyruvic transaminase showed increased activity especially when liver, heart muscle or skeletal muscles were injured by the poison. While in intoxications caused by CO, barbiturates, isoniazid, quinine and some tranquilizers, the alterations from the normal values were indicative of the degree of poisoning, this did not hold true for poisoning by Pb gasoline and methyl chloride.

- 2549 Harashima, S. (School of Med., Keio Univ., Japan): STUDIES ON INDUSTRIAL TOXICOLOGY, ESPECIALLY ON OCCUPATIONAL DISEASES DUE TO HEAVY METALS AND ORGANIC SOLVENTS. In The Abstracts of the Proceedings of the 16th General Assembly of the Japan Medical Congress (April), 1963, Osaka, Japan, 2 pp. Recent developments in industrial toxicology in Japan, particularly with regard to occupational diseases due to Pb and C tetrachloride, are reviewed. Instead of the threshold limit of 0.12 mg Pb/m<sup>3</sup> air, as recently suggested by the American Conference of Governmental Industrial Hygienists and Horiuchi and Ida's value of 0.05 mg/m<sup>3</sup> (1955), the author proposes a threshold limit of 0.10 mg/m<sup>3</sup>.

- 2550 Holtzman, R.B. (Argonne Natl. Lab., Ill.): MEASUREMENT OF THE NATURAL CONTENTS OF RaD ( $\text{Pb}^{210}$ ) AND RaF ( $\text{Po}^{210}$ ) IN HUMAN BONE - ESTIMATES OF WHOLE-BODY BURDENS. Health Physics 9:385-400 (Apr.), 1963.

The natural RaD ( $^{210}\text{Pb}$ ) concentration in man was determined from measurement of the RaF ( $^{210}\text{Po}$ ) in bone samples obtained from surgery and autopsy of unexposed individuals, mostly from Illinois. About 63% of the RaD is in the skeleton in apparent equilibrium with RaF, and, within a factor of 2, it is uniformly distributed in the skeleton. The average RaD concentration found in 128 bone samples was  $0.146 \pm 0.020$  pCi/g ash as compared to an average  $^{226}\text{Ra}$  concentration of  $0.037 \pm 0.007$  pCi/g ash. Little correlation between the 2 nuclides was observed. The average RaD concentra-



tions in the skeleton were 0.161 pCi/g ash in men and 0.119 pCi/g in women. These concentrations were generally higher in trabecular than in cortical bone, 0.184 and 0.105 pCi/g ash, respectively. No particular correlation was found between the residence histories of the donors and the RaD concentrations in their skeletons. Calculations based on some of the metabolic parameters of Pb and on the known concentrations of  $^{226}\text{Ra}$ ,  $^{222}\text{Rn}$  and RaD in the human biosphere, show food and air to be the major contributors of RaD in the subjects studied. The RaDEF decay chain is shown to contribute a radiation dose to the human skeleton more than double that from  $^{226}\text{Ra}$  and about equal to that from  $^{226}\text{Ra}$  and  $^{228}\text{Ra}$  combined. (From author's abstract; 49 references)

**2551** Hopkins, S.J.: THERAPEUTICS. Manufacturing Chemist 34:534-7 (Nov.), 1963. The discussion of recent developments in pharmaceuticals includes the use of CaNa acetate (sic, probably EDTA) in Pb poisoning, with the statement that as the drug must be given by injection and may also cause renal damage, its therapeutic value is limited. Penicillamine has been shown to mobilize stored Pb. With the advantage of easy oral administration, it may become, with wider experience, the standard treatment for Pb poisoning. (35 references)

**2552** Horeau, J., Gréaud, H., LeBourhis, J., Bureau, L., and Babin-Chevaye, L. (Medical Clinic, Paris, France): Nouveau cas de saturnisme d'origine alimentaire. (A NEW CASE OF LEAD POISONING OF DIETARY ORIGIN.) Annales de Médecine Légale et de Criminologie, Police Scientifique et Toxicologie 43:284-8 (May-June), 1963.

A case of Pb poisoning in a 53-yr-old man, due to ingestion each morning of a lemonade stored in a glazed earthenware container, is reported. Lemonade prepared from 2 lemons and 1 l. of water stored in this container for 24 hr, was found to contain 260 mg Pb/l compared to 0.020 mg when stored in a glass vessel, and the Pb content of the lemonade increased still more when the lemonade was kept in the glazed container for a longer period of time.

No Pb poisoning was suspected when the man was admitted to the hospital for the first time with symptoms of asthenia, dizziness and some hepatic irregularities. Three mo later he was again admitted to the hospital with abdominal colics, vomiting, and a Burton line. He showed a distinct anemia and presence of stippled basophilic cells; the Pb content of blood and urine was 120  $\mu\text{g}/100\text{ ml}$  and 810  $\mu\text{g}/24\text{ hr}$ , respectively; urinary coproporphyrins were increased. Three courses of treatment with CaEDTA resulted in complete recovery of the patient. The risk of Pb poisoning by the use of earthenware with Pb-containing coatings for alimentary purposes is discussed.

**2553** Horiuchi, K. (Osaka City Univ. Med. School, Japan): (LEAD POISONING.) Medicine (Tokyo) 20:71-4 (Jan.), 1963.

A review of the work accomplished on the subject at Osaka City University. (22 references)

**2554** Hoschek, R. (Stuttgart, Germany): Paral-

lelbestimmungen des Bleispiegels in verschiedenen Instituten. (PARALLEL DETERMINATIONS OF THE LEAD CONCENTRATION IN BLOOD IN DIFFERENT INSTITUTES.) Internationales Archiv für Gewerbepathologie und Gewerbehygiene 20:195-216 (May), 1963.

Seventy-one parallel determinations of the Pb level in blood were carried out by a team consisting of 14 reputed institutes located in Germany and other countries. Samples of blood from cattle to which a measured amount of Pb had been added, were distributed. The data obtained by the 14 institutes are shown in diagrams. Two of the institutes which used spectrographic methods had very satisfactory results. Four institutes using various modifications of polarography produced less satisfactory results. A not yet published coulometric method by Rosenmund and Opfermann appeared to be promising. The most frequently used method was the dithizone method. As a standardized method of determination the photometric reversion method by Ensslin and Dryer, using dithizone, is proposed. (20 references)

**2555** Hunt, V.R., Radford, E.P., Jr., and Segall, A.J. (Harvard School of Public Health, Boston, Mass.): COMPARISON OF CONCENTRATIONS OF ALPHA-EMITTING ELEMENTS IN TEETH AND BONES. International Journal of Radiation Biology 7, No. 3:277-87 (Sept.), 1963.

The suitability of teeth as indicators of the approximate levels of human skeletal burdens of naturally occurring internal  $\alpha$ -emitting isotopes was studied. Freshly extracted teeth were used. The time lapse between obtaining and processing the specimens was  $>1\text{ yr}$ . Consequently,  $^{210}\text{Po}$  was in equilibrium with  $^{210}\text{Pb}$  initially present and the results were reported as  $^{210}\text{Pb}$ ;  $^{226}\text{Ra}$  and  $^{228}\text{Th}$  were also measured. The coefficient of variation  $^{210}\text{Pb}$  from tooth to tooth for an individual was approximately 25%. Comparison of  $^{210}\text{Pb}$  and  $^{226}\text{Ra}$  levels in teeth and bones (taken postmortem from the iliac crest) from the same individual gave a significant correlation. Because of the variations found, it is concluded that care should be exercised in extrapolating from 1 tooth to an individual's body burden at low levels of radioactivity; that, however, teeth are as adequate as small bone samples for comparing levels of  $\alpha$ -emitting elements in groups of human subjects, and in estimating human skeletal burdens.

**2556** Ilić, C. (City Hosp., Belgrade, Yugoslavia): Toksička oštećenja sluha. (TOXIC DEAFNESS.) Medicinski Glasnik 17:71-5 (Feb.), 1963.

Discussion of the development of deafness from various toxic sources, such as drugs, alcoholism, and exposure to occupational poisons, including Pb, concludes with endogenous toxic states as cause.

**2557** Iordanidis, P. (Inst. Ind. Med. Hyg., Paris, France): Contribution à la sémiologie électroencéphalographique dans le domaine de la médecine du travail. (ELECTROENCEPHALOGRAPHIC SEMIOLOGY IN OCCUPATIONAL MEDICINE.) Archives des Mala-

dies Professionnelles de Médecine du Travail et de Sécurité Sociale 24:523-34 (June), 1963.

The discussion on the value of electroencephalograms in exposure to various industrial poisons, includes Pb poisoning. In the latter, the EEG generally shows an instability of the cortical electrical activity. The base rhythm is changed and the  $\alpha$ -rhythm may reach or even exceed a frequency of 13 waves/sec. An EEG should be taken in all cases of Pb poisoning with neurologic symptoms. (35 references)

- 2558** Jebavý, Z. (Univ. Hradci Kralove, Czechoslovakia): Ústní změny při intoxikaci olovem a jejich průkaz. (ORAL CHANGES IN LEAD POISONING AND THEIR DIAGNOSIS.) Ceskoslovenska Stomatologie 63, No. 2:84-8, 1963.

The manifestations of subchronic and chronic Pb intoxication in the oral cavity are discussed. Sixty-nine patients with suspected Pb intoxication were examined. Among these, 30.4% had Pb lines on their gums and 7.3% had anemic gums. Histochemical studies, using the chromate method, revealed precipitates of Pb chromate around capillaries or directly in the walls of their capillaries. It was demonstrated that macroscopic examination, using a magnifying glass, sufficed to detect Pb lines on the gums. However, a grey line on the gums is not sufficient to diagnose Pb intoxication. (From author's English summary)

- 2559** Johnson, P.C., Jr., ed. (Baylor Univ. Coll. Med., Houston, Texas): UNIVERSITY ROUND WARDS: ANEMIA WITH INTESTINAL COLIC. Medical Record and Annals 56:200-1 (Sept.), 1963.

A 35-yr-old tank cleaner at a refinery complained about nose trouble (reason for not wearing his face mask at work), constipation, and abdominal cramps. Laboratory studies showed an anemia with 9.3 g Hb, a red cell volume of 76  $\mu$ Ci, and a mean Hb concentration of 28.5%. There were 5.5% reticulocytes with stipplings in the red cells. Urine urobilinogen level was 7.7 mg/24 hr and urinary coproporphyrin >1000 mg%. Pb blood level was 0-10 mg%, urinary Pb content for the 1st 24 hr was 0.3 mg. It became clear that the patient was intoxicated by TEL. The symptoms and signs of Pb poisoning are briefly discussed, as is treatment with EDTA ( $\text{CaNa}_2$ -). Concerning the latter, lower doses (0.5 g iv in 10-20 ml saline) are recommended at 1-2 g/day to a total of 8-20 g. It is stated that it may not be effective in TEL poisoning.

- 2560** Kakhn, Kh.A. (Inst. Exptl. Clin. Med., Tallin, Estonian SSR): Izuchenie effektivnosti i ustoiчивosti lechebnogo deistviya  $\text{CaNa}_2\text{EDTA}$  pri svintsovom otravlenii. (STUDY OF THE EFFECTIVENESS AND PERSISTENCE OF THE THERAPEUTIC ACTION OF  $\text{CaNa}_2\text{EDTA}$  IN LEAD POISONING.) Gigiena Truda i Professional'nye Zabolevaniya 7:33-7, 1963.

Fifty-one patients with chronic occupational Pb poisoning were treated with injections of a 10% aqueous solution of  $\text{CaNa}_2\text{EDTA}$  in a daily dose of

2 g (20 ml) for 3 days, followed by a rest period of 3 days. Symptoms of mild intoxications disappeared after 2-3 such courses, while moderate and severe cases required 3 and 4 courses, respectively. During treatment, Pb excretion increased 3-100-fold. A definite relationship between the degree of Pb intoxication and Pb elimination was established. In the case of residual manifestations of Pb poisoning the basic treatment should be followed, within 1-3 mo, by a short supplementary course of 3-6 injections of  $\text{CaNa}_2\text{EDTA}$ . A lasting therapeutic effect depends on complete removal of the patient from Pb exposure and may be achieved within a period of 6 mo. Resumption of exposure to Pb has resulted frequently in relapses, especially in patients who had suffered severe intoxication.

- 2561** Kakhn, Kh.A. (Acad. Sci., Tallin, Estonian SSR): Aktivost' kholinesterazy syvorotki krovi u bol'nykh khronicheskim svintsovyim otravleniem i ee dinamika pri lechenii preparatom  $\text{CaNa}_2\text{EDTA}$ . (CHOLINESTERASE ACTIVITY OF THE BLOOD SERUM IN PATIENTS WITH CHRONIC LEAD POISONING AND ITS DYNAMICS DURING THE  $\text{CaNa}_2\text{EDTA}$  TREATMENT.) Gigiena Truda i Professional'nye Zabolevaniya 7:50-1 (Oct.), 1963.

The author first observes that a decrease in cholinesterase (ChE) activity occurs from excessive exposure to numerous substances. In his study he examined 39 patients with occupational chronic Pb poisoning before and after treatment with  $\text{CaNa}_2\text{EDTA}$ . Of these, 20 suffered with mild, 17 with moderate, and 2 with severe poisoning. Along with ChE activity, the blood picture as to stippled erythrocytes, red cell and reticulocyte counts, porphyrin and Pb levels in urine were followed in 21 patients for 4-12 mo (av 5) after treatment. Sibul's semimicrotitrimetric method was used for determination of ChE activity. The decrease in ChE activity paralleled the severity of the poisoning: in mild poisoning it was within the lower limit of normal, and in severe, especially in patients with toxic hepatitis, it was sharply reduced. In spite of treatment with a 10% solution of EDTA, the normal level of ChE activity was not reached until 6 mo after treatment was terminated. In cases of relapse, the ChE activity remained at the low level.

- 2562** Kanner, N. L. (Research Inst. of Occup. Hyg. and Prof. Diseases, Leningrad, USSR): Funktsional'noe sostoyanie kory nadpochechnikov u lits, podvergayushchikhsya khronicheskomu vozdeistviyu svintsa i benzola. (FUNCTIONAL CONDITION OF THE ADRENAL CORTEX IN CHRONIC INTOXICATION WITH LEAD AND BENZENE IN MAN.) Terapevticheskii Arkhiv 35, No. 11:95-9, 1963.

Adrenocortical function was assessed in 38 cases of chronic occupational Pb poisoning, in 8 who were at the time subject to the subacute or severe chronic types, and in 35 with chronic occupational poisoning by benzene and its homologs. A group of 28 essentially healthy individuals of the same ages as the patients served as controls. The following were determined: level of spontaneous secretion (content of free 17-hydroxycorticosteroids in

blood), function (content in blood 2 hr after administration of adrenocorticotrophic hormone (ACTH)), reaction (absolute increase in 17-hydroxycorticosteroids and relative decrease in eosinophil counts after ACTH), excretion of 17-hydroxycorticosteroids and 17-ketosteroids in urine. The data were first obtained on the control subjects in order to establish normal ranges. The techniques used are stated. Complete tests could not be carried out on all of the subjects involved. The data obtained and the number of subjects concerned are shown in a table.

In the initial stage of intoxication by Pb, adrenocortical function decreased slightly. Corticoid excretion was clearly lowered. In the stage when characteristic clinical signs appeared, a relative increase in activity took place so that the values approached the normal. The eosinopenic reaction was insufficient in 3 of 9 patients. In subacute poisoning with anemia and colic, excretion of corticoids and in most cases of 17-ketosteroids was abnormal in that it was both increased and decreased. Benzene intoxication affected the adrenocortical function more severely than did Pb.

- 2563** Katsnel'son, B.A. (Inst. Labor Hyg., Occup. Dis., Sverdlovsk, USSR): Nekotorye novye vozzreniya na patogenezu i terapiyu saturnizma. (Obzor zarubezhnoi literatury). (SOME NEW VIEWS ON THE PATHOGENESIS AND THERAPY OF LEAD POISONING. (SURVEY OF FOREIGN LITERATURE.)) Gigiena Truda i Professional'naya Zabolevaniya 7:47-9 (Feb.). 1963.

The effect of Pb on the porphyrin metabolism and treatment of Pb poisoning with chelates are reviewed on the basis of 18 references.

- 2564** Kehoe, R.A., Cholak, J., McIlhinney, J.G., Lofquist, G.A., and Sterling, T.D. (Univ. Cincinnati, O.; du Pont Co.; Ethyl Corp.): POTENTIAL HAZARD OF EXPOSURE TO LEAD. II. FURTHER INVESTIGATIONS IN THE PREPARATION, HANDLING, AND USE OF GASOLINE CONTAINING TETRAMETHYLLEAD. Archives of Environmental Health 6:255-72 (Feb.), 1963; Medical Bulletin, Standard Oil Company (New Jersey) 23:262-91 (Nov.), 1963.

Pb in the air at occupational sites was measured in 2 petroleum refineries, one near Los Angeles and the other near San Francisco, in which TML was being mixed with gasoline from time to time. Average Pb levels at points in and around the mixing installations in the 2 refineries were 193.0 and 54.1  $\mu\text{g}/\text{m}^3$  of air, respectively, and <70.0  $\mu\text{g}/\text{m}^3$  at other locations near the mixing installations. Sampling of the atmosphere of 10 service stations each in Los Angeles and San Francisco showed an average Pb concentration of 4.6 and 9.9  $\mu\text{g}/\text{m}^3$ , respectively, and the concentration of Pb at a centrally located site in each of the 2 cities averaged 4.3 and 1.8  $\mu\text{g}/\text{m}^3$ , respectively. Medical surveillance of the workmen employed at the several sites included the determination of Pb in the urine at intervals of  $\sim 3$  mo over a 16-mo period and of the Pb content of the blood at the beginning and end of the investigation. All data obtained were tabulated and statistically evaluated. The results of the tests demonstrated that

the exposure of the various groups of workmen to TML under the conditions of the study was negligible. The urinary Pb values for loaders of tank trucks averaged 0.026 mg/l; of handlers of TML gasoline, 0.025; of TML blenders, 0.021; of service station attendants, 0.024-0.040 (mean). The blood Pb concentrations for above occupations averaged 0.029 mg/100 g; 0.024-0.027; 0.024; 0.026-0.040.

- 2565** Kehoe, R.A., Cholak, J., Spence, J.A., and Hancock, W. (Univ. Cincinnati, O.): POTENTIAL HAZARD OF EXPOSURE TO LEAD. I. HANDLING AND USE OF GASOLINE CONTAINING TETRAMETHYLLEAD. Archives of Environmental Health 6:239-54 (Feb.), 1963; Medical Bulletin, Standard Oil Company (New Jersey) 23:150-75 (July), 1963.

A controlled experiment carried out on employees of a taxicab company is described. Observations were made (1) under the usual conditions of the operations of the garage, (2) when fuel containing 3 ml TEL/gal was used, (3) when a fuel containing an equivalent (in terms of Pb content) quantity of TML was substituted for TEL. Determinations of the Pb content of the air in the breathing zone of the individuals at work on the fueling island, made during periods of maximal activity (ie, when the greatest number of cars were supplied with fuel), showed a mean concentration ( $\mu\text{g}/\text{m}^3$ ) of organic and particulate Pb of 17.65, 28.59, 84.01, and 6.71, 9.88, 16.24, respectively. The periods, at which the air samples were taken, constituted only  $\sim 1/4$  of the hours of work of any one man. Pb analyses of the urine and blood of the employees were made during each of the 3 periods. Only 1 of 15 men had an apparently increased level of urinary Pb during part 2 (but he had provided only 1 specimen). Under part 3, 11 underwent very slight increases over those of part 2 and 7 over those of part 1.

The conclusion was drawn that the change in atmospheric Pb content in the garage resulted in no significant change in Pb absorption by the workmen. The Pb content of the blood, as expected, changed less and more slowly than that of the urine. Blood analyses were made both by a spectrographic and the dithizone method, the 1st one yielding somewhat higher and more variable results. The outcome of the study shows that, from the aspect of a potential hazard by Pb absorption from TML, there is no hygienic reason against its use.

- 2566** Kiryakov, K. (Sofia): ELECTROPHYSIOLOGICAL FINDINGS IN NEUROINTOXICATIONS WITH TETRAETHYL-LEAD. In Proceedings of the Bulgarian Society of Neurology and Psychiatry Section of EEG and Clinical Neurophysiology, Sofia, April 15, 1963, p. 709.

The EEG and the chronaxie of the common extensor muscles and the superficial flexors of the arm were investigated in 38 aviation employees, working in contact with Pb gasoline. The EEG tracings were predominantly of low voltage fast rhythms, with reduced (at times even inverted) reaction to light. Some of them were slowed or dysrhythmic. There was also a general decrease of chronaxie and the normal ratio, Chr extensors:Chr flexors = 2, was reduced. The EEG's in more than half of the cases could be interpreted as dominance of the

processes of excitability. The shortened chronaxie of subordination is a sign bearing the same significance. The electrophysiological findings are in good correlation with the mild clinical symptoms and signs of early neurointoxication. (From author's abstract)

- 2567** Kleinstein, I., Kleinstein, A., and Sandulesco, G. (Inst. for Med., Jassy, Romania): L'importance du dosage des précurseurs des porphyrines dans l'urine pour le dépistage d'une absorption minime de plomb. (THE IMPORTANCE OF DETERMINING THE PRECURSORS OF URINARY PORPHYRINS FOR THE DETECTION OF MINIMAL ABSORPTION OF LEAD.) In Union des Sociétés de Sciences Médicales, Société d'Hygiène: Premier Congrès National d'Hygiène et de Sécurité du Travail. Rapports et Résumés des Travaux (First National Congress of Industrial Health. Abstracts of Papers). Bucharest, 1963. p.52.

Urinary excretion of  $\delta$ -aminolevulinic acid (ALA), porphobilinogen and coproporphyrin was studied in a group of workers exposed to a minimal absorption of Pb and in a nonexposed group. ALA was found to increase in the Pb-exposed subjects while porphobilinogen and coproporphyrin remained at normal levels. Compared to urinary Pb excretion provoked by the administration of ethylenediaminetetraacetate (EDTA), the increase of ALA as a precursor of porphyrin seems to be earlier, more constant and more significant. ALA returns to normal values after administration of EDTA. The precursors of porphyrin were measured by use of a chromatographic column and by spectrophotometric analysis.

- 2568** Kochanowicz, T. (Inst. Med. Pracy, Zabrze, Poland): Próby stosowania chelatonu w kremach ochronnych u pracowników narażonych na działanie soli metali. (SODIUM-CALCIUM EDETATE IN PROTECTIVE CREAMS FOR WORKERS EXPOSED TO METAL SALTS. Medycyna Pracy 14, No.2:199-204, 1963.

Ointments containing 10%  $\text{CaNa}_2\text{EDTA}$  were used for the prophylaxis and treatment of workers exposed to Cr, Co, Mn, Pb, Ni and Zn salts. The use of the ointment for protection against skin disorders by these salts gave encouraging results. The use for purposes of treatment gave inconsistent results. The author suggests investigations on a larger number of workers for confirmation of the protective action of such ointments. (From author's summary)

- 2569** Kośmider, S. (Clin. Internal, Occup. Dis., Med. Acad., Zabrze, Poland): Das Verhalten der alkalischen Phosphatase im Serum bei gewerblichen chronischen Bleivergiftungen. (ROLE OF SERUM ALKALINE PHOSPHATASE IN CHRONIC OCCUPATIONAL LEAD POISONING.) Internationales Archiv für Gewerbepathologie und Gewerbehygiene 20:11-20 (Mar.), 1963.

Alkaline phosphatase in the blood serum was determined in 38 patients, 19-57 yr, who had been exposed to Pb for some months to 22 yr, before and after treatment with  $\text{CaNa}_2\text{EDTA}$ , administered every other day in daily doses of 3 g. In 33 of the patients the alkaline phosphatase activity averaged 0.70 mM, compared with 1.6 mM in 33 control sub-

jects. During treatment with EDTA, activity dropped to 0.52 mM, but returned to 1.34 after completed treatment.

The inhibiting effect of Pb on the activity of serum alkaline phosphatase was confirmed in experiments with 2 groups of rabbits, intoxicated with Pb acetate (10 mg/kg for 8 days and 6 mg/kg for 12 days, respectively). The problem whether Pb affects the formation of phosphatase or whether it acts directly on the enzyme thereby reducing its activity was studied in 11 in-vitro tests with human serum to which Pb acetate was added in concentrations of  $10^{-4}$ -1M. The results of these tests showed that Pb acts directly on the phosphatase, the decrease of activity being proportional to the concentration of Pb ions. Phosphatase activity was also determined in 10 normal subjects before and 1 hr after iv administration of 2 g  $\text{CaNa}_2\text{EDTA}$ ; average values found were 1.4 and 0.65 mM, respectively. In vitro tests with sera of 15 normal individuals to which EDTA in concentrations of  $10^{-4}$ -1M was added indicated that phosphatase activity is inversely proportional to the level of EDTA. The cause of phosphatase inhibition by EDTA was attributed to the binding of Mg ions. For this reason the author advises Mg supplements during EDTA treatment to compensate for a possible Mg deficiency. (20 references)

- 2570** Košutić, Z. (Fever Hosp., Med. Coll., Zagreb, Yugoslavia): Diferencijalno-dijagnostičke poteškoće kod olovniha kolika. (DIFFICULTIES IN DIFFERENTIAL-DIAGNOSIS IN LEAD COLIC.) Lijecnicki Vjesnik 85:161-4 (Feb.), 1963.

Pb poisoning of the gastrointestinal type in a man and his wife is presented. Their illness had been diagnosed earlier in another hospital as an acute intestinal obstruction; in consequence a laparotomy was performed on the husband. Pb-glazed earthenware was found as the source of the alimentary poisoning.

- 2571** De Kretser, A.J., and Waldron, H.A. (Med. Dept., Vauxhall Motors Ltd., Luton, England): URINARY DELTA AMINO-LAEVULINIC ACID AND PORPHOBILINOGEN IN LEAD-EXPOSED WORKERS. British Journal of Industrial Medicine 20:35-40 (Jan.), 1963.

Of 100 workers exposed to Pb in varying degrees, the urinary  $\delta$ -aminolevulinic acid (ALA) concentration was  $>0.6$  mg/100 ml in 34 subjects and between 0.3 and 0.6 mg/100 ml in 35. In only 20 of the workers was the urinary porphobilinogen concentration  $>0.1$  mg/100 ml, 2 of these cases being  $>0.2$  mg/100 ml. No significant correlation was found between the urinary concentration of ALA and coproporphyrin nor between ALA and the urinary Pb levels; in fact, the highest ALA level was associated with a urinary Pb of  $<200$   $\mu\text{g/l}$ . Raised urinary Pb was always associated with raised ALA. (22 references)

- 2572** De Kretser, A.J., and Waldron, H.A. (Med. Dept., Vauxhall Motors Ltd., Luton, England): THE MECHANICAL FRAGILITY OF THE RED CELL IN PATIENTS WITH LEAD POISONING. British Journal of Industrial Medicine 20:316-19 (Oct.), 1963.

The mechanical fragility of the red cell was stud-

ied in 68 workers who had been exposed to Pb in varying degrees, and on blood to which Pb had been added in vitro in concentrations up to 5 µg/ml. The results showed that the mechanical fragility index did not vary significantly from that of a control group. Furthermore, the use of various anticoagulants produced no significant alterations in the mechanical fragility index. But this index was always greatly increased in anemic subjects if the hemoglobin was below 80%. (24 references)

- 2573** Krivoglaz, B.A. (Inst. Ind. Hyg. Occup. Dis., Kiev, USSR): Lechebno-profilakticheskoe primeneniye unitiola v klinike profzabolevaniy. (THERAPEUTIC AND PROPHYLACTIC USE OF UNITHIOL IN THE TREATMENT OF OCCUPATIONAL DISEASES.) Gigiena Truda i Professional'nye Zabolevaniya 7:15-9 (Aug.), 1963.

The author reviews the effectiveness of unithiol, developed in the Ukraine by Petrun'kin et al, particularly in regard to As and Hg poisoning. This substance (Na 2,3-dimercaptopropane sulfonate) is related to BAL, but offers many advantages over it; it can be administered im, orally, or by aerosol inhalation. Satisfactory results have been found by Russian authors in the use of unithiol in Pb poisoning, although BAL has not been considered effective by Vigliani and others. Since unithiol acts somewhat differently from BAL, the author recommends further trials, both clinical and experimental. (24 references)

- 2574** Lechien, P., and Coutelier, L. (La Louvière, Belgium): Utilisation d'une méthode semi-quantitative de dosage des porphyrines urinaires dans la surveillance en série des travailleurs exposés au saturnisme. (THE USE OF A SEMI-QUANTITATIVE METHOD FOR THE ESTIMATION OF URINARY PORPHYRINS IN THE SERIAL SURVEILLANCE OF WORKERS EXPOSED TO LEAD.) Archives Belges de Médecine Sociale, Hygiène, Médecine du Travail et Médecine Légale 21:219-37 (Apr.), 1963.

The chemistry, biochemistry, biosynthesis of porphyrins and the classifications of the various porphyrias are discussed. Under normal conditions, 20-200 µg of coproporphyrin are excreted daily in the urine. In the case of porphyrias, this amount may be increased to several mg. In Pb poisoning, 2-3 mg of coproporphyrin are excreted daily. Several methods exist for the determination of porphyrins in the urine. The authors used a modified method by de Langen and ten Berg, based on the solubility of the porphyrins in ether and on their characteristic fluorescence under the influence of Wood's light.

The relation between the coproporphyrin content and the number of punctate red blood cells was studied. No punctate cells were found when the level of coproporphyrins was normal or very low. As the urinary coproporphyrin may increase without a simultaneous increase of the punctate cells, although the reverse situation may exist, the authors consider the determination of urinary coproporphyrins to be a more important symptom of Pb poisoning than a test for punctate cells. A system of industrial surveillance has been established as follows: hemoglobin and urinary coproporphyrins are

determined in all workers every 3 mo; this is done monthly or twice a month in workers exposed to a great risk or demonstrating an elevated level of coproporphyrins. This scheme has been successfully utilized in 2 industries comprising more than 200 workers exposed to the hazards of Pb poisoning.

- 2575** Lewis, C.E. (Univ. Kansas, Kansas City): THE TREATMENT OF CHRONIC INTOXICATION DUE TO LEAD, ARSENIC AND MERCURY. General Practitioner 27:129-32 (May), 1963.

The clinical picture of chronic Pb intoxication in children and adults and methods of treatment are reviewed.

- 2576** Lifshits, V.M. (Dept. Therapy State Med. School, Voronezh, USSR): Soderzhanie nekotorykh mikroelementov v eritrotsitakh, leukotsitakh i plazme krovi cheloveka. (THE CONTENT OF SEVERAL TRACE ELEMENTS IN ERYTHROCYTES, LEUKOCYTES, AND BLOOD PLASMA IN MAN.) Voprosy Meditsinkoi Khimii 9, No. 6:610-4, 1963.

The trace metals Ni, Zr, Zn, Ag, Cu, V, Tl, Al, Pb, Mn, Fe were determined spectrographically. The following average values, in µg%, were found for Pb: whole blood,  $33.9 \pm 2.16$  (males, 33.4; females, 31.6); erythrocytes,  $29.6 \pm 15.9$ ; plasma,  $9.05 \pm 3.8$ ; leukocytes, traces. (15 references)

- 2577** Linari, F., Coscia, G.C., Martorano, G., and Perrelli, G. (Univ. Turin, Italy): L'aminoaciduria nella intossicazione professionale da piombo. (AMINO-ACIDURIA IN OCCUPATIONAL LEAD POISONING.) Archivio Scienze Mediche 116:336-47 (Dec.), 1963.

The exploration of urinary excretion of amino acids by workers exposed to noxious substances, in order to detect renal lesions or interference with the general metabolism, has gained the attention of industrial physiopathologists. As the interpretation of results is still open to question, the authors have investigated the occurrence and the frequency of changes in the excretion of amino acids and the behavior of these acids in the blood of 19 workers, 21-55 yr old, with various degrees of Pb poisoning. There were 4 cases with acute, 4 with subacute and 9 with chronic poisoning, 2 others showed signs of abnormal Pb absorption. Data obtained on the content of δ-amino N in the blood, excretion in urine, clearance and reabsorption, as well as data referring to the renal function were tabulated. In men with Pb poisoning (showing thiosulfate clearance of 65-156 ml) the amino acid clearance ranged from 1.528-2.837 ml/min, exceeding the normal of 2.07 in 10 cases. The fasting urinary excretion of amino acids varied from 142-203 µg/min, av  $180.526 \pm 19.56$ , compared with a normal of 90-180. Amino acids in the blood were 6.40-10.23 mg%, av 8.35. The hypothesis is advanced that Pb affects the enzymes involved in the reabsorption and transport of amino acids, thereby causing a tubular hypofunction. Confirmation of this was seen by the authors in the comparison of the ratio of amino acid to thiosulfate clearance in patients with Pb poisoning and those afflicted with kidney disorders due to some other cause.

- 2578 Lob, M., and Clément, F. (Med. Coll., Lausanne, Switzerland): Réactions toxiques et allergiques de la moelle osseuse. (TOXIC AND ALLERGIC REACTIONS OF THE BONE MARROW.) Zeitschrift für Unfallmedizin und Berufskrankheiten 56:277-97, 1963.
- Various drugs and chemical substances of technological importance are the cause of changes in the bone marrow, at times very serious. Toxic reactions produced by them are infinitely more frequent than the allergic. There is need to distinguish medullary reactions of clinical importance (especially aplasias) from those that are only of secondary interest prognostically. After classifying the types of bone marrow changes with their most common etiologies, the authors discuss in greater detail the disturbances caused by benzene (fatal aplasia), chloramphenicol, pyrimidon and Pb (in respect to hemesyntesis) they point to the theoretical interest of hemolysis caused by a deficiency in glucose-6-phosphate-dehydrogenase. In conclusion, they recommend, among other preventive measures, frequent examination of the bone marrow, either by hematology or by biopsy. (49 references)
- 2579 Lockhart, R. (Univ. St. Andrews, England): MILK SUPPLEMENTATION AS A PROPHYLACTIC IN INDUSTRY. ITS USE AND MISUSE. Transactions of the Association of Industrial Medical Officers 13:65-6 (July), 1963.
- In a small pilot study additional milk was supplied to workers engaged in paint spraying in Dundee, England. The quantity given amounted in general to 1 pint/employee/working day. Some of the men stated that the only effect it had on them was to make them fat and that they had felt fitter without it. It is pointed out that the provision and drinking of milk is no substitute for procedures of good hygiene as outlined in various Factory Acts and Regulations.
- 2580 Lorenzo, J.A., Chiovino, F., and Giberti, C.A. (Hosp. Teodoro Alvarez, Buenos Aires, Argentina): Saturnismo agudo. (ACUTE SATURNISM). Dia Médico 35:1440-1 (Sept. 12), 1963.
- The case of a 17-yr-old Pb founder is described. The diagnosis of Pb poisoning was based on blood tests and determination of Pb in blood and urine and of uroporphyrins. The following values were considered as threshold limits: stippled cells, 0.50-1/thousand red cells; Pb in blood, 0.01-0.08%; Pb in urine, 0.08 mg/l; coproporphyrins, clear blue or green color of an acetic-acid solution of urine in Wood's lamp. In the case described, 1% of the red cells showed basophilic stippling; blood Pb was 0.21%; urinary Pb, 0.30%/l (sic). The signs had included paresthesia, asthenia, palpitations, abdominal pains. Recovery followed treatment with vitamins C and B, calcium glucoheptanate.
- Following a brief discussion of therapeutic management of Pb poisoning, including the use of the newer chelating agents, the authors outline the requisites of prevention: careful and complete pre-employment examination, proper placement and rotation of workers on jobs, periodic examination, showers and change of clothing after work, prohibition of smoking during work, and certain other measures followed by his group, such as administering to the workers biweekly a very weak solution of sulfuric acid to form insoluble Pb sulfates; milk, more for psychologic reasons aside from supplementation of calcium; silicone hand creams to prevent Pb absorption through the skin.
- 2581 Martin, S., Boudène, C., Truhaut, R., and Albahary, C. (Hosp. Saint-Denis, Paris, France): Etude comparée d'un nouveau chélateur du plomb, le sel monocalcique et trisodique de l'acide diéthylène triamine pentacétique (CaDTPA) et du sel monocalcique et disodique de l'acide éthylène diamine tétracétique (CaEDTA) dans le dépitage du saturnisme. (COMPARATIVE STUDY OF A NEW LEAD CHELATING AGENT, THE MONOCALCIUM AND TRISODIUM SALT OF DIETHYLENTRIAMINE-PENTAACETIC ACID (CaDTPA) AND THE MONOCALCIUM AND DISODIUM SALT OF ETHYLENEDIAMINETETRAACETIC ACID (CaEDTA) IN THE DETECTION OF LEAD POISONING.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 24:297-307 (Jan.-Mar.), 1963.
- The urinary excretion of Pb after iv administration of calcium disodium ethylenediaminetetraacetate (CaEDTA) or calcium trisodium diethylenetriaminepentaacetate (CaDTPA) was compared in subjects exposed to Pb hazards of various degree and in controls not exposed to Pb, among them several alcoholics. In one group of tests, DTPA only was used, but in most cases, both agents, administered at a 10-day interval, were compared in the same subject. DTPA used alone produced greater excretion of Pb, particularly in the first 5 hr, than did DTPA before or after EDTA. In most workers exposed to definite or moderate Pb risk, DTPA caused greater Pb excretion than EDTA; in those exposed to low risk, there was little difference between the drugs.
- It is concluded that even though the difference in action is not great, the substitution of DTPA for EDTA appears to be advantageous. However, further studies on prolonged treatment with DTPA are necessary to be sure that DTPA does not act more strongly than EDTA in removing the essential trace metals.
- 2582 Martinez, M., and Rojas, E. (Hosp. de la Raza, Mexico, D.F.): Manifestaciones gastrointestinales, hiperglicemia, estupor y terminacion fatal. (GASTROINTESTINAL MANIFESTATIONS, HYPERGLYCEMIA, AND STUPOR, WITH FATAL OUTCOME.) Revista de Investigacion Clinica 15:165-72 (Apr.-June), 1963.
- A case of chronic Pb intoxication with fatal outcome in a 27-yr-old miner is described. His history included alcoholism from 17-25 yr of age, with inebriation every 8-15 days. The signs and symptoms consisted of nausea, vomiting, abdominal pain, anorexia, asthenia and loss of weight. Hyperglycemia and constant progressive vomiting over a period of 10 mo resulted in his death. Various causes of death were considered in the clinical diagnosis but discarded, such as diabetes, cancer, infectious gastritis; finally, on the basis of his employment, a heavy-metal poisoning and malnutrition were considered. The final diagnosis of Pb poisoning was based on the presence of lesions in

the digestive and nervous system and possibly in the liver, and Pb deposits in the kidney (4+) and liver (3+).

- 2583** Meadows, G.S. (City Lab., Salford, England): LEAD IN FOOD DERIVED FROM TINNED STEEL FRYING PANS. *Journal of the Association of Public Analysts* 1, No.2:26-8, 1963.

After the occurrence of symptoms resembling those of Pb poisoning in a person who had eaten food prepared in a tinned steel frying pan, this pan and some other tinned steel frying pans were examined. Pb was determined in scrapings of the tinning and in test meals cooked in the pans. In 2 cases, the amount of Pb found in the tinning was less than 0.5% but in 4 other instances it ranged from 51.3-54.9%. Test meals cooked in the pan with 54.9% Pb in the tinning contained 35-85, av 55 ppm Pb, and meals cooked in the pan with 51.3% Pb in the tinning contained 7.3-11, av 9.2 ppm Pb. Microscopic examination showed some Pb in the meals to be in the form of very finely divided particles. It was assumed that some Pb was acquired mechanically rather than chemically, by the food being in contact with the semi-molten lining. A meal of 150 g cooked in the pan with 54.9% Pb in the tinning would thus give a Pb intake of ~8 ppm which is ~4 times the generally accepted maximum allowable amount for daily Pb ingestion. Although much of the Pb taken up by food in these frying pans is probably not in a soluble form, a possible hazard of Pb poisoning exists in their use.

- 2584** Meiklejohn, A. (Dept. Ind. Health, Univ. Glasgow, Scotland): THE SUCCESSFUL PREVENTION OF LEAD POISONING IN THE GLAZING OF EARTHENWARE IN THE NORTH STAFFORDSHIRE POTTERIES. *British Journal of Industrial Medicine* 20:169-80 (July), 1963.

The history of Pb poisoning in the pottery industry is reviewed. In 1947, a regulation was enacted that no glaze should be used which is not a Pb-less glaze or a low-solubility glaze. Since 1944, only 4 cases of Pb poisoning in the pottery industry have been recorded. Recent studies by the Medical Inspectorate of Factories, using blood examinations, showed no evidence of Pb absorption among the workers. (34 references)

- 2585** Mel'nikova, E.A., Parasenko, Z.G., and Artamonova, T.A. (Kubansk Inst. Med., USSR): O vliyaniy nekotorykh toksicheskikh veshchestv na syvorotochnye belki. (EFFECT OF CERTAIN SUBSTANCES ON SERUM PROTEINS.) *Gigiena i Sanitariya* 28, No. 3:28-32, 1963.

Examination of the working conditions in an oil refinery showed that the concentration of gasoline vapors in working areas did not exceed the MPC. In the ethylation department the concentration of TEL in the air during ethylation exceeded the MPC by 3 times. A prolongation of the time of heat coagulation of serum proteins was observed in 24 of 60 workers in contact with TEL gasoline, and in 7 of 31 workers in contact with TEL-free gasoline. The protein heat coagulation time was still prolonged after 1 yr in 4 patients examined for a 2nd time. The coefficient of se-

rum protein hydrophobization was reduced in 26% of workers in contact with TEL gasoline and in 4.9% in contact with TEL-free gasoline. In studying the effect of toxic factors on human blood it is necessary to study serum proteins as well as the formed elements of the blood.

- 2586** Merli, A. (Inst. Ind. Med., Milan, Italy): Comportamento dell'emometria - punteggiati basofili - porfirine urinarie - in operai di una fabbrica di accumulatori al piombo, sottoposti a trattamento con estratto epatico. (BEHAVIOR OF THE HEMOGLOBIN, PUNCTATE BASOPHILS, URINARY PORPHYRIN IN WORKERS OF A LEAD ACCUMULATOR FACTORY TREATED WITH LIVER EXTRACT.) *Rassegna di Medicina Industriale e di Igiene del Lavoro* 32:568-76 (Nov.-Dec.), 1963.

The manufacture of storage batteries involves various operations accompanied by different degrees of exposure to Pb dusts and fumes. These are briefly described, indicating the comparative level of exposure to Pb, ranging in magnitude from + to +++.

The author subjected workers of 1 factory, who upon quarterly examinations exhibited some signs of suspected or clear signs of Pb poisoning, to treatment with liver extract. One group was given the "anti-anemic principle," the other the "anti-toxic principle." The hemoglobin content, number of punctate basophils and urinary porphyrins before and after administration of the liver extract were tabulated. Both groups reported an improvement subjectively. Objectively, better results were obtained by treatment with the anti-anemic liver extract.

- 2587** Meythaler, F., and Eichhorn, W. (Municipal Hosp. Nürnberg, Germany): Über Bleivergiftungen. (LEAD POISONING.) *Ärztliche Forschung* 17, No. 11:569-71, 1963.

In view of the relatively high frequency of Pb poisoning among occupational intoxications, the author briefly discusses Pb poisoning generally, then cases that had been referred to the Hospital of Nürnberg. Over a 15-yr period from 1947 to 1962, among 86,395 admissions, there were 1955 cases of poisoning of which 1242 were suicidal attempts, 557 accidental, 110 occupational, 3 chronic and 56 questionable cases. With 11 cases, Pb poisoning ranked 3rd in place; aside from this, there were 3 accidental cases, 1 of which may have been intentional. Signs and symptoms, diagnosis and treatment of Pb poisoning are briefly reviewed and 3 cases are described in some detail. These concerned a 32-yr-old man, with fatal outcome; his wife, who exhibited chronic intoxication; their 4-yr-old child had suffered a mild form of poisoning. Inhalation of Pb fumes while melting Pb-containing scrap in their home was the cause of Pb absorption. The 3rd case described concerned a 20-yr-old Pb founder.

- 2588** Miura, H., Minami, A., Harada, K., et al; Morikawa, A., Fukui, T., Fukui, S., et al: (DEVELOPMENT OF LEAD POISONING IN A SHIP SCRAPING OCCUPATION. 1. STUDY FROM THE STANDPOINT OF INDUSTRIAL HYGIENE, AND HYGIENIC MANAGEMENT. 2. CLINICAL PROGRESS OF POISONED PATIENTS.) *Nagasaki Medical*



Journal 38:614-20; 621-6 (Sept.), 1963;  
Cumulative Index Medicus 5:N-894;N-910, 1964.

- 2589** Morris, C.E., Heyman, A., and Pozefsky, T. (Univ. Chapel Hill, Durham, N. Carolina): LEAD ENCEPHALOPATHY ASSOCIATED WITH DRINKING "MOONSHINE": A COMPLICATION OF ACUTE LEAD POISONING IN CHRONIC ALCOHOLISM. *Neurology* 13, No. 4:358-9 (Proceedings of 15th Annual Meeting of the American Academy of Neurology), 1963.

Fourteen patients with acute Pb encephalopathy have been admitted to the university hospitals in the past 10 yr. All were chronic alcoholics accustomed to drinking "moonshine" or other illegal whiskies. Symptoms usually associated with Pb poisoning such as peripheral neuropathy were not observed, but abdominal colic and gingival Pb line were occasionally present. Laboratory tests showed severe anemia, coproporphyrinuria and basophilic stippling. Elevated spinal fluid protein was frequently present but increased intracranial pressure was not a constant finding. Urinary Pb levels ranged from 0.10-4.5 mg/l, and 1.7-6.6 mg Pb/100 g of tissue were found in the livers of 4 autopsied subjects. Differentiation of this syndrome from other intracranial disorders is often difficult but immediate diagnosis and therapy with chelating agents are most important.

- 2590** Mosur, M. (Warsaw, Poland): Ołów i jego związki ze stanowiska toksykologii. THE TOXICOLOGY OF LEAD AND ITS COMPOUNDS.) *Ochrona Pracy* 18:13-19 (Nov.), 1963.

Sources of Pb poisoning, paths of entry and excretion, symptoms, course and sequelae of acute and chronic poisoning, including exposure to tetraethyllead, are discussed. Measures for the control of Pb poisoning in industry are proposed.

- 2591** Mountain, J.T. (US Pub. Health Serv., Cincinnati, O.): DETECTING HYPERSUSCEPTIBILITY TO TOXIC SUBSTANCES. AN APPRAISAL OF SIMPLE BLOOD TESTS. *Archives of Environmental Health* 6:357-65 (Mar.), 1963.

Procedures for detecting susceptibility to hemolytic effects from drugs and other chemicals, useful in predicting an individual's response to conditions associated with his industrial environment, are reviewed. The possible hypersensitivity of thalassemic individuals toward Pb and the difficulties encountered in the diagnosis of Pb intoxication in such persons, are mentioned.

- 2592** Mutafov, B. (Sofia, Bulgaria): L'expertise de la capacité de travail des ouvriers qui travaillent avec du plomb. (EVALUATION OF THE WORK CAPACITY OF LEAD WORKERS.) In *Union des Sociétés de Sciences Médicales, Société d'Hygiène: Premier Congrès National d'Hygiène et de Sécurité du Travail. Rapports et Résumés des Travaux* (First National Congress of Industrial Health. Abstracts of Papers). Bucharest, 1963, p. 37.

The possibility of shortening the time of temporary incapacity to work, in the course of which a mild development of Pb poisoning is observed, some positive changes in the hematologic indexes, and

the improvement of working conditions are discussed. The necessity is emphasized of regulating by law the temporary removal of workers from exposure and of a change of employment in cases of definite incapacity.

- 2593** Myerson, R.M., and Eisenhauer, J.H. (Veterans Admin. Hosp., Philadelphia, Pa.): ATRIOVENTRICULAR CONDUCTION DEFECTS IN LEAD POISONING. *American Journal of Cardiology* 11:409-12 (Mar.), 1963.

The diagnosis of Pb poisoning was established in 2 Pb smelters by the increased urinary and blood levels of Pb (urine, 0.247 and 0.304 mg/24 hr; blood, 0.106 and 0.107 mg/100 ml) and the increased amounts of ALA, CP and uroporphyrins in the urine. Electrocardiograms taken shortly after admission to the hospital revealed prolongation of the P-R interval, associated in one case with the presence of an ectopic auricular pacemaker. The EKG returned to normal after therapy with EDTA but recurrences followed reexposure to Pb. The author concludes that increased vagal tone produced by Pb seemed to be the most likely mechanism of the disorder.

- 2594** Neudauer, J. (Gen. Hosp., Ptuj, Yugoslavia): Naša opažanja u dijagnostici alimentarne intoksikacije olovom. (OUR EXPERIENCES IN THE DIAGNOSIS OF DIETARY LEAD POISONING.) *Liječnički Vjesnik* 85:139-48 (Feb.), 1963.

The author marvels about the fact that a disease such as Pb poisoning, which has been known already to the ancient Greek, Roman and Arabian, still presents diagnostic difficulties to the physician of the 20th century. He maintains that the diagnosis is easy and the treatment successful when the possibility of Pb poisoning is taken into consideration. Pb poisonings will occur as long as the standards of the peasants do not permit them to discard old clay utensils and as long as glazes containing soluble Pb oxides instead of insoluble Pb-B silicates continue to be used in the potteries. Forty cases of Pb poisoning (21 women, 19 men, 15-65 yr old) were observed by the author in Croatia. Detailed blood tests and analyses, including serum Fe, as well as urinary excretion of Pb and porphyrins were done. Mosatil was used in the treatment of the disease.

- 2595** Niimi, T., and Maeda, S.: (2 CASES OF LEAD POISONING.) *Naika* 12:176-80 (July), 1963; *Cumulated Index Medicus* 4:A-1004, 1963.

- 2596** Nottbohm, L. (Hildesheim, Germany): Der Überwachungsarzt im bleigefährdeten Betrieb. (THE SUPERVISORY PHYSICIAN IN PLANTS PRESENTING LEAD HAZARDS.) *Medizinische Welt* 44:224-8, 1963.

The author describes his work as an industrial physician in a battery plant in Germany. Preemployment medical examination is required by law. Men with previous or present Pb intoxication, tuberculosis, vascular, renal, metabolic or liver disease or ulcers and former prisoners of war who had acquired some sort of dystrophy, are considered as unsuitable. As respirators are advocated for high



levels of exposure, the men should have no nasal obstruction; mycotic skin troubles should also be watched for. The law prescribes a monthly supervision of battery workers, which includes a weight check and detailed blood and urine tests. Blood pressure is taken every 6 mo, X rays of the lungs every 2 yr. All laboratory tests have to be evaluated in comparison to previously obtained data. An increase of basophilic erythrocytes and coproporphyrin may occur in a new worker who after some time develops resistance to Pb so that intake and output of Pb become balanced. An evaluating scheme is shown in which 5 groups of subjects are classified on the basis of such tests as count of stippled cells, urinary porphyrin, Pb in blood, hemoglobin content and clinical symptoms; the classifications are: (1) no Pb absorption, (2) insignificant Pb absorption, (3) manifest but still not significant Pb absorption, (4) manifest Pb absorption, (5) incipient Pb intoxication. Another table shows the percentage distribution of Pb exposure in various work places. Preventive measures and education of the workers are discussed. For prophylactic purposes, vacations in a stimulating climate and administration of Mosatil are useful.

- 2597** Ohlsson, W.T.L. (Central Hospital, Angelholm, Sweden): DETECTION OF EXPOSURE TO LEAD BY A MOBILIZATION TEST WITH PERORAL PENICILLAMINE. *Occupational Health Review* 15, No. 3:14-8, 1963.

A mobilization test for the detection of mild, but potentially toxic exposure to Pb was devised in which the urinary content of Pb before and after oral administration of 0.45 g penicillamine was determined. The maximum permissible concentration was provisionally set at  $<100 \mu\text{g/l}$  of urine sample collected at bedtime just before taking penicillamine and  $<300 \mu\text{g/l}$  the following morning. The test was used to assess the degree of exposure to Pb in industrial premises. When urinary Pb excretion was found to be in excess of the accepted norm, protective measures were instituted. On some occasions, parallel determinations of ALA and Pb excretion in the urine were made, but because of the relatively mild exposure, no positive correlation was found. The value of ALA determination in such cases is questioned as detectable amounts occur only when toxic effects by Pb already exist and ALA excretion is not specific for Pb poisoning; on the other hand, increased urinary excretion of Pb occurs only when absorption of Pb has been excessive.

- 2598** Osborne, R.V. (Royal Cancer Hosp., London, England): LEAD-210 AND POLONIUM-210 IN HUMAN TISSUES. *Nature* 199:295 (July 20), 1963.

Appreciable amounts of  $^{210}\text{Pb}$  and  $^{210}\text{Po}$  may occur in certain human foodstuffs as a result of deposition from the atmosphere of long-lived Rn decay-products. Absorption of these products may therefore occur by both inhalation and ingestion, but, although measurements of the activity of  $^{210}\text{Pb}$  in many human bone samples have been reported, the ratio of  $^{210}\text{Po}$  to  $^{210}\text{Pb}$  in bone and the activities of these nuclides in human soft tissues have been reported in only a few samples.

Results of preliminary radiochemical estimations

of  $^{210}\text{Po}$  and  $^{210}\text{Pb}$  in human bone and soft tissue samples indicate an average body burden of  $^{210}\text{Po}$  in the range 330-450 pCi with at least 20% of the activity in the soft tissues. The upper and lower limits correspond to the assumptions that the more highly mineralized cortical portion of the skeleton has a  $^{210}\text{Po}/^{210}\text{Pb}$  ratio equal (a) to that in the trabecular region, taken here as 0.6, or (b) to unity, respectively.

- 2599** Pacséri, I.A.: A műanyagipar egészségügyi vonatkozásairól. (HEALTH PROBLEMS IN THE PLASTIC INDUSTRY.) *Munkavédelem* Budapest 9, No. 1-3:36-40, 1963.

Health problems in the Hungarian plastics industry are reviewed. Pb poisoning, caused by the use of Pb carbonate as a stabilizer, occurred in the manufacture of polyvinylchloride (PVC). Sporadic cases of Pb poisoning were also reported from a factory where PVC plates of old storage batteries were used as a source of PVC for further processing. (From *Bulletin of Hygiene* 38:1169-70, 1963)

- 2600** Paolino, W., Resegotti, L., Sartoris, S., and Infelise, V. (Univ. Turin, Italy): Studio sulla patogenesi dell'anemia saturina per mezzo del radioferro  $^{59}\text{Fe}$ . (STUDY ON THE PATHOGENESIS OF LEAD-INDUCED ANEMIA BY MEANS OF Fe-59 RADIOIRON.) *Minerva Medica* 54:527-30 (Feb.), 1963.

The mechanism of the development of Pb-induced anemia is discussed on the basis of the literature and experiments by the authors. Rabbits were injected im or iv with Pb acetate. The rate of plasma clearance of injected  $^{59}\text{Fe}$ , and the % of  $^{59}\text{Fe}$  incorporated in the circulating erythrocytes and in the heme of the circulating erythrocytes after 2-14 days were determined after 4, 8 and 12 injections and in normal animals. The results showed that the rate of  $^{59}\text{Fe}$  clearance in the plasma of Pb-poisoned rabbits increased constantly. The fact that the  $^{59}\text{Fe}$  content in the circulating erythrocytes was normal or only slightly increased, with a concomitant finding of erythroblastic hyperplasia of the bone marrow, favors the hypothesis of greater need of Fe in erythropoiesis and also demonstrates that, at the doses used, Pb did not interfere with the incorporation of Fe into the erythroblasts. Only high doses of Pb, administered iv, decreased significantly the incorporation of Fe into the erythroblasts. However, Pb affects the utilization of Fe in the hemoglobin synthesis, though also only in sufficiently high doses. This occurred after 12 im injections of Pb acetate, ie, 240 mg Pb, or after 8 iv injections corresponding to 160 mg Pb. Thus, anemia induced by large doses of Pb resembles thalassemia. The faulty utilization of Fe is attributed to enzymatic changes. An intraglobular pathogenesis seems to be present in Pb-induced anemia.

- 2601** Pascou, L., Ilia, E., and Ungureanu, S. (Inst. Pharmaceut. Med., Cluj, Romania): Les valeurs des données de laboratoire en relation avec les stades de l'intoxication saturnine. (RELATION OF LABORATORY FINDINGS WITH THE STAGES OF LEAD POISONING.) In *Union des Sociétés de Sciences Médicales, Société d'Hygiène: Premier Congrès*

National d'Hygiène et de Sécurité du Travail. Rapports et Résumés des Travaux (First National Congress of Industrial Health. Abstracts of Papers). Bucharest, 1963, p. 50.

Urinary Pb excretion before and after administration of EDTA, urinary coproporphyrin and stippled red blood cells were determined in a representative group of workers of a Pb-extraction plant. Data obtained on 228 subjects showed that spontaneous urinary Pb excretion was not related to the stage of poisoning. Also, urinary coproporphyrins measured in 247 men and stippled red cell counts in 276 workers did not vary significantly with the severity of poisoning or the working conditions within the factory.

**2602** Pecora, L., Fati, S., Mole, R., Balletta, A., and Daniele, E. (Univ. Naples, Italy): Il comportamento del metabolismo porfirinico nel saturnismo, con particolare riguardo all'ALA e al PBG. (BEHAVIOR OF THE PORPHYRIN METABOLISM IN LEAD POISONING WITH SPECIAL REGARD TO  $\delta$ -AMINOLEVULINIC ACID AND PORPHOBILINOGEN.) *Folia Medica* 46:105-24 (Feb.), 1963.

The behavior of  $\delta$ -aminolevulinic acid (ALA) in urine and blood plasma, porphobilinogen (PBG), urinary coproporphyrin (CP), free erythrocytic protoporphyrin (FEP) and Pb in blood and urine was studied in 36 subjects exposed to Pb for 1-30 yr and in 20 healthy controls. The following normal values were established: urinary ALA, 2.5 mg/24 hr; plasma ALA, 46  $\mu$ g; PBG, 1.5 mg/24 hr; CP, 120  $\mu$ g/24 hr; FEP, 60  $\mu$ g%; blood Pb, 80  $\mu$ g%; urinary Pb, 100  $\mu$ g/24 hr. In the 36 Pb-poisoned individuals urinary ALA was increased in 30 cases, plasma ALA in 29, PBG in 14, CP in 17, FEP in 32, blood Pb in 9 and urinary Pb in 15. A 100% increase was found for urinary ALA in 12; plasma ALA, 10; PBG, 3; CP, 1; FEP, 14; blood Pb, 0; urinary Pb, 11. The greatest frequency and significance of increase occurred with FEP (88%) and urinary ALA (83%), whereas coproporphyrinuria was present only in 47% of the cases tested.

The conclusion was drawn that determination of urinary ALA and FEP should be the first tests to be done in suspected Pb poisoning. Absence of an increase in both of these excludes the diagnosis of Pb intoxication; an increase in at least one of them is a very sensitive index of probable Pb intoxication. Since blood Pb values and PBG remain normal even in severe poisoning, these 2 are the least important tests for a diagnosis of early Pb poisoning.

Experimental Pb poisoning was produced in 20 rabbits, av weight 2.8 kg, by gastric administration of 2 cc of 20% Pb acetate/day, for 36-52 days. The same tests were carried out as in the studies with man, with the exception of blood Pb, and the results were listed in tables. All values were found to increase in experimental poisoning, particularly ALA, FEP and urinary CP. In both human and animal experiments, no correlation could be found between the degree of increase of the various metabolites.

**2603** Pecora, L., and Rossi, A. (Univ. Naples, Italy): Sul test di mobilizzazione del

piombo con dose unica di CaEDTA e carico orale di acqua. (A TEST OF THE MOBILIZATION OF LEAD WITH ONE DOSE OF CaEDTA AND ORAL INTAKE OF WATER.) *Folia Medica* (Naples) 46:949-61 (Nov.), 1963.

In discussing the various biological signs of Pb poisoning, the authors recently stated (1963) that only in rare cases are all signs present. The most frequently positive signs are increased free erythrocyte protoporphyrin (PP) and urinary ALA; coproporphyrin (CP) is increased only in ~47% of the cases, urinary Pb excretion in 41%, urinary porphobilinogen in 23%, and blood Pb in 4%. They consider 50-100 basophilic stippled erythrocytes (BSE)/million as normal and 500-600 as indicative of Pb poisoning. Since recent introduction of EDTA for the treatment of Pb poisoning has suggested its use also for diagnostic purposes, the authors applied the schedule proposed by Albahary (1961) in their present investigation. This consists of: (1) The subject collects the 24-hr urine on the day preceding the test; the Pb concentration in this sample is the basic value. (2) On the morning of the test, while fasting, the subject empties his bladder and then drinks 300 ml water and immediately thereafter is injected with 0.5-1 g EDTA in isotonic glucose solution. (3) Urine is collected after 5 and then after 19 hr and the samples are separately analyzed for Pb. The test is considered positive if the Pb concentration during the first 5 hr is 800  $\mu$ g/l and 700  $\mu$ g/l for 24 hr.

On 20 normal subjects, 20 subjects exposed to Pb but showing no definite clinical and biological signs of Pb poisoning, and 25 subjects with definite Pb poisoning, the results of the mobilization by EDTA were tabulated according to the following criteria: base blood Pb; PP; BSE; urine Pb base, in 1st 5 hr, in next 19 hr, and total 24-hr elimination; base urine CP and 5 hr, 19 hr, and total after EDTA. Blood Pb and BSE were normal in many Pb-exposed and Pb-poisoned subjects. PP was normal in 12 Pb-exposed cases and slightly increased or within normal limits in the other 8. Among the Pb-poisoned subjects, PP was normal in 1 and averaged 280  $\mu$ g/ml of red blood cells in the other 24. Urinary Pb was within normal limits in 11 of the 20 Pb-exposed and in 8 of the 25 Pb-poisoned subjects. When all 3 groups were subjected to the EDTA mobilization test and water intake, urinary Pb excretion in the normal group averaged a total of 49.1  $\mu$ g or 88.2  $\mu$ g/l during the 1st 5 hr and a total of 63.8  $\mu$ g or 55.7  $\mu$ g/l during the remaining 19 hr, with a 24-hr total of 113.6  $\mu$ g. The corresponding data in the Pb-exposed group were: 5 hr, 230.9  $\mu$ g or 790  $\mu$ g/l; 19 hr, 235.8  $\mu$ g or 235  $\mu$ g/l; 24-hr total, 467.5  $\mu$ g; in Pb-poisoned group: 5 hr, 547.2  $\mu$ g or 1491.1  $\mu$ g/l; 19 hr, 557.1  $\mu$ g or 675.2  $\mu$ g/l; 24-hr total, 1293.8  $\mu$ g.

The results showed that at 19 hr, the quantitative Pb excretion averaged about the same as the per-liter value, while at 5 hr, the per-liter values always exceeded the total excretion. The values obtained for Pb-exposed subjects were clearly higher than those for normal individuals; the highest differences occurred at 5 hr for the per-liter values, which in Pb-exposed were 9 times higher than in the normal. In the Pb-poisoned group, all values were ~2-3 times those of the exposed.

The conclusion was drawn that the mobilization test is very useful for the diagnosis of Pb exposure and Pb intoxication, even in the absence of other biological signs, and that the amount of Pb excreted during the 1st 5 hr is the most indicative sign. Per-liter values of 200-760 µg during the 1st 5 hr indicate Pb exposure and values >1253 µg indicate Pb poisoning. At 760-1253 µg, additional tests must be made to distinguish between Pb exposure and Pb poisoning. The authors point out that the fact that their values for normal subjects are slightly lower than found by other authors may be due to differences in water and food consumption and geographic conditions.

- 2604** Perrelli, G., Coscia, G.C., and Linari, F. (Univ. Turin, Italy): *Composti organici di piombo, quale recente causa di saturnismo. (ORGANIC LEAD COMPOUNDS AS A RECENT CAUSE OF LEAD POISONING. CLINICAL AND EXPERIMENTAL OBSERVATIONS.)* Minerva Medica 55: 2587-9 (Sept. 1), 1963.

Inorganic and organic Pb compounds are used as stabilizers in the plastics industry. The most frequently used compounds and their percentage in the finished plastic are: stearate, 0.5-2; dibasic stearate, 0.5; basic carbonate, 2-4; tribasic sulfate, 2-4; dibasic phosphite, 2-4; rarely used are the dibasic phthalate, 2-8, and salicylate, 2-5; the caprylate is not used.

During the past 5 yr, 9 cases of Pb poisoning caused by Pb stearate have been noted by the authors. The patients had been exposed to this substance for 1-11 yr. The most frequent clinical signs were abdominal colic (8 cases), normochromic or hypochromic anemia (6 cases) and gastroduodenitis (5 cases); also Burton's line (4 cases) and in 1 instance hypertension. In 2 patients, renal function was slightly disturbed, but no liver involvement or polyneuritis was noted. Fecal and urinary Pb excretion of 2 men, challenged by iv injection of 1.8 g CaNa<sub>2</sub>EDTA on the 11th day to 1 man and 1st and 11th to the other, was followed for 16 days. Concentrations as high as 13,500 µg/hr urine and 8400 µg/24 hr feces were found. In the 9 cases studied, the syndrome was comparable to that caused by inorganic Pb compounds although the abdominal pains appeared earlier and predominated the picture. Before administration of EDTA, the feces contained much more Pb than the urine. Injection of EDTA caused a large decrease of fecal Pb and correspondingly, a large increase of urinary Pb. A second dose of EDTA had a minor effect on urinary Pb excretion and hardly any effect on fecal Pb excretion. The chelating agent seemed to be useful for prophylaxis and therapy.

The absorption of Pb stearate is mentioned to be the result of inhalation and ingestion, the ease of absorption being due to the small particles inhaled, and to the affinity of Pb to gastric hydrochloric acid with formation of Pb chloride.

- 2605** Petrova, A., and Bakalov, D. (Sofia, Bulgaria): *Izsledvane na urina za porfirini pri nyakoi profesionalni otravyaniya. (EXAMINATION OF URINE FOR PORPHYRIN IN SOME OCCUPATIONAL POISONINGS.)* Khigiena (Sofia) 6, No. 4:37-41, 1963.

Urinary coproporphyrins were studied in healthy

individuals and in subjects with occupational exposure to ligroine, benzene, Pb, CO, Hg, Cu, etc. Coproporphyrinuria was encountered in all cases with Pb poisoning; it is considered a sensitive indicator in occupational poisonings.

- 2606** Pica, A. (Univ. Florence, Italy): *Rilevi igienico-sanitari in due colorifici ceramici. (HYGIENIC SANITARY STUDIES IN TWO CERAMIC DYE FACTORIES.)* Rassegna di Medicina Industriale e di Igiene del Lavoro 32:465-79 (Sept.-Oct.), 1963.

Since basic Pb chromate is a raw material for red ceramic dye, Pb poisoning is one of the hazards in ceramic dye factories. A total of 161 men, 16-62 yr old, who had been working in such a factory for 1-21 yr, were examined. Clinical and laboratory findings such as Pb colic, Burton's line, urinary coproporphyrin, basophilic stippling, anemia, were tabulated and correlated with the different phases of work. The greatest risks were found to occur in fusing and sifting of the raw material.

- 2607** Picard, M. (Soc. Ind. Med. Hyg., Strasbourg, France): *A propos d'un cas de saturnisme. (A CASE OF LEAD POISONING.)* Proceedings of the Society of Industrial Medicine and Hygiene. Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 24:558-9 (June), 1963.

A Pb content in the blood of 85 µg/100 ml was found in a patient who suffered from paralysis of the right hand and left arm. The man worked as an electrician and had not been exposed occupationally to Pb. Inquiry revealed that he lived in a house where the water which he used early in the morning and late in the evening for coffee or soup, passed through a 10 m-long pipe of Pb. Tests showed that the 1st 3 liters of water drawn in the morning contained 7 mg Pb/l. Other inhabitants of the house were unaffected because they used the water only at times when it had not been permitted to stay in this pipe for any length of time.

- 2608** Pieri, J., Tronconi, Moreau, and Eisinger: (Medical Society of Hospitals, Marseilles, France): *Conduite et surveillance du traitement par la pénicillamine au cours de la D.H.L. et dans les intoxications. (à propos de trois observations.) (METHOD AND SURVEILLANCE OF TREATMENT WITH PENICILLAMINE DURING HEPATOLENTICULAR DEGENERATION AND IN POISONINGS (IN CONNECTION WITH THREE OBSERVATIONS).)* Marseille Médical 100:51-7, 1963.

In the treatment of Pb poisoning with chelating agents the urinary excretion of Pb is increased. However, it is important to watch the chelating effect on vital metals in the body. The capacity of EDTA to do so, and other side effects are pointed out. Penicillamine is recommended as the chelator of choice. It has a low toxicity and produces effective and long-lasting results when administered in daily amounts of 1.80 g divided into 5-12 doses.

- 2609** Pislaru, V., Geleriu, R., Ungureanu, S.,

Culie, F., and Giurgiu, I. (Inst. Med. and Pharmacy, Cluj, Romania): Étude de certaines modifications fonctionnelles de l'appareil cardio-vasculaire chez les travailleurs d'une usine d'extraction du plomb. (STUDY OF CERTAIN FUNCTIONAL MODIFICATIONS OF THE CARDIOVASCULAR SYSTEM IN WORKERS OF A LEAD-EXTRACTION PLANT.) In Union des Sociétés de Sciences Médicales, Société d'Hygiène: Premier Congrès National d'Hygiène et de Sécurité du Travail. Rapports et Résumés des Travaux (First National Congress of Industrial Health. Abstracts of Papers). Bucharest, 1963, p. 60.

Determination of blood pressure, oscillometry, capillaroscopic and plethysmographic studies and the Teslenko test were applied to 2 groups of workers in March and May 1962. The studies showed that the cardiovascular apparatus is not so much affected by the presence of Pb as by complex factors of the work place. The observed effects that could be attributed to Pb were more of a central nervous or plexal origin. An arterial hypotension and a very low frequency of hypertension were noted. Oscillometric and capillaroscopic tests showed a clearly defined neurovegetative imbalance which correlated well with blood-pressure readings, and which the other tests revealed to be of central nature.

- 2610** Plamieniak, Z., and Smolik, R. (Clinic Internal Med., Wrocław, Poland): Zachowanie się białek surowicy w przypadkach przewlekłego zatrucia ołowiem. (SERUM PROTEIN PATTERN IN CHRONIC LEAD POISONING.) Polski Tygodnik Lekarski 18:358-61 (Mar. 4), 1963.

Electrophoretic studies of the serum protein in 32 patients with chronic Pb poisoning revealed that the  $\gamma$ -globulins were decreased, the decrease being related to the degree of intoxication. These observations confirm the injurious effect of Pb on the reticuloendothelial system. (From authors' English summary)

- 2611** Preda, N., Lillis, R., Nestorescu, B., and Roventa, A. (Inst. Hyg., Bucharest, Romania): La valeur de la décharge du plomb par le Ca-EDTA- $\text{Na}_2$  pour le diagnostic du saturnisme. (THE VALUE OF ELIMINATION OF LEAD BY MEANS OF Ca-EDTA- $\text{Na}_2$  IN THE DIAGNOSIS OF LEAD POISONING.) In Union des Sociétés de Sciences Médicales, Société d'Hygiène: Premier Congrès National d'Hygiène et de Sécurité du Travail. Rapports et Résumés des Travaux (First National Congress of Industrial Health. Abstracts of Papers). Bucharest, 1963, p. 57.

A study on 260 workers showed that excretion of Pb produced by daily iv administration of 2 g  $\text{CaNa}_2\text{-EDTA}$  for 5 consecutive days is a useful criterion in the diagnosis of Pb poisoning. The amounts of Pb excreted in the urine during the treatment indicate the amount of Pb accumulated in the organism and are characteristic, in most cases, of the clinical state of poisoning. Excretion of Pb in amounts not  $>1.20$  mg in 24 hr or 3 mg in 5 days

indicate abnormal absorption of Pb without pathologic phenomena, whereas in Pb poisoning the values are not  $<1.70$  mg/24 hr or 6 mg in 5 days. The test is conclusive both for a short or a longer (24 hr or 5 days) mobilization period and is helpful in cases where the usual diagnostic methods fail.

- 2612** Prodan, L., Ursan, G., and Suciu, I. (Inst. of Pharmaceut. Med., Cluj, Romania): Contribution à l'évolution dynamique du saturnisme chronique professionnel. (CONTRIBUTION TO THE DYNAMIC EVOLUTION OF CHRONIC OCCUPATIONAL LEAD POISONING.) In Union des Sociétés de Sciences Médicales, Société d'Hygiène: Premier Congrès National d'Hygiène et de Sécurité du Travail. Rapports et Résumés des Travaux (First National Congress of Industrial Health. Abstracts of Papers). Bucharest, 1963, pp 38-9.

Studies carried out over the last 12 yr concerning the evolution of chronic occupational Pb poisoning have shown that several stages of intoxication can be distinguished. Presaturnism is characterized by an increase of the Pb level in the urine and blood, porphyrinuria, basophilia and some functional and clinical symptoms such as gingivitis, enlarged liver, anemia. In the next stage, a complex clinical symptomatology appears, with functional reversible disturbances of the asthenovegetative, digestive, muscular and vascular systems. This is followed by the occurrence of lesions of the nervous system and other organs. In each stage, severe phases alternate with remissions. As the intoxication progresses, the severe phases become more frequent and longer and those of remission briefer. The following classification is proposed: presaturnism; saturnism of 1st degree (with functional reversible disturbances); saturnism of 2nd degree with organic lesions: first of compensating, and then of decompensating nature.

- 2613** Raikhman, L.M. (San.-Epidemiol. Div., Uman District Hosp., USSR): Sluchai pishchevogo otravleniya svintsom. (A CASE OF FOOD POISONING DUE TO LEAD.) Gigiena i Sanitariya 28:74-5 (June), 1963.

A combine farmer and his wife were referred to the hospital with severe stomach pains, frequent vomiting, nausea, headache. They were pale, showed dark gum line, moderate anemia (3.67 and 3.54 million erythrocytes); there were no stippled cells. Although at first contamination of food (preserves, etc) by glazed utensils was suspected, this and work exposure could be eliminated. It was found that for the last 3-4 days they had used flour out of a newly opened bag. This flour was darker than that in another bag; both lots came from the same grinding. Chemical analysis showed in the dark flour considerably more Pb (10-15 mg/kg) than in the light flour (3-5 mg/kg). Therefore in the past 1-1-1/2 mo the couple had ingested daily (considering that daily consumption of bread was 0.5-0.7 kg) 1.5-2 mg Pb, and in the last few days, even more. This is higher than the toxic dose (1 mg/day for 1 mo). The author states in a footnote that unfortunately analyses of the Pb content of blood and urine could not be made.

The source of Pb was the repair of the millstone with molten Pb.

- 2614** Ramzin, S., Atanackovic, V., and Sibalic, M. (Inst. for Public Health of SR Serbia, Belgrade): (ENDEMIC GOITER, NUTRITION, AND MICROELEMENTS IN GOITROGENIC AND NONGOITROGENIC AREAS.) *Acta Medica Iugoslavica* 17, No. 3:263-78, 1963.

The role of environmental factors, such as the trace elements as well as nutrition (aside from I), in the etiology of goiter, cretinism, deafness and dumbness was studied among the population of a small village in Yugoslavia, located in an area of endemic goiter and cretinism.

About 80 yr ago 26 families had migrated there from an area of mild endemic goiter but no cretinism. Marked degeneration took place from the 1st generation in this locality, so that by the end of the 50's a survey of some 1000 persons disclosed 6.9% to have degenerative symptoms. Consanguinity was excluded.

The investigation now reported includes analysis of the drinking water supply for content in I, F, Cu, Pb, Ni, and urochrome (for evidence of organic contamination) in this village and in 4 others showing either low or no endemic goiter and no cretinism, although in 1 of them there was endemic nephritis; another was 1 of endemic fluorosis. Extensive data were compiled of the nutrition and caloric intake of the families with and without cretins.

The conclusions were as follows: In the regions particularly poor in I, subclinical forms of cretinism, deafness and dumbness, and endemic hypothyroidism were found. Except for the I content, the nutrition of the populations in the most affected areas was similar to the nutrition of undernourished populations in goiter-free areas. The deficiency in both cases was significant in calories, proteins of animal origin, fats, liposoluble vitamins, and Ca. A deficiency of this kind was particularly marked in the families with cretins. The monotonous food consisting of cereals had an aggravating effect. The concentrations of Pb in the drinking water of the villages investigated ranged from 2.2-15.7 µg/l. They were considerably lower in the goiter regions than in those without goiter and cretinism. The F content ranged from 136-7600 µg/l and showed no correlation with the incidence of goiter and cretinism. Therefore both ions played no role as cogitrogenic factors. The concentrations in Ni and Cu were low in these areas and there was a positive correlation between the concentrations of I and Cu in water in the investigated areas. Supplementation with 100-150 µg I daily/person contributed to the eradication of endemic cretinism and deafness and dumbness, and particularly to the reduction in the incidence of the most severe forms of goiter.

- 2615** Riecken, E.O. (Univ. Hosp., Hamburg-Eppendorf, Germany): Histochemische Untersuchungen zum Schwermetallnachweis im menschlichen Knochen. (HISTOCHEMICAL INVESTIGATIONS FOR IDENTIFYING HEAVY METALS IN HUMAN BONES.) *Histochemie* 3, No. 4:298-306, 1963.

The availability of a simplified bone-biopsy tech-

nique (Bartelheimer, 1957, 1959) and the histochemical demonstration by Timm (1958) of heavy metals, particularly Pb, in bone by use of the sulfide-Ag reaction prompted the author to investigate whether the latter reaction gives positive results in human bone. He also wished to test the reproducibility of the sulfide-Ag method in animal experimentation, and its applicability for the clinical diagnosis of intoxication by Pb.

Human specimens were removed from the iliac crest and cortical bone of the femur by biopsy or at autopsy (Pb exposure is not indicated in any of the cases); the animal bones were the femurs of Wistar albino rats and NMRI albino mice poisoned by 4 ip injections, every other day, of 100 mg/kg of Pb-Na EDTA.

The reaction was positive in 60% of the human specimens. The fact that in the bone of some of the older persons both positive and negative results were obtained suggested to the authors an exposure to Pb varying from individual to individual. The cortical portion of the femur gave a stronger reaction than did the spongy substance of the iliac crest. Positive reaction was seen in all sections of the animal femurs.

It is concluded that the method is sufficiently sensitive for clinical diagnosis of Pb poisoning.

- 2616** Roth, B., and Klimkova-Deutschova, E. (Charles Univ., Prague, Czechoslovakia): THE EFFECT OF THE CHRONIC ACTION OF INDUSTRIAL POISONS ON THE ELECTROENCEPHALOGRAM OF MAN. Review of Czechoslovak Medicine 9, No. 4:217-27, 1963.

A group of 56 patients, 16-64 yr old, exposed occupationally to some toxic environment, was studied. Ten worked with heavy metals, 2 of them with Pb. All patients had complaints which made them seek medical aid; most of them had objective signs of intoxication or preintoxication. The electroencephalogram (EEG) was abnormal in 46% of the patients; 32% of the tracings showed sleep rhythms, and only 32% of the cases had normal tracings. (The finding of both abnormal changes and sleep rhythms in several cases accounted for the greater than 100% total.)

The authors conclude that even though a diagnosis of occupational disease and its cause cannot be made on the basis of the EEG alone, changes in the tracing may provide valuable information on a disorder of the central nervous system, on the localization of brain changes, their intensity and development. They therefore urge the inclusion of the EEG in the comprehensive clinical and laboratory examination before employment in hazardous jobs as well as in the subsequent periodic examinations. (31 references)

- 2617** Rubino, G.F., Coscia, G.C., Perrelli, G., and Parigi, A. (Univ. Turin, Italy): Comportamento del glutatone, del test di stabilità del glutatone e dell'attività glucosio-6-fosfato-deidrogenasica nel saturnismo. (BEHAVIOR OF GLUTATHIONE, THE GLUTATHIONE STABILITY TEST AND GLUCOSE-6-PHOSPHATE DEHYDROGENASE ACTIVITY IN LEAD POISONING.) *Minerva Medica* 54:930-2 (Apr.), 1963.

A total of 30 patients suffering from Pb poisoning

was studied. Group 1, consisting of 8 subjects, was in the stage of acute or subacute poisoning. Group 2, consisting of 19 individuals, showed signs of Pb absorption and the 3 cases in Group 3 demonstrated chronic saturnism. Data for Hb content, red cell and reticulocyte counts, urinary coproporphyrin, glutathione content in the erythrocytes, glutathione stability and glucose-6-phosphate dehydrogenase activity were tabulated for all patients and compared with those of 20 normal individuals. Average values for erythrocytic glutathione content, glutathione stability and dehydrogenase activity, respectively, were as follows: normal,  $57 \pm 6.74$ ,  $47.1 \pm 3.77$ ,  $277.53 \pm 12.34$ ; acute and subacute Pb poisoning,  $39.73 \pm 8.6$ ,  $34.91 \pm 9.9$ ,  $231.1 \pm 30.8$ ; Pb absorption,  $47.21 \pm 11.4$ ,  $40.68 \pm 8.04$ ,  $245.03 \pm 33$ . It is concluded from the results that the changes found were caused by the action of Pb on the oxidation-reduction system of the erythrocytes.

- 2618** Růžička, J. (Dept. of Occup. Diseases, Ostrava, Czechoslovakia): Použití metody stanovení olova po mobilizaci komplexonem EDTA v šestihodinovém vzorku moči. (DETERMINATION OF LEAD IN URINE SAMPLES SIX HOURS AFTER ADMINISTRATION OF AN ETHYLENE-DIAMINETETRAACETATE COMPLEX.) Pracovní Lékařství 15:242-5 (Aug.), 1963.

The urinary Pb content was determined on 72 samples from 40 workers exposed to Pb, 6 hr after iv administration of 2 g  $\text{CaNa}_2\text{EDTA}$ . The results showed a direct relationship between the amounts of excreted Pb and the hygienic conditions at the work place. Workers from plants where control measures had been taken, excreted an average of 0.468 mg Pb/24 hr, whereas urinary Pb excretion in workers from industries where working conditions were poor, was 3.323 mg/24 hr. The author emphasized the value of this test for out-patient practice.

- 2619** Saita, G., and Moreo, L. (Univ. Milan, Italy): Comportamento dell'acido delta-aminolevulinico nel siero di intossicati da piombo. (BEHAVIOR OF DELTA-AMINOLEVULINIC ACID IN THE BLOOD SERUM IN LEAD POISONING.) Medicina del Lavoro 54:183-90 (Mar.), 1963.

The content of ALA in the blood and urine and urinary Pb excretion before and after administration of  $\text{CaNa}_2\text{EDTA}$  were tabulated for 8 subjects presenting symptoms of acute Pb intoxication and for 11 chronic cases. Data for urinary coproporphyrin, protoporphyrin, Pb concentration in the blood, Hb and number of red cells and stippled basophils for the patients are also included. ALA concentration in the serum, before EDTA administration, ranged from 0.037-0.128 mg%, with a mean of 0.0975 mg% for the acute cases and 0.0503 mg% for the chronic. Upon administration of EDTA the acute cases responded with a rapid fall in ALA concentration, particularly during the first 2 days of treatment, while in the chronic cases the reduction was less marked.

The possible pathogenic mechanism responsible for the rise in ALA is discussed. The conclusion was reached that there is probably an interaction of various causative factors, ie, inhibition of ALA-dehydrogenase by Pb and increased permeability

of the membrane of the erythrocytes. The decrease of ALA in the serum during EDTA therapy, which is more rapid than the corresponding decrease in urinary ALA, is attributed to a reduction of the enzyme block and a loosening of the spasm of the renal arterioles due to Pb. (19 references)

- 2620** Sbertoli, C. (Univ. Milan, Italy): Estese paralisi degli arti superiori, insorte dopo breve esposizione al piombo. (EXTENSIVE PARALYSES OF THE UPPER EXTREMITIES AFTER BRIEF EXPOSURE TO LEAD.) Medicina del Lavoro 54:201-7 (Mar.), 1963.

A case of subacute Pb poisoning in a 23-yr-old, mentally subnormal worker in a battery factory is described. After 1 mo exposure as a mixer of Pb-containing material the patient showed abdominal colic and symptoms of a neuropathy of the upper extremities. Shortly after returning to work he developed symmetrical paralysis, nephrosis and subicterus. After iv treatment with  $\text{CaEDTA}$ , Pb and coproporphyrin in the urine and protoporphyrin and ALA in the blood were increased, indicating Pb intoxication. The severity of the case was attributed to the irresponsibility of the patient rather than to the hazard of the job.

- 2621** Schüttmann, Ch., and Schüttmann, W. (Inst. of Occup. Med., Berlin-Lichtenberg, Germany): Die medikamentöse Prophylaxe der gewerblichen Bleivergiftung mit oralen Gaben der Dinatriumkalziumverbindung der Äthylendiamintetraessigsäure ( $\text{Na}_2\text{CaEDTA}$ ).. (THE MEDICAL PREVENTION OF OCCUPATIONAL LEAD POISONING BY ORAL ADMINISTRATION OF CALCIUMDINATRIUM ETHYLENEDIAMINETETRAACETATE ( $\text{Na}_2\text{CaEDTA}$ ).) Zeitschrift für Ärztliche Fortbildung 57:1301-7 (Dec.), 1963.

Treatment of Pb intoxication with chelates such as EDTA is discussed. The mechanism of the chelating reaction is described. Due to the high affinity of Ca to the EDTA salts, it is essential to use an EDTA salt that is saturated in Ca, so that the chelate cannot combine with Ca in the blood. In the German Democratic Republic a  $\text{CaNa}_2\text{EDTA}$  called "Weiss" (made by Weiss and Co.) is available, which is administered by infusion or iv injection at a level of 1 g, twice daily for 3 days. This treatment is repeated 2 to 4 times with intervals of 2-3 days. The possibility exists that the chelates combine also with Fe and trace metals such as Zn, Cu, and Mn. The literature reporting an increased excretion of these metals during treatment of Pb poisonings with  $\text{CaNa}_2\text{EDTA}$  is cited. Another possible side-reaction mentioned by some authors is the development of toxic necrotic nephroses which, however, are generally caused by excessive doses of the chelate. The author never encountered this reaction but advises that the renal function be checked before and during treatment with EDTA and that a daily dose of 2 g not be exceeded. Since orally given  $\text{CaNa}_2\text{EDTA}$  is partly resorbed, iv treatment may be followed up with oral administration of 3 g EDTA daily in tablets to insure a consistent flow of Pb elimination.

Prophylactic treatment of Pb intoxications by oral administration of  $\text{CaNa}_2\text{EDTA}$  is suggested. Such pharmacologic prophylaxis is opposed by Kehoe,

Johnstone, Skinner and others, because it may lead to reduced efforts of industrial preventive measures. As Kehoe points out, it may even conceal poor industrial hygiene. The literature referring to the prophylactic use of EDTA is cited. The authors report that they introduced in a battery plant the prophylactic use of oral  $\text{CaNa}_2\text{EDTA}$ . The plant previously had a high rate of Pb poisoning; at some work places the air was found to contain 100 times the maximum allowable Pb concentration of  $0.15 \text{ mg/cm}^3$ . A selected group of 138 workers with high Pb exposure was divided into 2 groups, 1 of which was given 2 g  $\text{CaNa}_2\text{EDTA}$  daily for 1 wk of each mo, for a period of 1 yr. No manifest Pb intoxication occurred in the treated group while 5 cases with acute symptoms of Pb poisoning occurred among the controls. These results led to the introduction of prophylactic treatment of all Pb-exposed workers and since then no new cases of Pb poisoning were observed. Twelve spot checks of the Fe level in the serum gave values of  $>100 \text{ mg\%}$ .

Situations which call for prophylactic treatment with EDTA are discussed. A distinction should be made between routine prophylaxis and preventive treatment of pre-saturnism (characterized by a Hb content of  $<75 \text{ mg\%}$ , stippled cells of  $>3/1000$  erythrocytes, increased porphyrinuria). The latter is treated with 3 g EDTA daily for 7-10 days and possibly a 2nd course after an interval of several days. In some cases a change of the work place may be advisable. (59 references)

- 2622** Schwarzbach, W., and Schwerd, W. (Univ. Erlangen-Nürnberg, West Germany): Klinische und quantitative chemische Befunde bei akuter Bleivergiftung. (CLINICAL AND QUANTITATIVE FINDINGS IN ACUTE LEAD INTOXICATION.) *Archiv für Toxikologie* 20:173-8, 1963.

A 21-yr-old woman ingested a total of 10 g of litharge (Pb oxide) in increasing doses over a period of 7 days for the purpose of abortion. On the 7th day diarrhea started, followed by weakness and paresthesia in the legs, vomiting and abdominal pains. Clinical tests revealed a normochromic anemia, changes of the electrocardiogram, a Pb content in the blood of  $74 \text{ }\mu\text{g\%}$  and in the urine of  $225 \text{ }\mu\text{g/l}$ ; urinary coproporphyrin was  $177 \text{ }\mu\text{g\%}$ . The patient was treated with Ca, Na citrate and antidotum metallorum Sauter and given blood transfusions. Recovery was complete within about a month.

- 2623** Serra, C. (Orthopedic Center of Traumatology, Naples, Italy): Interesse das pesquisas electromiográficas nas moléstias internas e na medicina do trabalho. (IMPORTANCE OF ELECTROMYOGRAPHIC INVESTIGATIONS IN INTERNAL DISEASES AND IN INDUSTRIAL MEDICINE.) *Resenha Clinico-Científica* 32:267-77 (Nov.-Dec.), 1963.

The author reviews the significance of electromyographic examination in various disease states, ie, metabolic diseases, musculoskeletal and other disorders, and in occupational disease states, including Pb poisoning; the application in the latter was described by himself with Armbrósio, Santanelli, and others, in addition to other workers in this field.

- 2624** Serra, C., and Pannain, B. (Univ. Naples, Italy): BIOCHEMICAL AND E.E.G. FINDINGS IN SOME MODERN OCCUPATIONAL POISONINGS. *Rivista Sperimentale di Freniatria e Medicina Legale delle Alienazioni Mentali* 87:858-62 (June 30), 1963.

Previous publications of the authors concerning biochemical or electroencephalographic findings in various industrial poisonings are summarized and reviewed. In chronic Pb poisoning, changes in the activities of enzymes have been observed along with changes in the electroencephalogram. There was an increased reaction of brain electrical activity to intermittent photic stimulation, with "photic driving" patterns, which, in turn, caused an increase in the porphyrin content of blood.

The authors conclude that the most important advances in industrial and legal medicine can be achieved only through the correlation of many findings, such as the biochemical, histopathologic, and electrophysiologic; also that the activity of various parts of the central nervous system in occupational poisoning is not yet known.

- 2625** Shakhbazyan, G.Kh., and Trakhtenberg, I.M. (Kiev Med. Inst., USSR): PROBLEMS OF THE HYGIENIC EVALUATION OF CHEMICAL FACTORS IN AN INDUSTRIAL ENVIRONMENT. *Journal of Hygiene, Epidemiology, Microbiology and Immunology* 7, No. 3:371-86, 1963.

This evaluation of published information toward the establishment of standards for occupational exposure to various poisons includes data on the need for special differential norms for Pb in cases where workers are simultaneously exposed to high temperatures. (46 references)

- 2626** Shakhbazyan, G.Kh., Trakhtenberg, I.M., Savitskii, I.V., and Goncharuk, G.A.: (EXPERIMENTAL ANALYSIS OF THE EFFECT OF COMMERCIAL POISONS ON HEART FUNCTION. THE CARDIOTOXIC EFFECT OF HEAVY METALS.) *Gigiena i Fiziologiya Truda, Proizvodstvennoi Toksikologii Klinika Profesional'noi Zabolevanii* (Kiev: Gos. Izd. Med. Lit. Ukr. SSR) Sb. 1963:81-6.

In the presence of an asthenovegetative syndrome, Pb caused a tendency to bradycardia, connected with neurodynamic cortical changes in the myocardium. The accompanying hypotonia was due to blockade of sulfhydryl groups of chemoreceptors of vessels and to alterations of vagus nerve tonus. (From *Referativnyi Zhurnal Khimii* 1964:Abstract No. 11275; *Chemical Abstracts* 61:6253, 1964)

- 2627** Shatrova, S.P. (Inst. Ind. Hyg. Occup. Dis., Gor'ki, USSR): Effektivnost lecheniya elektrosnom pri nekotorykh professional'nykh zabolevaniyakh. (THE EFFECTIVENESS OF ELECTRIC SLEEP THERAPY IN SOME OCCUPATIONAL DISEASES.) *Gigiena Truda i Professional'nye Zabolevaniya* 7:45-7 (Sept.), 1963.

Electric sleep therapy was prescribed for 40 patients, 30-50 yr old, 16 of whom suffered from chronic TEL poisoning, 14 from chronic Pb poisoning, and 10 from vibration sickness. All exhibited, among other clinical signs and symptoms, neurologic involvement, the chief of which were

complaints of sleep disturbances. The patients were followed for up to 2 yr. The effectiveness of this therapeutic means was evident to the author by improvement in sleep patterns, general well-being and frame of mind. However, it was evident that in some patients, the course of therapy has to be repeated.

- 2628** Shraiber, L.B., and Mosevich, P.N. (Uzbek Res. Inst. Sanit. Hyg. Occup. Dis., Tashkent, Uz. SSR): K patogenezu preimushchestvennogo porazheniya luchevego nerva pri svintsovom otravlenii. (CONTRIBUTION TO THE PATHOGENESIS OF THE PREDOMINANT INVOLVEMENT OF THE RADIAL NERVE IN LEAD POISONING.) Zhurnal Nevropatologii i Psikhiatrii 63, No. 12:1775-9, 1963.

Based on clinical and experimental procedures and electrophysiological, chemical, biochemical and histochemical tests it was found that Pb caused the most significant destruction in the radial nerve and to a slightly less extent in the median and ulnar nerves. The selective action of Pb is related to the different structures of nerve fibers. Chromatography showed that changes had occurred in the quantity and distribution of amino acids in the albumin hydrolyzate obtained from the facial nerve. (From Biological Abstracts 45: Abst. No. 100424, 1964)

- 2629** Siegel, G.S. (US Publ. Health Serv., Washington, D.C.): LEAD EXPOSURE AMONG DECORATIVE AND HOUSE PAINTERS. Archives of Environmental Health 6:720-3 (June), 1963.

Although the diminished use of Pb-pigmented paints and good industrial hygiene practice have markedly reduced the prevalence and severity of Pb poisoning among painters, special purpose Pb paints are still used. To ascertain the extent of Pb risk, among painters, 107 of some 300 painters regularly employed by the Federal General Services Administration were enlisted. The Pb exposure of this group had never been monitored. Since these men perform all types of interior and exterior finishing, and many also paint in their spare time for remuneration, their techniques and types of paint used were considered to be representative of current practices in the trade. In addition, 10 control subjects (5 male and 5 female) served for the assessment of Pb absorption as measured by concentrations in single 10-ml samples of blood. The analyses were performed by the Division of Occupational Health using the PHS method. No elevated blood Pb levels were found, the mean for the group being 0.023 mg/100 g Pb and the range from 0.013-0.040 mg/100 g. This mean level approximated that of a control group of 5 males (0.024, range 0.018-0.034 mg/100 g) and the recently reported mean blood concentration value of an urban male population (Hofreuter et al, 1961). The 5 female controls showed a mean of 0.014 and a range of 0.010-0.017 mg/100 g. Tables show the results on each of the 107 painters with age, occupational data (years of service, type of painting), and of controls, with age, sex, occupation.

The author concludes that the risk of Pb poisoning associated with current materials and methods of application used in the decorative and house

painting trades appears to be negligible. Within the painter group, no significant relationship between blood Pb values were associated with age, methods of application, or number of years engaged in the painting trades.

- 2630** Singerman, A. (Univ. Buenos Aires, Argentina): Incidencia de las plantas elaboradoras de plomo y derivados sobre la vecindad. (INFLUENCE OF FACTORIES PRODUCING LEAD AND ITS DERIVATIVES ON THE POPULATION.) Revista de la Asociacion Bioquimica Argentina 28, No. 147-8:91-100, 1963.

After a critical review of diagnostic methods for the determination of ALA and urinary coproporphyrin in Pb poisoning, the author reports values obtained by her in 10 Pb founders and 12 individuals living near a minium and litharge plant. All subjects of the 1st group showed a significant increase of ALA compared to the normal of 2.5 mg/24 hr. Excretion of coproporphyrin was below the normal limit of 200 µg/24 hr in 3 cases and above this threshold in the other 7 men. The Pb level in blood was ~60 µg/100 g in all of them, which is considered within normal limits. In the 2nd group, 3 subjects showed excessive levels of ALA and coproporphyrin, the remainder being within or close to normal limits.

The author points out the importance of sanitary supervision of individuals exposed to Pb hazards.

- 2631** Sonkin, N. (Pawtucket, R.I.): STIPPLING OF THE RETINA. A NEW PHYSICAL SIGN IN THE EARLY DIAGNOSIS OF LEAD POISONING. New England Journal of Medicine 269:779-80 (Oct. 10), 1963.

Eight workers in a wire manufacturing company, who had been exposed to Pb compounds for 6 mo-1 yr, developed retinal stippling. Retinal changes, visualized as a glistening deposition of greyish Pb pigment surrounding the optic disk, appear to be a reliable early sign of Pb intoxication. Laboratory findings such as excess urinary Pb and stippling of the erythrocytes showed some correlation with the retinal findings. The retinal stippling was reversible within a period of 4 mo following removal of the workers from Pb exposure.

- 2632** Sours, J.A. (Columbia Presbyterian Medical Center, New York, N.Y.): NARCOLEPSY AND OTHER DISTURBANCES IN THE SLEEP-WAKING RHYTHM: A STUDY OF 115 CASES WITH REVIEW OF THE LITERATURE. Journal of Nervous and Mental Disease 137:525-42 (Dec.), 1963.

Patients coded under the categories of hypersomnia, somnolence and narcolepsy at the Columbia-Presbyterian Medical Center from 1932-61 were identified, their clinical records were reviewed, and follow-up studies were carried out whenever possible. Patients were seen for neurologic and psychiatric evaluation, using the established criteria for diagnosis. Of the 130 identified cases, all of whom complained of somnolence, 15 were rejected. There were 75 with primary (idiopathic) narcolepsy; of the remaining with secondary (symptomatic), 1 was a case of Pb encephalopathy. In the description of the cases and types of narcolepsy, the author reports that organic hypersomnia was associated with lues, head injuries and both



endogenous and exogenous intoxications. The patient with a chronic brain syndrome secondary to Pb poisoning had episodes of hypnosia lasting 6-12 hr. The review of the literature is based on 112 references.

- 2633** Stahuljak, D., and Zuskin, E.: *Otrovanje olovom-problem javnog zdravstva. (LEAD POISONING. A PUBLIC HEALTH PROBLEM.)* Liječnički Vjesnik 85:187-90 (Feb.), 1963. The occurrence of Pb poisoning from Pb-contaminated food and beverages is discussed. (29 references)

- 2634** Stancev, S. (Sofia, Bulgaria): *La prophylaxie du saturnisme chronique par l'administration buccale de  $\text{CaNa}_2\text{EDTA}$ . (PROPHYLAXIS OF CHRONIC LEAD POISONING BY ORAL ADMINISTRATION OF  $\text{CaNa}_2\text{EDTA}$ .)* In Union des Sociétés de Sciences Médicales, Société d'Hygiène: Premier Congrès National d'Hygiène et de Sécurité du Travail. Rapports et Résumés des Travaux (First National Congress of Industrial Health. Abstracts of Papers). Bucharest, 1963, pp. 37-8.

A group of 14 workers was treated prophylactically for 8 days, without interruption of work, with 2 g  $\text{CaNa}_2\text{EDTA}$ /day (10 cc of a 10% solution in the morning and evening). These men, who were engaged in the production of Pb oxides, were exposed to elevated atmospheric concentrations of Pb and showed signs of incipient Pb poisoning. The Pb level in blood and urine was determined daily before and after treatment and compared with that of 10 untreated workers. The treated men excreted in their urine during the 8 days of treatment an amount of Pb which, without treatment, would have been excreted in the course of 52.3 days. Hematologic values and porphyrinuria improved. In 3 cases, urinary Pb excretion after administration of 1 g EDTA was determined every 2 hr for 24 hr. In other cases, serum Fe was determined and proved to be normal. In 2 cases, the prophylactic treatment was repeated with good success after 4 mo.

Oral treatment with 2 g EDTA in a 10% solution for 8 days is recommended for workers who show signs of incipient Pb intoxication and for those subjected to the inhalation of Pb. Prophylactic treatment with EDTA is much more efficient than that with Na citrate.

- 2635** Storozheva, N.N.: (CONTENT OF Pb AND Sn IN HEALTHY AND CARIOUS TEETH.) *Stomatologiya* 42, No. 1:44-8, 1963.

Pb and Sn were measured spectrographically. The Pb content of permanent teeth was found to increase with age, being 3.5  $\mu\text{g/g}$  in children aged 5-10 yr and reaching 15  $\mu\text{g/g}$  in adults aged 40 yr and above. The Pb content of milk teeth was 3.9-7.0  $\mu\text{g/g}$ . In adults of a given age group carious teeth had a significantly higher Pb content; the Pb level was highest in enamel and least in cement. (From Chemical Abstracts 59:988, 1963)

- 2636** Suzuki, T. (Univ. Tokyo, Japan): (LEAD INTOXICATION AND HEMOGLOBIN BIOSYNTHESIS.) *Igaku No Ayumi* 44:100-2, 1963. A review with 42 references. (From Chemical Abstracts 62:15336, 1965)

- 2637** Sverdlov, S.L. (Novozybkov Hosp. Bryanskoi Region, USSR): *O klinicheskoi diagnostike bytovogo saturnizma. (CLINICAL DIAGNOSIS OF LEAD POISONING OCCURRING IN HOME LIFE.)* Sovetskaya Meditsina 27, No. 6:140-1 (Abstracts), 1963.

Pb poisoning frequently occurs in families using glazed earthenware for the preparation of food. In the investigation described, quantitative determination of Pb of 135 glazed jars and other containers revealed Pb poisoning risk in 118. From 1958-60, 384 patients with a varying course of illness were admitted in the local clinic; in addition, 300 ambulatory cases were seen. Pb colic, and other signs of poisoning were observed. Almost all exhibited arterial hypotension, disturbances of gastric and gallbladder function, muscular pains, etc. Correct diagnosis is considered to be essential for the elimination of Pb poisoning in everyday life.

- 2638** Tarasova, A.V., and Davydova, G.N. (Inst. of Ind. Hyg. and Occup. Diseases, Leningrad, USSR): *Vliyanie svintsa na aktivnost shchelochnoi fosfatazy krovi. (EFFECT OF LEAD ON THE BLOOD ALKALINE PHOSPHATASE ACTIVITY.)* *Trudy Leningradskogo Sanitarno-Gigienicheskogo Meditsinskogo Instituta* 75:207-14, 1963.

The experiments reported were undertaken to determine whether changes in the levels of alkaline phosphatase in the blood appear in the initial stages of Pb poisoning, and would thus be useful in the diagnosis of the disease.

Preliminary in vitro tests showed that inactivation of phosphatase activity increases with increased concentrations of Pb added to the serum. Severe Pb poisoning was then induced in 2 rabbits (weight 2-3.2 kg) by iv injection of 20-50 mg Pb nitrate; 2 rabbits served as controls. After injection, the phosphatase activity was measured daily for a wk, and then on alternate days for a period of 2 mo and more. Chronic intoxication was induced by repeating the injection after 20 days. The external signs of poisoning in the acute experiment were variable and appeared due to individual susceptibility. Alkaline phosphatase activity of both control and experimental animals before poisoning showed significant individual variations. After administration of Pb, the activity rose sharply (to 144-199 mg%) in the course of 2-7 days, and just as rapidly returned to initial values. The response to repeated administration of Pb was similar. In 1 rabbit, the activity continued to decrease and the animal died on the 17th day after injection.

The behavior of alkaline phosphatase was then followed in the Clinic in 128 hospitalized workers who had been subject to exposure to Pb (ages 19-60 yr, 101 men and 27 women), and in 172 practically well workers of the machine shop of a metallurgic factory. All investigations were done in the same season of the year. Most of the workers observed (68%) were from 26-35 yr old and had worked from 2-15 yr. Ten workers had earlier experienced Pb poisoning, and 6 showed initial signs of poisoning (high stippled cell counts, disorders of the central nervous system). The levels of alkaline phosphatase activity in the blood varied from 10.3-

67.3 mg% (av 34.8 mg%). No significant changes in the activity could be observed in the workers showing no signs of intoxication. There was a tendency toward an increase in workers <21 and >45 yr old as compared with those from 21-45 yr old. The means of the activity in workers of the machine shop and the Pb-exposed varied only insignificantly. Comparison of the phosphatase activity of the Pb-exposed group aged from 21-45 yr with the control group, again showed no significant differences, and only indicated a tendency to some increase in activity.

- 2639** Teichmann, W. (Martin-Luther Univ. Halle-Wittenberg, Germany): Kasuistischer Beitrag zur Behandlung der Bleivergiftung mit dem Chelatbildner  $\text{Na}_2\text{-MDTA}$  in niedriger Dosierung. (CASE REPORT ON THE TREATMENT OF LEAD POISONING WITH THE CHELATING AGENT  $\text{Na}_2\text{EDTA}$  IN SMALL DOSES.) Zeitschrift für die gesamte innere Medizin und Ihre Grenzgebiete 18:597-9 (July 1), 1963.

A 37-yr-old worker who had been exposed to the fumes of Pb smelting in a cable factory for 8 mo, complained of paresthesia and nausea and showed a distinctive Pb line and urinary coproporphyrins of 0.690 mg/day. A diagnosis of Pb poisoning was made and the patient was given treatments with 1 g  $\text{NaEDTA}$  in 500 ml physiological  $\text{NaCl}$  solution as a continuous drip infusion over a period of at least 3 hr. Two infusions/wk were administered to a total of 8 g within 4 wk. The subjective complaints disappeared after the 1st 3 days. After 2 infusions basophilic stippling was no longer detectable. The Pb line disappeared after 4 wk. The Pb content of the blood which was 0.354 mg/100 ml at the beginning of the treatment dropped to 0.088 mg/100 ml after 4 wk, and the urinary excretion of Pb dropped to 0.182 mg/day. After completion of the treatment the following data were found: Hb 85%, erythrocytes  $4.05 \times 10^6$ , serum Fe 103  $\mu\text{g}$ , serum Ca 9.8 mg%, coproporphyrin 0.034 mg/day. The advantages of the treatment with small intermittent doses of EDTA are discussed. (31 references)

- 2640** Teisinger, J. (Prague): Biologische Expositionsteste in der Gewerbetoxikologie. (BIOLOGICAL EXPOSURE TESTS IN INDUSTRIAL TOXICOLOGY.) Handbuch der Gesamten Arbeitsmedizin, Vol. IV, Part 2, 1963.

In reviewing the title subject, the author points out that in establishing biological exposure threshold limits, a number of difficulties must be resolved. Concerning normally occurring substances, such as Pb, benzoic acid, phenol, etc, it is necessary to establish the normal concentrations of nonexposed people. This cannot be done on the basis of literature data, because environmental conditions, dietary habits, etc, vary, but must be worked out for each country or locale. Other factors to be considered in the absorption and elimination of toxic substances, among many others, are individual metabolic and other differences, physical effort in respect to inhaled substances, as well as temperature. The occupational exposures discussed are: aniline, As, benzene, phenol, Be, Pb, Cr, F, Cd, CO, Mn, nitro- and dinitrobenzene, Hg,  $\text{CS}_2$ ,  $\text{H}_2\text{S}$ , Tl, toluene, tri-

chloroethylene, U, HCN, CN, and nitriles. An extensive bibliography for each of the above substances is included.

- 2641** Teisinger, J., and Styblova, V. (Inst. of Ind. Hyg. and Occup. Diseases, Prague, Czechoslovakia): Hallazgos neurologicos en el saturnismo cronico. (NEUROLOGICAL FINDINGS IN CHRONIC PLUMBISM.) Medicina y Seguridad del Trabajo 11:12-6 (Jan.-Mar.), 1963.

Sixty-one persons, 23-64 yr old, with proved Pb poisoning, seen in the Clinic for Occupational Diseases in Prague, who had been exposed to varying degrees of Pb hazards, were examined neurologically. Of these 61 men, 21 had worked as Pb smelters, 16 had been employed in a battery plant, 12 in a paint factory, 3 in glass works, 6 were typographers, and 3 had been occupied in other work. The length of exposure was 3 mo-34 yr; 40 had been exposed <5 yr. Neurological changes due solely to Pb were present in 46 subjects, of whom 3 were severely affected, 20 slightly, and 23 moderately. The changes were either mainly functional (with symptoms of headache, excitability, weakness) or organic (consisting of lesions in the central nervous system). A significant correlation was found between the neurological changes and the degree of poisoning.

- 2642** Tipton, I.H., and Cook, M.J. (Univ. Tennessee, Knoxville; Oak Ridge Natl. Lab., Tenn.): TRACE ELEMENTS IN HUMAN TISSUE. PART II. ADULT SUBJECTS FROM THE UNITED STATES. Health Physics 9:103-45 (Feb.), 1963.

Central values and an estimate of the variation about the central values are given for 24 trace elements in 29 tissues of 150 adult subjects, victims of instantaneous death, who had spent their lives in the US. This group is considered as a sample of the normal adult population of the US and as such a source of information for "standard man." The data, obtained by spectrographic analysis of the samples prepared, were analyzed both by common statistical methods and by a distribution-free method involving ranking the values of the concentrations of the elements in the tissues. Median concentrations of Pb in tissues ( $\mu\text{g/g}$  of tissues ash) were as follows: Adrenal, 27; aorta, 140; brain, 5; diaphragm, 10; esophagus, 10; heart, 5; duodenum, 25; jejunum, 13; ileum, 20; cecum, 27; sigmoid colon, 13; rectum, 20; kidney, 98; larynx, 64; liver, 130; lung, 47; muscle, -5; ovary, 13; omentum, 30; pancreas, 49; prostate, 10; spleen, 27; skin, 46; stomach, 12; testis, 12; thyroid, 10; trachea, 44; urinary bladder, 13; uterus, 5. Pb was observed in >8% of all samples analyzed though less frequently in brain and muscular tissues. The concentrations of Pb in tissues varied widely. (29 references)

- 2643** Tipton, I.H., Cook, M.J., Steiner, R.L., Boye, C.A., Perry, H.M., Jr., and Schroeder, H.A. (Univ. Tennessee, Knoxville; Oak Ridge Natl. Lab., Tenn.; Alcoa Res. Lab., New Kensington, Pa.; Tennessee Eastman Corp., Kingsport; Washington Univ. School Med., St. Louis, Mo.; Dartmouth Med.

School, Hanover, N.H.): TRACE ELEMENTS IN HUMAN TISSUE. PART I. METHODS. Health Physics 9:89-101 (Feb.), 1963.

Emission spectroscopy was used for the determination of 26 trace elements, including Pb, in as many tissues and organs from as many normal individuals from as many locations in the US in as short a time as possible in order to throw light on the elemental composition of "standard man." This information was required by Committee II of the International Commission on Radiological Protection upon which MPC calculations could be made. The methods described are for collection and preparation of samples, including a sample autopsy information sheet; the method used, and the statistical methods. (15 references)

- 2644** Tolot, F., Zech, and Soubrier, R. (Bern, Switzerland): Traitements actuels du saturnisme. Résultats et possibilités. (PRESENT-DAY TREATMENT OF LEAD POISONING. RESULTS AND FUTURE POSSIBILITIES.) Revue Suisse de Médecine 52:938-42 (July), 1963. The urinary elimination of Pb and the therapeutic and diagnostic value of  $\text{CaNa}_2\text{EDTA}$  was studied in 47 cases of Pb poisoning over a period of 3 yr. Intravenous infusion of EDTA caused a high urinary Pb elimination while oral administration produced lower results (1690  $\mu\text{g/l}$  on the average). In doubtful cases of Pb poisoning, diagnosis may be confirmed by a clearly positive elimination of Pb. With regard to tolerance, no detrimental effects were noted in the 47 cases treated. (From Occupational Safety and Health Abstracts 2:342, 1964)

- 2645** Tritsmans, E. (Inst. of Hyg., Antwerp, Belgium): La présence de globules rouges à granulations basophiles dans le sang périphérique. (THE PRESENCE OF RED BLOOD CELLS WITH BASOPHILIC STIPPLING IN THE PERIPHERAL BLOOD.) Archives Belges de Médecine Sociale, Hygiène, Médecine du Travail et Médecine Legale 21:161-72, 1963. The number of stippled basophilic erythrocytes was studied in the blood of 1082 healthy subjects (797 men and 285 women), not exposed to Pb risk, aged 15-65 yr (av 28.5 yr). In 95% of the observations, 0-0.4 stippled cells/1000 red blood cells were found; this range was therefore considered as normal; findings beyond 1/1000 were considered to be outlying observations. Thus, in the author's laboratory, values  $>0.4/1000$  give rise to suspicion of excessive Pb absorption. No sex variation was noted, means being 0.145 for men and 0.142 for women. However, those older than 40 showed lower values (means: 15-25 yr, 0.145; 26-40 yr, 0.140; 41-65 yr, 0.086). Variations were also caused by the method of determination, and the author suggests that each laboratory establish its own normal values.

The effect of air pollution was investigated by comparing data on 497 persons living in Antwerp, Malines and Boom with 500 residents of rural areas. The means were 0.149 in "polluted" areas and 0.132 in rural, with 8.45% and 6.20% of the values, respectively, being  $>0.4/1000$ . Therefore, the effect of air pollution was deemed not to be significant. Questioning revealed that 1/3 of the group from the polluted areas might have consumed water con-

taining Pb and the remainder was exposed to Pb occupationally. All data obtained were statistically evaluated. (26 references)

- 2646** Unseld, D.W. (Municipal Hosp., Ulm, Germany): Moderne Therapie der Bleivergiftung. (MODERN THERAPY IN LEAD POISONING.) Medizinische Welt 1963:1403-7 (July 6).

In the past 5 yr, 38 cases of Pb poisoning were seen in the author's hospital, indicating the need of continuing interest in the problem. The author calls attention to the need of experience in the diagnosis of Pb poisoning.

The treatment of Pb intoxication in many cases is limited to removing the patient from further exposure. Pb intoxications of fairly short duration disappear spontaneously either by excretion of the excessive Pb or by its storage and immobilization in the skeleton. However, treatment is advisable to speed up the elimination of Pb. The drug of choice in the author's clinic is  $\text{CaNa}_2\text{EDTA}$ .  $\text{CaNa}_2\text{EDTA}$  is injected iv in daily doses of 1 g for 2 days at 2-day intervals. Special dental care is required as long as the gingival Pb line exists. Additional therapy is needed for intestinal disorders, liver and kidney diseases and hematologic and nervous disturbances.

- 2647** Urbanowicz, H., Sroczyński, J., and Piekarski, B. (Inst. of Toxicol. and Occup. Med., Zabrze, Poland): Wydalanie kwasu  $\delta$ -aminolewulinowego w przebiegu ołowicy. (URINARY EXCRETION OF  $\delta$ -AMINOLEVULINIC ACID IN LEAD POISONING.) Medycyna Pracy 14, No. 3:205-10, 1963.

Urinary excretion of ALA was studied in 20 persons with chronic Pb poisoning, before and after administration of  $\text{CaNa}_2\text{EDTA}$ . The results were correlated with urinary excretion of coproporphyrins and the number of basophil stippled red cells in the peripheral blood. A great increase of ALA in Pb poisoning was noted. This test is considered to be the most sensitive and specific method of detecting increased Pb absorption. In the course of treatment with EDTA, urinary excretion of ALA decreased rapidly. The mechanism of increased urinary excretion of ALA in Pb intoxication is discussed. (From author's English summary; 27 references)

- 2648** Veliev, B.A., and Levanov, Yu.M.: (COMPOSITION OF SERUM PROTEINS UNDER THE STRAIN OF CHRONIC SATURNISM.) Izv. Akad. Nauk Kaz. SSR, Ser Med. Nauk 1963, No. 1:76-9.

In chronic Pb poisoning, the total protein content of the blood and the albumin:globulin ratio are reduced. (From Chemical Abstracts 59:10681, 1963)

- 2649** Vurdelja, B. (Univ. Zagreb, Yugoslavia): Saturnizam s atipičnim tokom. (UNUSUAL CLINICAL COURSE IN A CASE OF LEAD POISONING.) Lijecnicki Vjesnik 85:157-60 (Feb.), 1963.

A case of Pb poisoning with some unusual clinical and laboratory findings is reported. These findings (febrile course, high erythrocyte sedimentation rate, fluid levels in bowels in the X-ray picture of the abdomen) suggested an acute intes-

tinal obstruction. However, the effect of treatment with Mosatil (CaNa<sub>2</sub>EDTA) at the dosage of 2.4 g daily confirmed the diagnosis of Pb poisoning. The man admitted that he had been drinking daily 3-5 l. of wine which had been stored in earthenware vessels.

- 2650** Walshe, J.M. (Univ. Cambridge, England): CURRENT THERAPEUTICS. 192. PENICILLAMINE. Practitioner 191:789-95 (Dec.), 1963.

This is a review of the chemistry, pharmacology, toxicology and clinical uses of penicillamine. (24 references)

- 2651** Westerman, M.P., and Jensen, W.N. (Pittsburgh, Pa.): EFFECT OF LEAD, IN VIVO AND IN VITRO, ON RADIOPHOSPHORUS INCORPORATION INTO ERYTHROCYTE PHOSPHATIDES. Journal of Clinical Investigation 42:991-2 (Proceedings of 55th Annual Meeting) (June), 1963.

The in vitro rate of <sup>32</sup>P incorporation into red cell phosphatides of 5 patients and 6 rabbits with hemolytic anemia of chronic Pb poisoning was determined. Similar measurements were made in normal human blood after preincubation with various concentrations of Pb. <sup>32</sup>P uptake in in-vivo and in-vitro Pb blood was limited to the phosphatidic acidlike fraction. Phosphatidic acid <sup>32</sup>P in Pb human and rabbit erythrocytes was, respectively, 64-114 and 35-132 counts/min/μg (normal values 163 ± 40 (man) and 236 ± 71 (rabbits) cpm/μg of red cell phosphatidic acid). Blood incubated with Pb (0.01-20 μM) showed increased <sup>32</sup>P incorporation into phosphatidic acid at 0.06 μM and complete inhibition at 20 μM. The studies show a suppression of <sup>32</sup>P incorporation into red cell phosphatidic acid in Pb poisoning that might contribute to the hemolytic anemia in saturnism. High concentrations of Pb added in vitro to whole blood cause inhibition of <sup>32</sup>P incorporation into phosphatidic acid, while at lower concentrations enhancement occurs.

- 2652** Willett, R.W. (Raleigh, N.C.): ACUTE LEAD ENCEPHALOPATHY DUE TO INGESTION OF ILLICIT WHISKEY. North Carolina Medical Journal 24:21-4 (Jan.), 1963.

A case of acute Pb encephalopathy is reported because, though the signs and symptoms of chronic Pb poisoning are well known, less widely known is the fact that Pb poisoning may also cause an acute Pb encephalopathy in adults. In adults presenting convulsions, somnolence, mania, delirium, or coma, the possibility of Pb encephalopathy should not be excluded.

A 34-yr-old Negro woman was admitted to the hospital presenting a bizarre combination of symptoms and signs including stupor, high fever, convulsions, metabolic acidosis and anemia. Her case remained an extremely difficult diagnostic problem until the combination of chronic alcoholism (she was estimated to have drunk 1/2-1 pint of whiskey/day, most of which was illicit "white lightning"), anemia, and basophilic stippling of the red cells led to the presumptive diagnosis of acute Pb poisoning. This was later substantiated by necropsy and blood level findings. The liver appeared to be enlarged, pale and mottled owing to increased fat in the central areas, the brain weighed 1265 g and a marked softening was discovered; hyperemia

and prominence of small vessels in the basal nuclei and internal capsules were found; the cerebral ventricles were slightly dilated. The blood Pb level was 155 μg/100 ml. The patient died on the 3rd day after admittance.

- 2653** Williams, R.T. (St. Mary's Hosp. Med. School, London, England): METABOLIC FATE OF FOREIGN COMPOUNDS AND TOXICITY. Archives of Environmental Health 7:612-20 (Nov.), 1963.

This discussion includes TEL among the substances causing toxicity by oxidation. The reaction in the case of TEL is that an oxidative deethylation yields triethyllead (TrEL) and acetaldehyde. The enzymes involved in this biological oxidation occur in liver microsomes. TEL is metabolized to TrEL in the liver only, but its site of toxic action is the brain and central nervous system. TEL as such is inert in the brain but its metabolite TrEL is toxic. Probably, the TrEL formed in the liver is transported to the brain where it exerts its toxic effect.

- 2654** Wyllie, J., Petermann, H., and Petermann, E. (Kingston, Ontario): EFFECT OF PENICILLAMINE IN PROMOTING LEAD EXCRETION. Canadian Medical Association Journal 88: 1155-9 (June 8), 1963.

A spectrochemical study was carried out of the urine and blood of 14 subjects exposed to Pb in their work for several yr, but without obvious signs of intoxication. Determinations were made before and after a dose of 0.9 g penicillamine, administered on a single day, as follows (mg/l): average total urinary porphyrin excretion 0.506, 0.386 (normal 0.274); average Pb excretion <0.013, 0.367 (normal 0.031 and 0.047, respectively); average erythrocyte porphyrin content (μg%) 76.8, 76.95 (both ~3 times normal); blood Pb (μg%) 7.61, 5.68.

- 2655** Yaverbaum, P.M. (Regional Hosp., Irkutsk, USSR): Aktivnost al'dolazy v syvorotke krovi pri kontakte so svintsom. (BLOOD SERUM ALDOLASE ACTIVITY FOLLOWING EXPOSURE TO LEAD.) Gigiena Truda i Professional'nye Zabolevaniya 7, No. 10-38-42, 1963.

Aldolase activity in the blood was determined in 16 women and 14 men, 18-62 yr old (controls). The group of Pb-exposed subjects who showed no signs of Pb poisoning consisted of 67 males and 7 women, 21-55 yr old. The results in the latter group showed that regardless of the length of contact with Pb, 27% showed increased aldolase activity in the blood.

In experiments with white mice (av 18.2 g weight), given sc for 7-9 days 0.1 ml 1% solution of Pb nitrate, no change in liver aldolase activity was found.

In addition to the increase in aldolase activity of the serum in the human subjects exposed to Pb a correlation was seen with the increase in urinary Pb excretion, while in the control subjects no such correlation was observed. A correlation was also sought between coproporphyrin (CP) excretion in 29 workers. Increased aldolase activity (>9.11 units) and increased CP was found in 6; normal aldolase and CP in 8; normal aldolase was

accompanied by increased CP in 10 and a reverse relationship was found in 5. The author therefore concludes that in Pb-exposed subjects the determination of serum aldolase activity may represent an effective test in the diagnosis of Pb poisoning.

- 2656** Zahorski, W. (Silesian Acad. Med., Zabrze, Poland): Mechanizm patogenetyczny ołowicy w świetle badań klinicznych i doświadczalnych. (PATHOGENIC MECHANISM OF LEAD POISONING IN THE LIGHT OF CLINICAL AND EXPERIMENTAL INVESTIGATIONS.) *Polskie Archiwum Medycyny Wewnętrznej* 33:323-5, 1963.

The review considers the mechanism of Pb action on the basis of changes in the porphyrin metabolism, ALA, enzymes, glutathione, sulfhydryl groups, and amino acid metabolism. (17 references)

- 2657** Zegarski, W. (Clinic Intern. Med., Gdansk, Poland): Zachowanie się żelaza w surowicy krwi u ludzi w zatruciu ołowiem. (THE BEHAVIOR OF SERUM IRON IN PEOPLE WITH LEAD POISONING.) *Acta Biologica e Medica (Gdansk)* 7:33-60, 1963.

The possible causes of Pb anemia are reviewed and an investigation of the effect of Pb on the serum Fe level in 71 workers, exposed to Pb poisoning, is reported. The men were employed in sorting and salvaging batteries, painting with red Pb or cutting and cleaning sheet-metal painted repeatedly with red Pb. The diagnosis of Pb poisoning was established on the basis of interviews with the patients, physical examination, determination of the Pb level in blood and urine, urinary coproporphyrins, basophil stippling and hematology. Serum Fe was determined by Heilmeyer and Plattner's method (normal value,  $111.2 \pm 14.6$   $\mu\text{g Fe}/100$  ml serum). Data obtained by different authors for the Pb content in blood and urine for normal and Pb-poisoned subjects are tabulated. The patients were divided into 4 groups according to their symptoms. In 31 men with obvious Pb poisoning a statistically significant increase of serum Fe (average 181  $\mu\text{g}$ ) was noted. In 5 individuals in the early stage of Pb poisoning, the serum Fe level averaged only 133  $\mu\text{g}$ . The serum Fe increased with the time of exposure to Pb. Both of these 2 groups showed distinct relationship between the coproporphyrin concentration and the serum Fe level. There was, however, no relation between the rate of anemia and the increase of serum Fe, and there were only 3 cases of pronounced anemia. The conclusion was drawn that the hypersideremia in Pb poisoning must have other causes besides a disturbed Hb synthesis and hemolysis. Possible other causes for the increase of serum Fe are discussed such as porphyrinuria and the effect of Pb on Fe-containing enzymes, causing an interference of Fe utilization. When Pb poisoning remains untreated, hemochromatosis may occur as a result of hypersideremia. Since Pb anemia is not connected with an Fe deficiency, treatment with Fe drugs will be useless. The harmful effect of Pb on enzymes leading to deficient synthesis of Hb and to coproporphyrinuria suggests the administration of vitamin B<sub>12</sub> and lactoflavin in the treatment of Pb poisoning. Experiments, employing these drugs, confirmed their useful effect. The most frequent

symptoms in Pb poisoning were listed as coproporphyrinuria, increase of Pb in blood and urine and increase of serum Fe. The increased excretion of coproporphyrins is considered as a very sensitive indicator of the toxic action of Pb. (From author's English summary) (52 references)

- 2658** Zorina, L.A. (Inst. Hyg. Occup. Disease, Moscow, USSR): (CURRENT STATUS OF THE PROBLEM OF THE USE OF CaNa<sub>2</sub>EDTA IN LEAD POISONING IN CLINICAL CONDITIONS.) *Gigiena Truda i Professional'nye Zabolevaniya* 7: 9-14 (Aug.), 1963.

Data reported in the literature and personal observations of the author concerning the use of CaNa<sub>2</sub>EDTA in Pb poisoning are reviewed. EDTA is used for therapy, prophylaxis and diagnosis of Pb poisoning. Its ability to control Pb colics is pointed out. While EDTA is very efficient when used in mild poisonings, its use is contraindicated in Pb poisoning with nervous manifestations. Side-effects occurring during treatment limit its use in out-patient practice. (From author's English summary)

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- 2659** Albahary, C. (Hospital Center of St. Denis, Paris, France): Les troubles porphyriques dans le saturnisme. Etude comparée (à propos de 33 malades hospitalisés). (PORPHYRIA IN LEAD POISONING. COMPARATIVE STUDY (IN REFERENCE TO 33 HOSPITAL CASES.)) *Archives des Maladies Professionnelles, de Médecine du Travail et de Sécurité Sociale* 25:495-507 (Sept.), 1964.

Clinical signs, counts and stippled cells, free protoporphyrin and  $\delta$ -aminolevulinic acid (ALA) in the blood; ALA, porphobilinogen, coproporphyrin and Pb in the urine and the results of provoked urinary Pb excretion were tabulated for 33 subjects suffering from Pb poisoning. Thirty-one of these patients were workers, exposed to Pb for 2 mo to 18 yr, of whom 3 were eliminated after 3-9 mo, 2 were women suffering from alimentary Pb poisoning. The following threshold values were adopted from the literature: red blood cells, 4 million/mm<sup>3</sup>; stippled cells, 10/100 erythrocytes; protoporphyrin, 0.060 mg%; ALA in blood serum, 0.060 mg%; urinary ALA, 5 mg/24 hr; urinary porphobilinogen, 2 mg/24 hr; urinary coproporphyrin, 0.2 mg/24 hr; Pb in urine, 0.10 mg/24 hr. The tabulated data were summarized in a diagram and the following observations were made: ALA in the blood rarely exceeded twice its threshold value and never exceeded 5 times its threshold value; the determination of urinary porphobilinogen was of no interest; the following were the most important tests in this order: urinary coproporphyrin, protoporphyrin in the blood, urinary ALA. By setting the threshold value for urinary ALA at 5 mg/24 hr, this test is of preponderant interest; also very important is the study of urinary coproporphyrin and particularly that of free protoporphyrin in the blood. An increase of urinary ALA is the most indicative biologic anomaly whereas an increase of ALA in the blood has only limited value.

All these tests are of interest from the viewpoint of physiopathology. They demonstrate that Pb is a powerful enzyme-inhibitor which interferes with the synthesis of hemoglobin at various stages. For diagnostic purposes, however, clinical signs, anamnesis, hematology and toxicological signs must be considered since porphyrin disorders are not specific for Pb poisoning. For the detection of harmful Pb absorption, the determination of Pb in the urine before and after iv administration of EDTA or DPTA is indispensable. A urinary Pb excretion of  $\geq 1$  mg Pb/24 hr after administration of a chelating agent indicates that further examinations should be carried out, regardless of the Pb content in urine and blood previous to EDTA treatment.

Presently, the law for Pb industries in France requires only an initial determination of blood urea and periodic blood checks including the count of punctate red cells. It appears desirable to require a half-yearly check of the ratio of punctate cells to red blood cells, and of urinary Pb concentration, and to recommend, where necessary, the estimation of urinary ALA and protoporphyrin and of urinary Pb excretion after EDTA administration.

- 2660** Aleksieva, Č., Batolska, A., Kostov, Moševa, N., Mutafov, B., Panajotov, B., and Celebiev, A.: BALNEOTHERAPY WITH SULPHUR MINERAL WATERS IN HEAVY METAL POISONING. Works of the Scientific Research Institute of Labour Protection and Occupational Diseases, Profizdat, Sofia, Bulgaria, 12:53-61 (Sept.), 1964.

See Abstract No. 2495.

- 2661** Altman, I., and Ciocco, A. (School Public Health, Univ. Pittsburg, Pa.): INTRODUCTION TO OCCUPATIONAL HEALTH STATISTICS. II. RATES. Journal of Occupational Medicine 6:409-15 (Oct.), 1964.

The authors discuss the meaning of statistics in relation to absolute numbers and proportions, stating that "statistical significance is an inference involving chance...." Statistics by themselves are not sufficient for complete judgment but are a tool to be used along with other observations.

In a report on Pb poisoning in a storage battery plant, the data collected to show the effects of Pb upon the health of workers included number of employees, employment records (showing age, sex, occupation, exposure, dates of employment, transfer, illnesses, accidents, etc), records of Pb poisoning (through compensation records), hospital records, laboratory results, and results of physical examinations of those with Pb poisoning. From these types of data a table was made for 2 hypothetical plants which showed by age brackets total number of employees, number of deaths, deaths/1000 in each plant, combined number of employees, expected deaths/each plant rate. From this then, crude death rates and age-adjusted rates were calculated. The report also gave incidence rates of compensation cases by duration of employment and by department. The authors used this brief account to emphasize the care and thought that should go into a statistical study.

- 2662** Altshuler, B., Nelson, N., and Kuschner, M. (New York Univ., N.Y.): ESTIMATION OF LUNG TISSUE DOSE FROM THE INHALATION OF RADON AND DAUGHTERS. Health Physics 10: 1137-61 (Dec.), 1964.

In an assessment of the radiation dose in relationship to the risk of lung cancer, such as has been observed in U and fluorspar miners, it is assumed that the malignancy is induced by alpha irradiation of basal cells in the bronchial epithelium. The radon (Rn) decay chain proceeds from  $^{222}\text{Rn}$  in 3.8 days to  $^{218}\text{Po}$  in 3.05 min to  $^{214}\text{Pb}$  in 26.8 min to  $^{214}\text{Bi}$  in 19.7 min to  $^{214}\text{Po}$  in 2.7 x  $10^{-6}$  min to  $^{210}\text{Pb}$  in 19.4 yr to  $^{210}\text{Bi}$  in 5.02 days to  $^{210}\text{Po}$  in 138.3 days to stable  $^{206}\text{Pb}$ . The study attempts to associate measurements of atmospheric concentrations with a carcinogenic tissue dose. The effective dose is calculated by an analysis which includes the distribution of atmospheric activity by size and daughter, the prediction of  $\alpha$  decay in the bronchial regions, measurements of epithelial thickness and classification of dose by inhaled daughter, size, alpha particle, region and tissue depth. The cancer-related dose associated with one working level (WL) of Rn daughters is estimated to be 20 rads/yr for nose breathing at 15 l/min, and may be higher. Comparison with animal experiments suggests that the working level may not be safe and that 30 pCi/l of daughters (0.1 WL) may not be too conservative for the MPC.

- 2663** Angle, C.R. and McIntire, M.S. (Children's Memorial Hosp., Omaha, Nebr.): LEAD POISONING DURING PREGNANCY. FETAL TOLERANCE OF CALCIUM DISODIUM EDETATE. American Journal of Diseases of Children 108:436-9 (Oct.), 1964.

The literature concerning the effect of maternal Pb poisoning on the fetus and the use of Pb as an abortifacient is briefly reviewed. As no previous reports of the treatment of Pb poisoning during pregnancy were found, the authors consider their case unique.

A family of 6 had been heating their living room stove with battery casings as fuel for several mo. Pb poisoning was diagnosed in the 19-mo-old son who had been having convulsions for 8 wk, and a 3-yr-old brother died with acute Pb encephalopathy. Two older brothers showed high Pb concentrations in the blood, anemia with basophilic stippling, and signs of hyperactivity. They were treated iv with 75 mg/kg/day of  $\text{CaNa}_2\text{EDTA}$ , for 4 days. The mother, who was in the 8th mo of pregnancy, showed 0.24 mg% Pb in blood, anemia with 8.6 g% hemoglobin and marked basophilic stippling, positive urinary coproporphyrins and abdominal colics. She was given 75 mg EDTA/kg/day iv, for 7 days. When she was delivered of a normal infant, the cord blood had a Pb concentration below 0.06 mg%. The urine of both mother and infant was negative for coproporphyrin; the mother's hemoglobin had increased to 10.2 g% and there was no more basophilic stippling. When the child was given a complete pediatric-neurologic examination at the age of 4-1/4 yr, no abnormalities were found in the electroencephalogram, radiographs of skull and long bones, blood urea nitrogen, urinalysis and blood count. The authors point out that therapy

of the mother with EDTA 4 wk before delivery had apparently no ill effects on the infant. It might be assumed that EDTA, due to its low molecular weight, passes the placental membrane. However, since fetal toxicity occurs in <25% of cases of Pb poisoning in the last trimester, the successful outcome may have been independent of the treatment.

- 2664** Anonymous:  $^{210}\text{Pb}$  per rapide diagnosi di avvelenamento da piombo. (THE USE OF  $^{210}\text{Pb}$  FOR PROMPT DIAGNOSIS OF LEAD POISONING.) Comitato Nazionale per l'Energia Nucleare, Rome (Italy) Notiziario 10, No. 5:50-1, 1964.

A review of research done in the US on the use of  $^{210}\text{Pb}$  for rapid diagnosis of Pb poisoning was presented. (From *Excerpta Medica*, Sect. 23, 2: Abstr. No. 1130, 1965)

- 2665** Aprosina, Z.G. (Acad. Med. Sci., USSR): Nekotorye osobennosti techeniya khronicheskikh toksicheskikh (professional'nykh) gepatitov. (CERTAIN PECULIARITIES IN THE COURSE OF CHRONIC TOXIC (OCCUPATIONAL) HEPATITIS.) In Trudy I-go Moskovskogo (Ordna Lenina) Meditsinskogo Instituta imeni I.M. Sechenova, E.M. Tareev, ed. 28:183-96, 1964.

Sixty patients (54 women, 6 men), 30-55 yr old, who had had long contact with hepatotoxic substances (nitrobenzenes, benzene, dichloroethane, carbon tetrachloride, methylene chloride, halowax, Pb), were observed by the author. The role of diet, cholesterol levels, diagnostic aids and prognosis are discussed without reference to any particular exposure. Stress is laid on the biliary tract as one of the most important sites in the clinical picture of chronic toxic hepatitis; whatever changes are observed in it, will reflect functional disorders and organic lesions. For the demonstration of lesions of the biliary tract it is necessary to examine carefully the syndrome by means of duodenal catheterization and cholecystography. The latter particularly appears to be the method of choice for the study of biliary function in chronic toxic hepatitis and its sequelae.

- 2666** Bariety, M., Gajdos, A., and Poulet, J. (Hosp. Hotel-Dieu, Paris, France): Anémie sévère avec hypoplasie médullaire globale provoquée par une intoxication saturnine aiguë. (SEVERE ANEMIA WITH GLOBAL MEDULLARY HYPOPLASIA DUE TO ACUTE LEAD POISONING.) *Presse Médicale* 72:597-9 (Feb. 29), 1964.

The case of a 50-yr-old man who had worked until shortly before hospitalization for 3 wk, 4-5 hr/day, in a storage battery plant grinding Pb plates, is described. The man had severe abdominal pains and asthenia, but no signs of a polyneuritic syndrome. Blood tests revealed the presence of stippled erythrocytes and a severe anemia. Since there was a suspicion of Pb poisoning, the porphyrin metabolism was studied. Urinary coproporphyrin excretion was found to be 0.516 mg (normal, 0.100-0.150); urinary  $\delta$ -aminolevulinic acid (ALA)/24 hr amounted to 16 mg (normal, 1-2 mg); ALA in the blood plasma was 0.067 mg/100 ml (normal, 0.007-0.057), free protoporphyrin in the red

blood cells, 0.420 mg/100 ml (normal, 0.050-0.070). The Pb concentrations in blood and urine were 0.284 mg/l and 1.411-2.730 mg/24 hr (normal, <0.090 and <0.100, respectively). Treatment with EDTA, glucose, khellin, atropine and novocain controlled the digestive troubles within 48 hr, but the asthenia worsened and the red blood cell count dropped from 4,010,000-2,780,000 within 6 days and to 2,320,000 in the following 3 days. A grave global medullary hypoplasia with hypoleukocytosis, hypopolynucleosis and decrease of platelets was obvious. The hypoplasia was attributed to the Pb intoxication although literature studies by the author did not reveal another example of this phenomenon. A massive toxic effect of Pb was observed also in the severe derangement of the porphyrin metabolism which until shortly before discharge reached a urinary excretion of 74 mg/24 hr of ALA and 3 mg of coproporphyrin (normal, 2 and 0.0150 mg, respectively). In discussing the mechanism of Pb anemia, the authors point out the combined causative action of 3 factors, ie, (1) inhibition of hemo-synthetase, (2) partial hemolysis and (3) direct action of Pb on the medullary elements.

For unusually severe cases of Pb poisoning, treatment with adenosine-5-monophosphoric acid has proved beneficial. This patient was given a daily dose of 250 mg, im, for 4 wk. However, the authors are not certain whether the improvement of the hematologic picture could be attributed solely to this therapy, while its favorable effect on the porphyrin metabolism seemed to be less questionable.

- 2667** Barry, P.S.I., and Turner, D. (Assoc. Octel Co. Ltd., Ellesmere Port, Cheshire, England): TETRAETHYL LEAD POISONING. Letters to the Editor. *Lancet* 1:1275 (June 6), 1964.

Referring to the article by Dr. O. Gutniak in *Lancet* 1:1137-8 (May 23), 1964, the authors point out that there is no recorded case of chronic TEL intoxication. Cases that have occurred were ascribable to an acute exposure, with only a few days or at most a few weeks of symptoms being reported. Also pointed out is a misinterpretation of the report by Cremer who refutes the view that the solubility of TEL in brain lipids causes its neurotoxic action. The signs and symptoms recorded by Gutniak et al, could well be associated with undue exposure to gasoline vapors, for the vapor-pressure relationship of the latter and TEL are such that air contamination by gasoline occurs before the concentration of TEL rises to any appreciable level. Since Pb levels in blood are not unduly raised in TEL intoxication, the elevated levels reported by Gutniak could be due to nonoccupational exposure to inorganic Pb or to Pb-containing filling metals, solders, and combustion products present in garages, which may well have contributed to the body burden of Pb in certain of these cases.

- 2668** Bartolozzi, O.: Consuntivo di nove anni di profilassi con versenato di calcio in uno stabilimento di accumulatori. (REPORT OF NINE YEARS OF PROPHYLACTIC TREATMENT WITH CALCIUM VERSENATE IN A STORAGE BATTERY



PLANT.) Abstracts of Meeting of the Association of Industrial Physicians of Lombardy. *Medicina del Lavoro* 55:315-6, (Apr.), 1964.

In a storage-battery plant employing 400 workers the hygienic conditions during a period of 5 yr prior to prophylactic treatment with CaEDTA were compared with those during 9 yr after introduction of such treatment, as well as with those of a new battery plant of ~150 workers, which was almost completely automated, with good sanitary facilities. For various reasons, prophylactic treatment was not practiced in the new plant. A daily dose of 2 g EDTA in 10% aqueous solution was given for 10 consecutive days twice a year; in special cases, the dose was doubled. The results of the comparison as to presence of disease, coproporphyrin, stippled erythrocytes and average mortality rate showed the beneficial effect of the treatment. Any fears as to harmful effects of the treatment were allayed.

In the discussion, Sassi points out that prevention by drugs, the innocuousness of which has not been established, is no substitute for technical preventive measures. However, even the most modern plants have not yet solved completely the technical problems.

- 2669** Besançon, F., Buzzi, F., and Debray, C. (Hosp. Bichat, Paris, France): Le rythme du jejunum humain au cours de la digestion: Électromanographie endocavitaires avec repas lacté. (THE RHYTHM OF THE HUMAN JEJUNUM DURING DIGESTION: ENDOCAVITARY ELECTROMANOGRAPHY WITH A MILK MEAL.) *Archives des Maladies de l'Appareil Digestif et de la Nutrition* (Paris) 53:525-34 (May), 1964.

The motility of the small intestine during digestion of a milk meal was studied in 18 subjects of whom 12 were normal, 3 were affected by pernicious anemia, 1 by Pb poisoning, 1 by multiple stenosis of the jejunum and 1 by scleroderma. Insertion of catheters into the jejunum and recording were done according to the technique of Emerit (1962). In the normal individuals, the motile response of the jejunum was immediate and intense; the pressure of the endocavitary jejunal base and the number of waves were increased. In the Pb-poisoned patient, jejunal pressure was recorded during an attack of Pb colic which occurred 1.5 hr after ingestion of the milk meal. The pressure of the endocavitary jejunal base rose progressively from 12-38 cm (of water) within ~80 sec and returned abruptly to the base level at the same time as the pain stopped. This phenomenon of pain and elevation of pressure took place 4 more times after which the motile response was normal again. The tracings made by the authors support the hypothesis that the pain in Pb colics is associated with a spasm of the small intestine. Levrat et al, who took X rays of the intestine of Pb patients, observed a slow passage of Ba and a very abnormal distention of the small intestinal loops. However, Lerza et al, in a study of 73 Pb patients, noted that hypertonic spasms of the small intestines occurred 4 times as often as hypotonic spasms, a finding which agrees with that of the authors.

- 2670** British Industrial Biological Research Association: THE METABOLISM OF EDTA. *Food and Cosmetics Toxicology* 2:741-5 (Dec.), 1964.

The treatment of Pb poisoning with iv injections of Ca edathamil (CaEDTA) has been studied extensively. Since, however, small quantities of EDTA salts are also used as food additives, the question posed itself whether prolonged intake of small quantities of EDTA salts could adversely affect the mineral metabolism of the body. A review of available evidence indicates that the amount of EDTA likely to be ingested by an adult eating food containing EDTA in the necessary technical quantities will chelate only a minute fraction of the available dietary Ca and, if CaEDTA is used, this depletion becomes negligible. Also, the reduction of Fe absorption that results from the use of EDTA is very small and probably occurs only in states of positive Fe balance.

- 2671** Brugsch, H.G. (Dept. of Labor and Industries, Boston, Mass.): HAZARDOUS LEAD EXPOSURES AMONG STRUCTURAL-STEEL WORKERS. *New England Journal of Medicine* 270:211 (Jan. 23), 1964.

Attention is called to hazardous exposure to Pb fumes among structural-steel workers who are engaged in torch cutting or spray painting. In 1960, 23 men engaged in the restoration of a bridge across the Charles River were found to excrete abnormally high quantities of Pb in the urine. The same phenomenon was found more recently in 4 out of 5 men dismantling girders of a bridge. In both cases, acetylene-torch cutting was carried out on structures which had received repeated coats of paint, many containing Pb. Two other cases of Pb poisoning had occurred recently among bridge workers doing spray painting. Symptoms such as abdominal colics, loss of weight, constipation and unexplained anemia in workers engaged in torch cutting or spray painting should always raise the suspicion of Pb poisoning. It is requested that any information in such cases be communicated to the Division of Occupational Hygiene, which is equipped to carry out determinations of urinary Pb and coproporphyrin.

- 2672** Buchwald, H. (Occup. Hyg. Service, Slough, England): THE EXPRESSION OF URINE ANALYSIS RESULTS. OBSERVATIONS ON THE USE OF A SPECIFIC GRAVITY CORRECTION. *Annals of Occupational Hygiene* 7:125-36 (June), 1964.

Urine analysis is very useful in the detection and control of environmental hazards. Air sampling tests are used to measure the actual concentrations of harmful substances in the air, but the results do not necessarily indicate the extent of absorption by those exposed. The author reviews the problems brought out in the literature concerning the collection of specimens and expression of results. These may be expressed as total excretion/24 hr, excretion/unit volume of urine (usually mg/l) on a 24-hr specimen, or per unit volume on a spot specimen (single voiding), or per unit volume on spot or cumulative specimens (composite of 2 or more voidings) corrected for urine concentration. The total excretion/24 hr, accepted as the most reliable is difficult to obtain



from personnel. Also, the total volume of urine excreted in 24 hr varies according to body weight, degree of physical exertion, temperature and drinking habits, so that without a correction for urine concentration, results on any of the specimens can be most misleading.

Means of correcting for concentration are the determination of the urinary creatinine content, or by measuring the specific gravity (SG). The latter is done with a urinometer (hydrometer) in a fraction of the time required for the determination of creatinine, and is therefore the more practical. Caution is expressed in applying the correction factor in cases where renal damage is suspected, which may be caused by certain toxic substances such as Hg, C tetrachloride, and others, and which may lead to changes in the output of urinary solutes; therefore, in such cases, the investigator must verify whether a concentration correction is still valid. The mean used for SG correction by many investigators, particularly in the United States, is 1.024, as determined by Levine and Fahy (1945) in a survey of a large population sample in the USA, whereas the mean of 1.016, as based on several hundred determinations in the Slough area and in Eire, is considered to be a more realistic standard for persons in the British Isles. The implications of the two standards is that using the latter will give results having 2/3 the value of those corrected to the former. Since it has been proposed that "maximum biological concentrations," such as the urinary (MUC) be considered, the author questions whether the North American SG correction of 1.024, with the correspondingly higher MUC values be accepted in the United Kingdom or the more realistic mean of 1.016.

Experimental data collected in routine investigations by the Occupational Hygiene Service (with summaries of the analytical methods used given in the Appendix), are presented for urinary Hg, phenol, sulfates, F, and Pb, to demonstrate the effectiveness of the SG correction in correlating the results of urine analysis.

Concentration corrections are specially important when considering the results of long-term monitoring of exposure to environmental hazards. The application of the SG correction to urinary Pb analyses is demonstrated in 4 graphs of monthly urinary Pb analyses for 4 persons exposed to Pb dust and fume. The figures show the variation of SG as well as the corrected and uncorrected Pb concentrations. The findings pointed to the fact that in these cases airborne Pb was not necessarily the only source of contamination. Though the Pb concentration in the atmosphere may have been fairly constant, the total amount of Pb absorbed by a person is dependent on other factors, including method of working and standards of personal hygiene.

- 2673** Buczkowski, M. (Silesian Med. Academy, Zabrze, Poland): Der Einfluss der Bleivergiftung auf die Bildung von fetalem Hämoglobin. (THE EFFECT OF LEAD POISONING ON THE DEVELOPMENT OF FETAL HEMOGLOBIN.) Internationales Archiv für Gewerbepathologie und Gewerbehygiene 20, 537-46 (Aug.), 1964.

The fetal hemoglobin level was studied in 28 men and 1 woman, aged 24-56 yr, who suffered from Pb poisoning, 30 controls of the same age bracket and 22 rabbits, weighing 2500-3500 g each, which had been experimentally poisoned with Pb. Pb intoxication in the human subjects was established on the basis of their anamnesis and clinical and laboratory tests such as presence of stippled basophils, coproporphyrinuria and decreased content of hemoglobin and erythrocytes. Fetal hemoglobin was estimated using Singer's alkali denaturation test, modified by B. Fischer (American Journal of Clinical Pathology 27:48-51, 1957). In the control group, the arithmetic mean of fetal hemoglobin was 0.54%, SD  $\pm 0.12$ . The group of patients was subdivided into 2 groups according to the degree of Pb intoxication: (1) The fetal hemoglobin in 12 severe cases ranged from 1-2.8%, av 1.83%, SD  $\pm 0.57$ . A correlation between fetal hemoglobin and number of stippled basophils and erythrocytes, respectively, was obvious in this group. (2) In the 17 less severe cases the arithmetic mean of fetal hemoglobin was 0.58%, statistical significance 0.6.

In the experimental studies, Pb poisoning was induced in the rabbits by daily iv injection of 6 mg/kg body weight of a 0.9% alkaline solution of Pb acetate, for 10 days. The animals showed a rapid decrease of erythrocytes and of hemoglobin content and an increase of stippled basophils. The fetal hemoglobin level increased from a pre-experimental av of 51.01% to an av of 58.65%; there was also a distinct correlation between fetal hemoglobin and number of erythrocytes and stippled basophils, respectively.

The author points out that both the clinical and experimental data indicate a statistically significant increase of fetal hemoglobin in Pb poisonings. This increase which is directly proportional to the degree of intoxication, is best demonstrated in the animal experiments.

Literature references are quoted to show the specific behavior of fetal hemoglobin which decreases from 91.2% in an 18-wk old fetus to 73.7% in a newborn and to 5% during the 1st year of life. Both the author's results and the literature references point out that the globin synthesis may be affected by genetic factors as well as by outside influences. The conclusion is drawn that severe Pb anemia may be considered as an acquired disorder of hemoglobin synthesis and that the increase of fetal hemoglobin is one of the causes of increased hemolysis in Pb poisonings.

- 2674** Brüscke, G. (Med. Univ. Clinic Charité, Berlin; German Coll. Body Culture, Leipzig, Germany): Zur Problematik des histochemischen Eisennachweises in Erythrozyten, Leukozyten und Thrombozyten des peripheren Blutes. (PROBLEMS OF HISTOCHEMICAL DEMONSTRATION OF IRON IN ERYTHROCYTES, LEUKOCYTES AND THROMBOCYTES OF THE PERIPHERAL BLOOD.) Deutsche Gesundheitswesen 13:565-7 (Mar. 26), 1964.

As reviewed by the author, erythrocytes containing ionizable Fe in granule form have been called siderocytes, and erythroblasts with analogous structure, sideroblasts. The Fe of the granules is trivalent and present in a chemical bond as yet

unknown. Siderocytes are young cell elements comparable to reticulocytes or young erythrocytes, usually more abundant in bone marrow than in peripheral blood, sharing in the process of erythropoiesis. In the neonate, 3-17% siderocytes are present in the blood and disappear entirely after 3-4 days. In the premature neonate, the abundance of siderocytes moves in reverse proportion to the infant's age, decreasing rapidly with increasing age of the fetus. In the blood of the normal human being, siderocytes are either absent or present in very minute amounts.

The presence of siderophile granules in the red blood cell precursors is thus an entirely normal phase of Hb metabolism for the formation of erythrocytes. Their appearance in the peripheral blood however denotes pathologic changes in Hb synthesis as can occur in Pb poisoning, after splenectomy, sometimes in hemolytic anemia and occasionally in leukocytosis, after massive roentgen irradiation and from overdoses of Fe. It is believed that in Pb poisoning the incorporation of Fe into the porphyrin structure is impaired because of interference with its penetration through the cell membrane into the cell and its retention on the cell membrane.

The presence of siderophile granules in the white blood cells is due to phagocytosis of colloidal Fe complexes administered parenterally in high doses. The appearance of siderophile granules in the thrombocytes can be explained by the uptake on the surface of the thrombocytes of colloidal Fe complexes injected in high doses, resulting in thrombocytopenia due to platelet agglutination.

- 2675** Butt, E.M., Nusbaum, R.E., Gilmour, T.C., Didio, S.L. and Sister Mariano (Los Angeles County Hosp., Calif.): TRACE METAL LEVELS IN HUMAN SERUM AND BLOOD. *Archives of Environmental Health* 8:52-7 (Jan.), 1964.

Trace metal concentrations were determined in the sera of 3 groups of individuals in the Los Angeles area. Series 1 consisted of 122 blood donors at the Los Angeles County Hospital; series 2 of 93 patients in Saint Luke Hospital, Pasadena, Calif., subjected to surgery and treatment; and series 3 was composed of 50 presumably normal individuals who were employees of Saint Luke Hospital. The results are tabulated. The mean values of Pb concentrations and standard error (SE) for the 3 series were, respectively (mg/100 ml):  $0.0039 \pm 0.0002$ ,  $0.0027 \pm 0.0005$ ,  $0.0028 \pm 0.0003$ . The Pb content in the whole blood from 47 individuals from series 3 had a mean of  $0.0177$  mg/100 ml, SE  $0.0008$ . When the subjects of series 3 were divided into age groups of 20-29, 30-49 and 50-63 yr, the respective mean values for the Pb content in the serum were  $0.0028$ ,  $0.0025$ , and  $0.0029$  mg/100 ml. Pb levels in the serum of subjects residing in the Los Angeles area for 0-10, 10-30 and 30-60 yr, were, respectively:  $0.0025$ ,  $0.0032$  and  $0.0026$  mg/100 ml. For individuals driving an automobile for 0-500 and >500 miles/mo, the mean Pb concentration in the serum was  $0.0059$  and  $0.0069$  mg/100 ml, respectively; for smokers and non-smokers it was  $0.0064$  and  $0.0060$  mg/100 ml, respectively. Mean values of Pb levels in serum in

individuals from series 2 (patients in Saint Luke Hospital) arranged in age groups, were as follows (mg/100 ml): newborns,  $0.0065$ ; 5-19 yr,  $0.0013$ ; 20-29 yr,  $0.0026$ ; 30-49 yr,  $0.0024$ ; 50-79 yr,  $0.0033$ . In this same group, the mean Pb concentrations in serum in 37 males, age 14-82 yr, and 45 females, age 8-76 yr, was  $0.0023$  and  $0.0022$  mg/100 ml, respectively.

In discussing the results, the authors remark that their blood Pb values are lower than those reported by Kehoe and Bowen, and that the metal serum levels were rather uniform in all classifications such as age, race, sex, or length of residence in the Los Angeles area. Age, sex, auto driving, and length of time in the Los Angeles area had no effect on the mean serum values for Pb.

- 2676** Castellino, N., and Grieco, B. (Univ. Naples, Italy): Determinazione comparativa del piombo nel sangue e nelle urine mediante metodo polarografico e colorimetrico. Considerazioni sulla forma chimica del piombo urinario. (COMPARATIVE DETERMINATION OF LEAD IN THE BLOOD AND URINE BY POLAROGRAPHIC AND COLORIMETRIC METHODS. CONSIDERATIONS ON THE CHEMICAL FORM OF URINARY LEAD.) *Folia Medica* 47: 57-72 (Jan.), 1964.

In view of the diagnostic importance in Pb poisoning of the determination of concentrations of Pb in blood and urine, the authors undertook the comparison of results obtained by the colorimetric dithizone and polarographic methods on samples collected from 15 normal subjects and 24 workers exposed to Pb under basal conditions and after challenge with  $\text{CaNa}_2\text{EDTA}$ . Among the Pb-exposed, 14 were patients of the authors' clinic on whom diagnosis of Pb poisoning had been established, and 10 were typographers who, while showing elevated absorption of Pb, continued their work during the period of the tests. The chemical form of urinary Pb was investigated to determine the 2 fractions of "total Pb" and "precipitable Pb" which, according to Dinischiotu et al (1960) and others, reveals, before any other tests or clinical signs do, the degree of exposure. In other words, the finding of elevated nonprecipitable Pb represents an increased absorption; upon removal of the worker from the exposure, this fraction rapidly diminishes. In their comparative investigation, the authors determined the total urinary Pb as follows: 2 samples of 10 ml urine were ashed with nitric and perchloric acid; one sample was then analyzed by the colorimetric method of Bessman (1955); the dry residue of the 2nd sample was dissolved in a mixture of tartaric and hydrochloric acid (HCl), then treated with 8% HCl and read on the polarograph. For the determination of the precipitable Pb, 2 samples of 40 ml urine were treated with a saturated solution of ammonium chloride and hydroxide, and a saturated solution of Na phosphate. The precipitate of one of the samples was then dissolved and treated as above described for the polarographic method. That of the second sample was ashed with nitric and perchloric acid and extracted according to Bessman's colorimetric dithizone method. The nonprecipitable portion (in which Pb was thought to be probably present in the form of an organic complex) was

Obtained by subtracting the precipitable from the total Pb. Further, by applying the formula  $\frac{\text{total Pb} - \text{precipitated Pb}}{\text{total Pb}} \times 100$ , the quantity of the bound Pb was obtained, expressed as the percentage of the total quantity of excreted Pb.

Tabulation of the results showed that there was no statistically significant difference between the values obtained by the 2 methods, but that a statistically significant difference existed between the Pb values for blood and urine in the 2 groups tested. The nonprecipitable fraction of urinary Pb ranged within rather wide limits (4-23.3% of total urinary Pb in controls and 22.5-51% for exposed subjects). The nonprecipitable fraction increased parallelly with the total Pb. The values of precipitable and total urinary Pb before administration of EDTA indicated that the administration of the chelating agent produced a statistically significant increase of total urinary Pb excretion, and that this increase was greater in the exposed group. However, the values of precipitable Pb in constant volumes of urine did not change after EDTA treatment, which was attributed to the excess of Pb as being excreted in the form of a complex.

In the opinion of the authors, the polarographic method is the more rapid, particularly for the measurement of Pb in blood, also more sensitive and specific. Since dithizone reacts with other metals such as Bi, Cd, and Zn, high Pb values found in exposed subjects by colorimetric analysis may be due to the presence of other metals besides Pb. Concerning the determination of the 2 fractions of urinary Pb, the authors do not believe it to be of practical value, as it does not permit the differentiation between exposure or nonexposure to Pb in individual cases, for a wide variation was found in both normal and exposed subjects.

- 2677 Cempel, M., Krechniak, J., and Byczkowski, S. (Med. Acad., Gdansk, Poland): (BEHAVIOR OF SERUM PROTEINS IN PERSONS EXPOSED TO LEAD POISONING.) Gdanskie Towarzyst. Nauk., Wydział Nauk. Mat.-Przyrodniczych, Rozprawy Wydziału III No. 1:42-8, 1964.

Total serum proteins, globulins and prothrombin time were determined in the blood of 95 shipyard painters exposed to Pb. Total serum proteins were normal (6.5-8%) in 40 and elevated (8.0-9.3%) in 55 cases. A normal albumin content of 60-70% was found in 17 workers while in 78 it was decidedly lowered (30-60%). Fractionation of globulins was reported only for 89 cases of whom 88 showed an increased  $\alpha_1$ -level, 81 an increased  $\alpha_2$ -level, and 83 and 80 men, respectively, had increased  $\beta$ - and  $\gamma$ -globulins, 32 of them showing  $\gamma$ -globulin increases of >20% above normal. Prothrombin time was normal in 32, lowered in 33 and increased in 16. No uniform trends were observed. (From Chemical Abstracts 64:14847, 1966)

- 2678 Chisolm, J.J., Jr. (Johns Hopkins Univ., Baltimore, Md.): DISTURBANCES IN THE BIOSYNTHESIS OF HEME IN LEAD INTOXICATION. Journal of Pediatrics 64:174-87 (Feb.), 1964.

The purpose of this discussion was to summarize

recent experimental data on the relationships between the effects of Pb and EDTA on heme synthesis, to correlate the findings with those in human Pb poisoning, and to point out how this information has been applied to the early detection and therapeutic management of Pb intoxication in man. The concluding remarks bring out the finding that the steps inhibited by Pb are those mediated by sulfhydryl enzymes, yet these steps are not uniformly inhibited by other heavy metals. While heme synthesis in the red cell is clearly deranged by Pb, little is known of Pb effect on heme synthesis in other organs such as kidney, liver, and brain; although it is clear that solar irradiation and vitamin D administration enhance the absorption of Pb from the intestine, the increased incidence of acute Pb poisoning in children during the summer months is still not fully explained. Deranged porphyrin synthesis merits further study with respect to any possible relationship which it may have to the seasonal incidence of Pb poisoning.

The experimental studies of the past decade have clarified the complex interrelationships in the mechanisms responsible for the anemia of Pb poisoning. To this the role of the basophilic stippled cell is central. Removal of these abnormal erythrocytes from the circulation appears to be largely responsible for the reduced red cell survival time observed in Pb poisoning. The incorporation of Fe into protoporphyrin IX is largely inhibited so that Fe and protoporphyrin IX accumulate but little heme is formed. The basophilic stippled cell contains a complement of enzymes not found in mature erythrocytes and these are capable of synthesizing porphyrins. This is apparently responsible for much of the excess porphyrin accumulated.

Although the disturbance in heme synthesis caused by Pb does not correlate closely with the other more serious clinical manifestations of Pb intoxication, its importance lies in the fact that this derangement can be readily detected prior to the onset of serious symptoms. The preliminary evidence of the effects of EDTA alone and in the presence of Pb upon porphyrin synthesis in the experimental animal suggests that the clinical use of CaEDTA alone especially in severely ill patients may be hazardous for it enhances the toxic effect of Pb on heme synthesis. Because of this finding the current therapy of acute Pb poisoning with chelating agents is being re-evaluated. (62 references)

- 2679 Chojecki, Z., and Kowalski, H. (Clinic of Internal Diseases, Warsaw, Poland): Badania wchłaniania witaminy  $\text{Co}^{58}\text{-B}_{12}$  w przewlekłej ołowicy. (STUDIES ON THE ABSORPTION OF VITAMIN B-12 LABELED WITH  $\text{Co}^{58}$  IN CHRONIC LEAD POISONING.) Polski Tygodnik Lekarski 19:938-41 (June 15), 1964.

The gastric contents of 14 patients with chronic Pb poisoning and of 5 normal subjects were analyzed for their secretion of HCl and of pepsin. The Pb-poisoned patients frequently showed a deficiency in or no secretion of HCl and a decrease of pepsin secretion. In some cases, there was also a decreased secretion of the intrinsic factor. The mean value of secretion of the intrinsic factor,

expressed as the amount of  $^{58}\text{Co}$  and vitamin  $\text{B}_{12}$  excreted in the Schilling test, was 21.5% in the controls and 16.1% in the Pb patients. The reduced secretion of the intrinsic factor in Pb poisoning was associated with achlorhydria and decreased activity of plasma pepsinogen, and not with the signs of megaloblastic anemia in the peripheral blood. The development of megaloblasts in Pb poisoning may be explained by insufficient excretion of the intrinsic factor and exhaustion of vitamin  $\text{B}_{12}$  stored in the liver. (From authors' summary)

- 2680** Cis, C., Perani, G., and Cavagna, G. (Univ. Milan, Italy): Alterazioni cocleo-vestibolari nell'intossicazione da piombo-tetraetile. (COCHLEOVESTIBULAR CHANGES IN TETRAETHYL LEAD POISONING.) *Medicina del Lavoro* 55:811-9 (Dec.), 1964.

Twenty workers from a plant manufacturing TEL, admitted to the Milan Industrial Clinic, were subjected to tests of the auditory and vestibular system in order to study the characteristics and the location of otoneurologic changes and to ascertain whether such changes would be indicative in the diagnosis of TEL poisoning for medicolegal purposes. The men, aged 21-58 yr, had been subject to moderate exposure to TEL for a prolonged period of time and had shown indications of subacute poisoning. The diagnosis was based on determinations of the level of Pb in blood, urinary Pb excretion before and after administration of versenate, urinary coproporphyrin and protoporphyrin IX in the red blood cells. They had been selected from a large group of TEL-exposed workers so that only such men were included whose cochleovestibular function had been affected solely by TEL. The usual tests indicated only slight alterations in hearing. However, vestibular examination, using a modified method of Veitz, revealed in all cases a significant syndrome characterized mainly by nucleoreticular lesions. Nine men showed spontaneous polymorphic symptoms of the whole vestibular system, whereas in 11 men the picture was almost normal, with only a slight decrease of bilateral reflex activity. In discussing the findings, the authors observe that after the toxic stage had passed, changes are detectable only by means of instruments, the dizziness having gradually worn off with time. They consider the otovestibular examination of value in the diagnosis of TEL poisoning, together with laboratory tests demonstrating past exposure to the agent. In addition, this examination is considered useful in deciding whether the patient who has overcome the stage of intoxication is able to resume work.

- 2681** Consolazio, C.F., Nelson, R.A., Matoush, L.O., Hughes, R.C., and Urone, P. (US Army Med. Research and Nutrition Lab., Denver, Colo.): THE TRACE MINERAL LOSSES IN SWEAT. US Army Medical Research and Nutrition Laboratory Report No. 284, Aug. 18, 1964, (AD447-382) 14 pp.

The trace mineral losses in sweat in relation to a normal intake and to the minimal daily requirement or allowance was studied on 3 healthy men during 4-day periods, in an environmental chamber at 37.8°C and 50% relative humidity. The daily physical activity of the subjects consisted of

only 30 min of moderate activity on the bicycle ergometer with the remainder of the day spent in sedentary activities. The daily food consisted of 4 menus which were notated to coincide with each period. The menus provided 3283 calories each with 12.46 mg Zn, 3.52 mg Cu, 4.24 mg Mn, 889 µg Cr, 172 µg Mo, 202 µg Ni and 404 µg Pb. Sweat rates were measured for each period by Adolph's (1947) method, using arm sweat samples, by measuring weight changes during exposure and adjusting for water intake and weight loss due to urinary and fecal output. Data were tabulated for the excretion in sweat of Co, Cu, Mn, I, Cr, Se, Sr, Zn, Mo, Al, Pb, Ni and Sn, over 7.5 hr exposure periods during each of the 4 day experiments. Cu excretion was fairly high, averaging 1.94, 1.79, and 1.04 mg during the last 3 periods; Se excretions averaged 0.30-0.37 mg, and those of Cr 0.057-0.061 mg; for Pb analyses, samples were available only for the 2 last periods, with a Pb content of 0.317 and 0.195 mg respectively. Figures for intake, output and balance were shown for Zn, Cu, Cr, Mn, Mo, Co, Ni and Pb. Percentage losses in sweat, in relation to the daily intake, were, approximately, Zn 18, Cu 40, Cr 6.9, Mn 2.3, Mo 35.5, Ni 41, Pb 50. The implication of these losses for the evaluation of minimal daily requirements was pointed out. The studies also confirm that the excretion of trace minerals in sweat decreases appreciably after acclimatization to a hot environment.

- 2682** Corsi, G.C., and Picotti, G. (Inst. Ind. Med., Univ. Padua, Italy): Su alcuni aspetti clinici dell'intossicazione da piombo tetraetile (con particolare riguardo al sistema nervoso centrale e al sistema emopoietico). (SOME CLINICAL ASPECTS OF TETRAETHYLLEAD INTOXICATION (WITH SPECIAL REGARD TO THE CENTRAL NERVOUS AND HEMOPOIETIC SYSTEMS).) *Acta Medica Patavina* 24, No. 4:545-68, 1964.

Of the workers studied, all (47) were engaged in the manufacture of TEL; among them were 2 chemical laboratory workers exposed in the mixing operation. Four workers who had died were not seen by the authors, but the records were made available to them. The type of work varied as did the duration of exposure (3 wk-14 mo); the time elapsed between discontinuing work because of onset of poisoning and admission to the hospital also differed. The frequency of subjective and objective symptoms is tabulated. The "triad" of bradycardia, hypotension and hypothermia was given special attention. The authors emphasize that this triad of signs may be masked by the gravity of the general clinical picture. EEG and vestibular function examination showed frequent damage to the brain stem; therefore, these tests must always be carried out on such patients. A slight degree of anemia was noted in some cases. The erythrocyte protoporphyrin (PP) level, coproporphyrinuria and urinary Pb elimination are considered valuable diagnostic signs. The increase in the PP does not seem to be dependent on a failure of Fe incorporation into the PP molecule. (288 references)

- 2683** Cosma, V., Fodor, O., Munteanu, P.,

Schwartz, M., Medrea, B., Erdösy, S., Badea, G., Forgacs, V., Crăciun, I., and Farkas, M. (Med. Clinic, IMF, Cluj; Metallurgical Ind. Med. Dept., Baia Mare, Romania): Cercetări privind unele boli digestive în mediul toxic saturnin profesional (boala ulcerosă și hepatita cronică). (RESEARCH ON SEVERAL DIGESTIVE DISEASES IN OCCUPATIONAL RISK OF LEAD POISONING (ULCER DISEASE AND EPIDEMIC HEPATITIS).) *Medicina Interna* 16:221-8 (Feb.), 1964.

In a study of the consequences of epidemic hepatitis and of the incidence of ulcers in workmen of a Pb processing plant, the authors found a high proportion of chronic hepatitis (24%) among those who had suffered from epidemic hepatitis. No peculiarities of the clinical picture were noted and results of function tests were marginal. In exposure to Pb, ulcerous afflictions exhibit certain clinical peculiarities as regards the periodicity of dyspepsia, which is dominated by pain. The authors classify the symptomatology into 2 groups: the "classical" group, and the other, more specific one, superimposed by signs of Pb absorption. (From authors' summary; 18 references)

**2684** Dantin Gallego, J. (Natl. Inst. of Med. and Occup. Health, Madrid, Spain): El saturnismo, enfermedad general. (LEAD POISONING, A GENERAL DISEASE.) In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. II, pp. 752-4.

Knowledge of what is perhaps the oldest occupational disease has undergone great fundamental changes. Whereas formerly painters and typographers were mainly affected by Pb poisoning, the hazards today are greatest among galvanizers, founders, storage battery workers, moulders, etc. The formerly unknown route of absorption by inhalation has proved to be 10-20 times as active as that by the digestive tract. Treatment of Pb poisoning has experienced a revolution with the use of chelating agents such as EDTA. Much, however, remains to be improved in the diagnostic field. The evolution of the concept of the clinical picture of Pb poisoning since Renaut (1875) is briefly reviewed. Although Pb poisoning has not disappeared, the classical symptoms have changed. As absorption occurs over an extended period of time, the syndrome of acute poisoning has lost importance. The role of the nervous system in Pb poisoning and the interpretation of neurologic symptoms formerly and today are discussed. Normal individuals have a Pb content in the spinal fluid of less than 18 µg%; in nonfatal cases of Pb encephalopathy it is 25-50 µg, in fatal cases about 100 µg. Relations between the cerebral cortex and the digestive apparatus have been discussed by Rabano. Typical though not specific alterations have been found in the bone marrow; also involved in Pb poisoning is the vascular system. In conclusion, the author presents a survey of modern techniques available for the diagnosis of Pb poisoning.

**2685** Dashash, A. (Inst. of Ind. Hyg. and Occup. Diseases, Moscow, USSR): Izmenenie soderzhaniya zheleza v krovi i moche u bol'nykh s intoksikatsiei svintsom pod vliyaniem kompleksoterapii (pentatsin-CaNa<sub>3</sub>DTPA). (CHANGES IN THE IRON LEVELS OF THE BLOOD AND URINE IN PATIENTS WITH LEAD POISONING TREATED WITH A COMPLEXING AGENT (PENTACYNIUM CaNa<sub>3</sub>-DTPA).) *Gigiena Truda i Professional'nye Zabolevaniya* 8, No. 12:12-6, 1964.

The Fe content of the urine following treatment with CaNa<sub>3</sub> pentetate (pentacynium) was studied in 15 patients with chronic Pb poisoning, generally of mild or moderate nature. The drug was administered in doses of 20 ml/day (5-10% solution) in 3-day courses at intervals of 4-5 days. A slight increase in excretion of Fe occurred which, however, promptly returned to its normal level after the treatment was discontinued. Blood studies showed that during medication total Fe gradually increased and plasma Fe declined. Concomitantly, the Hb level increased. The author concludes that pentacynium has a normalizing effect on the synthesis of Hb which in the opinion of many authors is deranged in the development of Pb-induced anemia.

**2686** De Zorzi, C. (Univ. Rome, Italy): Il livello della protoporfirina libera eritrocitaria ed il tasso urinario dell'acido δ-aminolevulinico e delle coproporfirine in un gruppo di soggetti esposti all'azione tossica protratta del piombo. (THE LEVEL OF FREE ERYTHROCYTE PROTOPORPHYRIN AND URINARY LEVEL OF DELTA-AMINOLEVULINIC ACID AND COPROPORPHYRINS IN A GROUP OF SUBJECTS EXPOSED TO THE PROLONGED TOXIC ACTION OF LEAD.) *Zacchia* 27:464-71 (July-Sept.), 1964.

The modifications of porphyrin and its precursors in individuals exposed to Pb were studied in 24 male workers, aged 29-62 yr and exposed to Pb for 2-40 yr, and 10 nonexposed subjects. δ-Aminolevulinic acid (ALA) was determined by the method of Mauzerall and Granick (1956), urinary coproporphyrin by that of Askevold and Schwartz and Rimington and Sveinsson (cited by Haeger-Aronsen, 1960); blood and urinary Pb were determined colorimetrically and polarographically, respectively. Literature data for nonexposed subjects give 0.600 mg Pb/1000 g blood, 0.050 mg Pb and 0.080 mg CP/l urine and a maximum of 0.293% ALA. Free protoporphyrin (PP) in the 10 controls, as determined by the method of Grinstein and Wintrobe (1948) ranged from 0.018-0.050 mg/100 cc of erythrocytes. Data for the exposed subjects ranged as follows: PP 0.024-0.435 mg%, ALA 0.071-1.754 mg%, CP 0.010-0.716 mg/l, blood Pb 0.190-0.647 mg/1000 g, urinary Pb 0.005-0.105 mg/l. PP was increased above normal in 7 cases; ALA in 5 (simultaneously with PP); CP in 4 (but only in 2 of these PP and ALA exceeded the normal); and in 1 case, PP, ALA, CP, and blood and urinary Pb showed a parallel increase.

The conclusion was drawn that a test for PP and ALA is particularly useful in the detection of early Pb poisoning.

- 2687** Dingwall-Fordyce, I. (Univ. Manchester, England): A FOLLOW-UP STUDY OF LEAD WORKERS. In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. II, pp. 843-4.

A retrospective survey, based on records of a group of companies, of men with known Pb exposure was undertaken to test the suggestion made by Boyland in 1962 that exposure to Pb compounds might cause cancer in man. The samples included 425 retired workers of whom 184 had died in the years 1926-1960; of an unknown number of men employed from 1946-1961 in a storage battery factory, 153 who had died while still employed. Each man was graded according to the degree of recognized Pb hazard associated with the jobs he held. Pb hazard and Pb in urine, respectively, were nil and within normal limits in Grade A; negligible and within normal limits in Grade B; and considerable and 150+  $\mu\text{g/l}$  in Grade C. Actual numbers of deaths compared with expected numbers which for the pensioners were calculated from the population at risk assuming the same mortality standardized for age and yr as that of all males in England and Wales. This could not be done for the employed men as the population at risk was unknown; instead, the actual number of deaths was compared with expected deaths based on the ratio of specific causes to all causes. A significant excess of observed deaths from all causes was found in Grade C (greatest exposure). Among pensioners who had been subjected to the greatest exposure to Pb, deaths from malignant disease occurred in 10 vs an expected 12.5, and among the employed, in 17 vs an expected 18.5. The number of deaths from malignancy increased as exposure to Pb decreased after improvement in factory conditions. It was thus concluded that malignancy was not related to Pb absorption. A relatively large number of deaths was attributed to cerebral hemorrhage and cerebral thrombosis, with incidence diminishing as exposure decreased with improved working conditions.

- 2688** Dizon, G.D., Anselmo, J.E., Almonte, J.B., Aquino, R., and Navarro, A. (Bureau of Health Services, Manila, Philippines): STUDY OF HEALTH HAZARDS IN THE STORAGE BATTERY MANUFACTURE IN THE PHILIPPINES. In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. III, pp. 1004-10.

Cases of Pb poisoning in storage battery shops in Manila, which had occurred between 1949 and 1956 (7 in 1949, 3 in 1950-1951 (these were acute poisoning in children of battery shop owners), 6 in 1955 and 1 in 1956), were reviewed and the results of a study done in 1963 in 5 big battery shops located in the suburbs of Manila were reported. Four of these plants employed >20 workers and one had <10 men. The length of employment ranged from 7 mo to 17 yr, and 1 supervisor had worked for 28 yr. The following determinations were made and tabulated: atmospheric Pb levels in the working environment; urine spot sampling for porphyrin and

Pb; and examination of exposed workers for clinical manifestations of poisoning. In 2 of the shops, atmospheric Pb concentrations were within the threshold limits and laboratory and clinical findings were satisfactory; in 1 of them the workers wore gauze nose covers and were treated prophylactically with EDTA-tablets. In the 3 other shops, the data obtained indicated unsatisfactory working conditions. It was pointed out that supervision of storage battery shops in the Philippines was started in 1949. Companies are willing to follow recommendations, yet much is still to be desired in their compliance. Some have installed exhaust systems, some supply respirators, but workers prefer the use of gauze nose covers. Rotation of jobs is practiced and a few shops administer EDTA-tablets prophylactically to workers with positive urinary porphyrin.

- 2689** Djuric, D., Kilibarda, M., Novak, L., Panov, D., and Vukotic, M.: (Inst. Occup. Health, Belgrade, Yugoslavia): STUDIES ON AIRBORNE RADIOACTIVE CONTAMINATION OF MINERS IN A YUGOSLAV URANIUM MINE. Health Physics 10:1059-64 (Dec.), 1964.

The atmosphere of a Yugoslavian uranium mine was periodically measured for 4 yr for Rn concentrations. The concentrations of  $^{210}\text{Po}$  in the urine of miners were determined and the potential sources of  $^{210}\text{Pb}$  and  $^{210}\text{Po}$  and the possibility of correlation Rn exposure and Po excretion in urine were discussed. (25 references)

- 2690** Druyan, R., and Haeger-Aronsen, B. (Univ. Lund, Sweden): AMINOACETONE EXCRETION IN PORPHYRIAS AND IN CHRONIC LEAD INTOXICATION. Scandinavian Journal of Clinical and Laboratory Investigation 16, No. 5: 498-502, 1964.

The excretion of aminoacetone (AA) and ALA was studied in patients with diseases characterized by increased excretion of ALA: acute intermittent porphyria, porphyria cutanea tarda, porphyria variegata and chronic occupational Pb intoxication. Fresh urine samples were analyzed immediately or stored at  $-20^\circ\text{C}$ , pH5, to minimize breakdown of aminoketones. Creatinine, uroporphyrin and coproporphyrin were determined by standard methods as described previously by Haeger-Aronsen (1958, 1960), aminoketones were measured by the method of Urata and Granick (1963). AA and ALA were identified by their chromatographic properties; ALA did not contaminate AA column fractions and vice versa. In 10 normal control subjects, the mean excretion and 95% confidence limits of AA and ALA in mg/g creatinine were 0.59, 0.15-1.03 and 1.63, 0.85-2.40, respectively. In all patients, ALA excretion was increased to more than 2.4 mg/g creatinine while AA excretion was within the 95% confidence limits established for normal controls. No relationship could be demonstrated between the excretion of AA and ALA among the patients. Therefore, diversion of glycine from AA to ALA appeared unlikely.

The effect of diet on aminoketone excretion was studied in 2 obese women, receiving no medication, whose intake after a control period with an ad libitum diet was restricted to 600 calories glucose/day. ALA excretion remained constant but AA

excretion was significantly reduced.

- 2691** Dynnik, V.I. (Inst. Ind. Hyg. and Occup. Diseases, Kharkov, USSR): Funktsional'naya deyatel'nost' pochek pri nachal'nykh proyavleniyakh khronicheskoi intoksikatsii svintsom. (RENAL FUNCTION IN INITIAL MANIFESTATIONS OF CHRONIC LEAD POISONING.) Gigiena Truda i Professional'nve Zabolovaniya 8, No. 9:57-9, 1964.

Clinical examination and renal function tests were performed on 99 patients with mild chronic Pb poisoning, using modern methods: urinalysis, Zimnitskii's test, determination of the urea clearance coefficient, Anbar's constant, creatinine clearance, tubular reabsorption, renal flow of blood plasma by means of cardiotrast, filtered fraction.

The patients, who had been exposed to higher than permissible levels of concentration of Pb, comprised 41 smelters, 43 were engaged in gas-cutting painted metal, and 15 were in other Pb trades. Most were from 25-50 yr old, only a few >50, and their exposure to Pb was from 2-10 yr. Upon admission, the predominant complaints were general weakness, excessive sweating, irritability, periodic headaches, decreased appetite, etc. History revealed no previous renal disease. Examination showed pallor in 23, loose and easily bleeding gums in 27. Muffled heart sounds were noted in 48. Blood pressure was normal. Neurologic findings included, among others, slight sensory polyneuritis.

Concentrations of Pb in the urine ranged up to 0.2 mg/l; in blood, 0.06 mg %, counts of stippled erythrocytes were from 800-4000/million cells; reticulocytes ranged to 2%; polychromasia, 2+-3+; Hb was decreased to 70-75%; urinary porphyrins were up to 0.09 mg/l.

Mild Pb poisoning was most frequently characterized by vasculovegetative dystonia, incipient blood disorders, at times spastic colitis, etc. In 29, traces of albumin, cylinders, erythrocytes and renal epithelia were seen in the urine. Polyuria was noted in 10, and nycturia in 14. Disturbed concentrating capacity of the kidney was not demonstrable. Decreased urea clearance of 74-50% was found in 29, and <50%, in 16 of 93 so tested. Increased Anbar constant from 0.12-0.15 occurred in 27; >0.15, in 16. The renal flow of plasma was reduced from 600-400 ml/min in 30; to <400, in 17; in 43 it was normal. Of 90 men tested, creatinine clearance was decreased in 25, and the filtered fraction was increased in 37. Tubular reabsorption was found only rarely.

The changes in renal function observed confirm to the author his assumption that chronic Pb poisoning produces spasms of the abducent (efferent) blood vessels of the kidney.

- 2692** Editorial: (G. Richet) (Tenon Hosp., Paris, France): Saturnisme et insuffisance rénale chronique. (SATURNISM AND CHRONIC RENAL INSUFFICIENCY.) Acta Clinica Belgica 19:1-4, 1964.

Editorial objection was raised to the present tendency to eliminate Pb poisoning as one of the causes of Bright's disease. Henderson (1953) was able to follow the fate of 266 of 401 children ad-

mitted to the Brisbane, Australia, Pediatric Clinic with Pb poisoning between 1915-1934. Of these, 127 had kidney disease or arterial hypertension, leading to death of 101 within 5-35 yr following intoxication. This finding was confirmed by Nye (1933), and Vigdortschik who compared the frequency of cardiovascular disorders and nephropathy in 3500 workers having contact with Pb and 1600 having none. Hypertension and uremia in the former group was 3-fold of the latter. As additional evidence, Henderson and Inglis observed that in Queensland, primary chronic nephropathy was accompanied by a clearly higher bone Pb content than in other Bright's disease patients.

Confirmation of the signs of Pb-induced chronic nephropathy described in the last century was found by the author and associates (1964) in a systematic study of the kidneys of 8 patients suffering from chronic Pb poisoning. These include knowledge of long exposure to Pb, if not the duration of Pb poisoning or of the latent period before kidney lesion becomes evident, which consists of habitual absence of all urinary anomalies, proteinuria, hematuria, leukocyturia, frequent precession of a hypertensive syndrome before the slowly developing renal insufficiency and finally, severe vascular lesions involving not only the kidney but the entire arteriolar system. In 3 of these subjects gout (tophus in 1) was also observed; in 4 others uremia was elevated, suggesting an elective defect of renal uric acid excretion.

Two procedures for the proof of Pb as cause are described. The 1st is the induced Pb excretion test with iv administration of 500 mg EDTA; the 2nd is renal biopsy. In 2 of the above subjects electron microscopy of the sections revealed nuclear inclusions in the proximal tubular cells, signs considered to be specific for Pb poisoning. Both patients had had no contact with Pb for 6 and 7 yr, yet the inclusions were present, indicating Pb as the origin of Bright's disease.

Electron microscopy is a long and difficult procedure. However, the author feels certain that methods of staining and fixation will be improved, thus allowing Pb intranuclear lesions to be more readily identified. It will then be possible to determine the exact position of Pb poisoning among the chronic nephropathies of toxic origin. (19 references)

- 2693** Editorial (I.H. Scheinberg): D-PENICILLAMINE, WITH PARTICULAR RELATION TO WILSON'S DISEASE. Journal of Chronic Diseases 17:293-8, 1964.

The chemistry and use primarily in Wilson's disease of D-penicillamine, the regimen, toxicity and results are reviewed. Other therapeutic uses include Pb poisoning in which it has clearly increased urinary excretion of Pb. While it is less effective than EDTA on a molar basis, this is in part offset by the fact that it can be administered orally while EDTA cannot be so given in Pb poisoning. (17 references)

- 2694** Efe, S. (Univ. Istanbul, Turkey): STUDIES ON URINARY EXCRETION ON DELTA-AMINO-LEVULINIC ACID IN CASES OF SATURNISM AND IN PLUMB WORKERS. New Istanbul Contribution to Clinical Science 7:209-26, 1964.

The author suggests the differentiation of 3 degrees of Pb poisoning: (1) latent Pb poisoning with objective manifestations but few or no subjective symptoms; (2) manifest Pb poisoning characterized by objective signs and subjective symptoms; and (3) asymptomatic Pb poisoning which includes individuals exposed to Pb but without subjective symptoms and objective signs except increased urinary excretion of ALA.

Urinary ALA, Pb and coproporphyrin, Pb in blood, porphobilinogen and stippled erythrocytes were determined in 18 cases of manifest, 75 of latent and 17 of asymptomatic Pb poisoning; ALA was also determined in 63 subjects without known exposure to Pb. ALA was found to be increased in all cases of manifest poisoning, in all cases of latent Pb poisoning with the exception of typographers who are exposed to exceedingly small amounts of Pb, and in 9 of 17 asymptomatic Pb workers. Since an increase of ALA is rather specific for Pb poisoning, this test is considered to be the most sensitive and reliable criterion for the diagnosis of Pb intoxication. It is also one of the earliest signs of Pb exposure as evidenced in the case of 3 workers in whom, after only 10-20 days of exposure, urinary ALA excretion had increased 5- to 10-fold the normal, while neither stippled erythrocytes nor lymphocytosis and eosinophilia had yet developed. On the contrary, in the 63 patients with diseases unrelated to Pb exposure, ALA excretion showed normal value. In the treatment of Pb poisoning with EDTA, the return to normal levels of urinary ALA excretion can be considered as a criterion of cure of the patients. In the explanation of increased ALA excretion in Pb intoxication, the author favors the hypothesis that Pb promotes the synthesis of ALA rather than the assumption that Pb inhibits ALA-dehydrase.

- 2695** Ermakov, E.V. (USSR): Khronicheskoe otravlenie tetraetilsvintsom. (CHRONIC POISONING BY TETRAETHYLLEAD.) Lenmedgiz, 1963, 98 pp. Reviewed by A.B. Reznikov. *Gigiena i Sanitariya* 29, No. 7:122-4, 1964.

The reviewer remarks that although Ermakov observed only individuals in contact with ethyl gasoline for aviation or automotive purposes, he considers intoxication by ethyl gasoline to constitute chronic intoxication by TEL. In taking exception to this view, Reznikov, himself a doctor of medical sciences, argues that intoxication by ethyl gasoline is reversible and differs both qualitatively and quantitatively from intoxication by TEL. Though acute and subacute poisoning by ethyl gasoline may occur more frequently in people thus exposed, chronic intoxication by ethyl gasoline is possible only in cases of complete disregard of industrial safety measures. The reviewer also objects to the lack of differentiation by Ermakov of aeronautical gasoline containing 4 ml ethyl fluid/kg, and automotive gasoline containing 0.75 ml ethyl fluid/kg. He points out that the symptomatology of intoxication by aviation gasoline is not at all identical with that by automotive gasoline and that neither one may be equated with TEL poisoning.

Nonetheless, Reznikov considers the book to be

of interest to hygienists, neuropathologists, psychiatrists and young physicians for diagnostic purposes.

- 2696** Evans, R.D. (Massachusetts Inst. Technol., Cambridge): GENERAL RADIOBIOLOGY. In Radium and Mesothorium Poisoning and Dosimetry and Instrumentation Techniques in Applied Radioactivity. Annual Progress Report, U.S. Atomic Energy Commission Document MIT-952-1, May 1964, pp. 152-62.

Routine weekly measurements of the  $^{137}\text{Cs}$  body burdens of 6 normal subjects showed an increase to 6-7 times that of the winter of 1961 and 1962. Data from whole-body  $\gamma$  counts of individuals given a tracer injection of  $^{132}\text{Cs}$  were analyzed with a computer Frantic program. Results are reported from whole-body  $\gamma$  counting of individuals for  $^{137}\text{Cs}$ ,  $^{186}\text{Re}$ ,  $^{195}\text{Pt}$ ,  $^{226}\text{Ra}$  and  $^{210}\text{Pb}$ . (From Nuclear Science Abstracts 18: Abstract No. 43184, 1964)

- 2697** Ezhdik, I., Suev, I., Veleganov, S., and Ilchev, I. (Bulgaria): Nyakoi osobenosti v ozdravitel'niya protses na ranite b usloviyata na olovno-tsinkovite rudnitsi. (SOME FEATURES OF THE WOUND HEALING PROCESS AMONG WORKERS IN A LEAD-ZINC MINE.) (Preliminary Report.) *Khirurgiia* (Sofia) 17:145-7, 1964.

The investigation was concerned with the effects of silica dust and sanitary conditions, with no reference to Pb.

- 2698** Falkowska, Z., Sobkowicz, H., and Tur, J. (Eye Clinic AM, Warsaw, Poland): Przypadek przewlekłej ołowicy ze zmianami w ośrodkowym układzie nerwowym i narządzie wzroku. (CHRONIC LEAD POISONING WITH VISUAL AND CENTRAL NERVOUS SYSTEM DAMAGE.) *Polski Tygodnik Lekarski* 19:12-5 (Jan. 1), 1964.

See Abstract No. 2254.

- 2699** Fleming, A.J. (Du Pont de Nemours, Wilmington, Del.): INDUSTRIAL HYGIENE AND MEDICAL CONTROL PROCEDURES. MANUFACTURE AND HANDLING OF ORGANIC LEAD COMPOUNDS. *Archives of Environmental Health* 8:266-70 (Feb.), 1964.

The manufacture and distribution of tetraethyl-(TEL) and tetramethyllead (TML) in the United States is carried out under strict and systematically applied measures of control, proposed by the US Public Health Service and implemented by the manufacturers and distributors. The control of the health of employees working with these compounds is based on sound clinical medicine, proper industrial hygiene and adequate analytical procedures. Representative examples of the distribution of Pb in tissues, blood and excreta of adults having no exposure to Pb and of those with various degrees of exposure are shown in 3 tables. With the knowledge of these data, an examination schedule for the worker can be set up. The control procedures followed at the Chambers Works for all Pb workers and their selection are outlined and the form used is shown. Pb workers report



to the nurse every 2 mo. If urinary Pb exceeds 0.11 mg/l, the employee is rechecked monthly, unless deemed otherwise; if it exceeds 0.15 mg/l, he is moved to an area of less exposure; if it exceeds 0.20 mg/l, he is kept out of the Pb areas, and examined by the physician. The health supervisors ascertain the reasons for any increased elimination of Pb. Medical inspections and educational talks are made periodically. Air sampling in Pb areas is done daily. As a result of the program, there has been no serious incident of exposure and no case of Pb poisoning in the past 30 years.

Assistance and consultation is also extended by the manufacturers or distributors of Pb alkyls to petroleum refineries in providing environmental and medical supervision for workers in mixing operations and advisory services in the storage and distribution of TEL-gasoline. While the use of gasoline containing TEL in concentrations of 4 ml/US gal or less as a motor fuel involves no hazard by inhalation or skin contact, the cleaning and repairing of storage tanks and tank cars and trucks requires strict precautionary measures to render these operations safe. Precautions in the handling of TEL and related compounds in the laboratory are also set forth. The measures as formulated and publicized have been remarkably effective.

- 2700 Foreman, H. (Univ. Minn., Minneapolis): TOXIC SIDE EFFECTS OF ETHYLENEDIAMINE-TETRAACETIC ACID. In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Vol. II:881-4, 1964.

In view of the fact that EDTA is used extensively for the treatment of Pb poisoning, its toxic side effects were investigated. The most significant of these is renal irritation. Other distressing symptoms are the so-called "excessive chelation syndrome, occasional glycosuria and trace metal depletion". A judicious dosage schedule is recommended, that is doses not exceeding 50 mg/kg for 5 days followed by 2 days of rest, using a 0.5% concentration in 5% glucose in water or saline. Concomitant administration of vitamin B, particularly B<sub>6</sub>, is advisable.

- 2701 France, National Board for Social Security (Paris): Les maladies professionnelles. (OCCUPATIONAL DISEASES.) (Published by the Social Security, Paris) Travail et Sécurité 16:283, 1964.

The number of people dying of occupational diseases had decreased in France from 37 in 1961 to 31 in 1962; one death was due to Pb poisoning. The total number of men receiving workmen's compensation for the 1st time decreased from 4836 to 4339 and Pb cases decreased by 103. The list of diseases for which workmen's compensation was paid for the 1st time in 1963 is headed by Pb poisoning which contributed 239 cases. (From Zentralblatt für Arbeitsmedizin und Arbeitsschutz 16:52 (Feb.), 1966)

- 2702 Gajdos, A. (Hosp. Hôtel-Dieu, Paris, France): L'intérêt du dosage de l'acide

δ-aminolévulinique dans les urines pour le dépistage du saturnisme. (IMPORTANCE OF THE DETERMINATION OF δ-AMINOLEVULINIC ACID IN THE URINE FOR THE DETECTION OF LEAD POISONING.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 25:436-9 (July-Aug.), 1964.

The author considers the determination of urinary CP and free erythrocytic protoporphyrin to be interesting but nonspecific tests for the diagnosis of Pb poisoning. Also, they may yield normal data in cases of definite latent Pb poisoning. This latter phenomenon was experienced during a mass intoxication due to consumption of wine that contained 4.5 mg Pb/l. Examination of 37 individuals showed 59% with anemia, 78% with stippled erythrocytes, 92% with increased erythrocytic protoporphyrin (>50 µg/100 ml) and 89% with increased urinary CP (>300 µg/24 hr), ie, 8 and 11% respectively, had normal values for protoporphyrin and CP. A more sensitive and more specific test is the determination of urinary ALA, the normal value of which fluctuates between 1 and 2 mg/24 hr or 1-1.5 mg/l. ALA was estimated by the method described by Mauzerall and Granick (Abstract No. 3696). The diagnostic value of the estimation of urinary ALA in human Pb poisoning was demonstrated in a group of 46 cases. Although urinary CP was normal in 4 subjects, ALA was increased in all 46. Corresponding observations were made by Haeger-Aronsen (Abstract No. 2141) who found that 15 men among 100 Pb-poisoned workers showed increased urinary excretion of ALA but normal urinary CP. The specificity of the increase of ALA in Pb poisonings was illustrated in a study of 94 subjects with various diseases or occupational intoxications other than Pb poisonings. ALA was increased in only 3 among 20 cases of anemia, 1 among 18 cases of hepatic cirrhosis and 2 of 20 cancer cases. Furthermore, ALA is always greatly increased in acute porphyrias. In conclusion, the author points out that, by considering simultaneously the clinical picture, the determination of urinary ALA is a valuable test for the diagnosis of Pb poisoning. Since the determination is a simple procedure, its routine use in occupational medicine is advocated.

- 2703 Gammarrata, M. and Bartoli, E. (Univ. Bari, Italy): Considerazioni sui rapporti tra intossicazione saturnina e deficit cocleare. (CONSIDERATIONS ON RELATIONS BETWEEN LEAD INTOXICATION AND COCHLEAR DEFECT.) Clinica Otorino-laringoiatrica 16:136-44 (May-June), 1964.

Previous investigations on the effect of Pb on the cochlear-vestibular system were reviewed and studies made by the authors on 50 workers of a storage battery plant were reported. These men of whom 90% were between the ages of 20 and 30 years, had been in their present job for 1-14 yr, 74% of them <4 yr. Internal symptoms were absent in 34; the Pb blood level in the group ranged from 27-144 µg%, with 70-90 µg% in the majority; a defect of the hearing apparatus was found in 32 men or 64% of those tested, but in 2/3 of those

so affected the hearing loss did not exceed 40 db and concerned mainly the high-frequency tones. No endoscopic auricular alterations were found and the affected men were not aware of their decreased hearing capacity. About 32% of the affected workers showed a minor symptomatology characteristic of chronic Pb poisoning which, however, did not require their removal from work. Pb concentrations in the blood ranged from 45-144 µg%, with 70-90 µg in the majority of cases. The incidence of the defect was 70% in men exposed to Pb <3 yr and 58% in those exposed >3 yr. An individual sensitivity to Pb was assumed.

- 2704** Gattner, H. (Univ. Freiburg/Br., Germany): Die δ-Aminolävulininsäureausscheidung bei der Bleieinwirkung. (THE EFFECT OF LEAD ON THE EXCRETION OF δ-AMINOLEVULINIC ACID.) In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. II, pp. 633-4.

The mechanism of the action of Pb on the basis of latest knowledge of the synthesis of the hemoglobin (Hb) molecule is discussed. Increased excretion of coproporphyrin III, anemia due to increased degradation of the porphyrin-hemoglobin molecule, and the occurrence of stippled erythrocytes are not manifestations of increased degradation as caused by Pb, but rather indicate an inhibition of the synthesis of the Hb molecule. Blockage of the first stages of this synthesis causes a so-called overflow mechanism, or an increase of heme precursors, one of which is ALA. The occurrence of stippling also finds another interpretation. In the young erythrocytes, suppression of mitochondria takes place with simultaneous accumulation of ribonucleic acid. Their ability to synthesize heme to equalize the Hb deficit is termed a state of "self-deception," as Heilmeyer mentioned, a feed-back mechanism caused by blockage of enzymes active in the metabolism may take place. The following enzymes are inhibited by Pb: (1) ALA-dehydrase which enables formation of porphobilinogen from 2 molecules of ALA; (2) coproporphyrinogen-decarboxylase which catalyzes coproporphyrinogen to protoporphyrin IX; and (3) Goldberg enzyme or heme chelatase which enables incorporation of iron into the porphyrin molecule, this being the last step of heme synthesis.

Studies on normal individuals and Pb-exposed workers (typographers, printers, storage battery workers) yielded the following results: (1) Excretion of ALA increases parallel to urinary excretion of Pb and other clinical findings of Pb poisoning; (2) this test is very sensitive; (3) determination of coproporphyrin is also a valuable test in Pb poisoning; (4) examination of spot urine samples is inconclusive (a finding of 1000 µg ALA in morning urine still permits a normal ALA excretion in a 24-hr period; a finding of 1000-2000 µg is indicative of increased ALA excretion; but only values exceeding 3000 µg are definitely pathologic). Determination of creatinine excretion yields inaccurate data which permit only vague conclusions. (5) Excretion of ALA is highly specific for Pb poisoning. Details of this in-

vestigation have been published in the Deutsche Medizinische Wochenschrift 89:1027-35, 1964.

- 2705** Gattner, H. and Schrantz, G. (Univ. Freiburg, West Germany): Bestimmung der δ-Aminolävulininsäure-Ausscheidung im Urin zur Frühdiagnose der Bleivergiftung. (DETERMINATION OF δ-AMINOLEVULINIC ACID EXCRETION IN URINE FOR THE EARLY DIAGNOSIS OF LEAD POISONING.) Deutsche Medizinische Wochenschrift 89:1027-35 (May 22), 1964.

The urinary excretion of ALA was determined in healthy controls, aged 23-54 yr, and in Pb-exposed workers of a printing and battery plant, aged 18-66 yr. In each case, urine was collected over the 24-hr period. Estimations of ALA and coproporphyrin III were made in the morning urine and in the urine voided during the day so that the 24-hr excretion could be calculated. The ALA concentration is generally larger in the morning urine than in that voided during the day. Therefore, determination of ALA only in the morning urine would lead to an incorrect calculation of the 24-hr excretion. The increase in coproporphyrin practically corresponds to that of ALA. Normal values for ALA and coproporphyrin III are tabulated and compared with data given in the literature. Haeger-Aronsen's method of measuring ALA in relation to creatinine is also discussed.

The significance of the determination of ALA and coproporphyrin III for the diagnosis of Pb poisoning is explained as follows: (1) Practically considered, an increase of urinary excretion of ALA is a specific sign of Pb intoxication, although a similar increase of ALA is observed in hereditary acute porphyria; however, there is a simultaneous increase of porphobilinogen which is not typical of Pb poisoning. (2) Determination of ALA and coproporphyrin III are more sensitive tests than the count of basophilic erythrocytes. The following threshold values in µg/24 hr are proposed: coproporphyrin, 120; ALA, 4000. (3) Considering the wide range of fluctuations of the ALA content in the morning and the daytime urine, an ALA excretion in the morning urine up to 1000 µg may be considered to be in the normal range; amounts ranging from 1000-2000 µg are suspicious and those >3000 µg are definitely pathologic. In doubtful cases determinations must be made of a 24-hr specimen. (4) Determination of coproporphyrin and count of basophilic erythrocytes are valuable preliminary tests, while the estimation of ALA will confirm the diagnosis. (5) Urinary Pb excretion approximately parallels the ALA values and, within limitations, may indicate the degree of the poisoning. (37 references)

- 2706** Gaultier, M., Fournier, P.E., Gervais, P., and Beusnel, J. (Hosp. Fernand Widal, Paris, France): Possibilités d'action d'un Centre Régional de toxicologie en Médecine du Travail. (POSSIBILITY OF ESTABLISHING A REGIONAL CENTER OF TOXICOLOGY IN OCCUPATIONAL MEDICINE.) Archives des Maladies Professionnelles, de Médecine du Travail et de Sécurité Sociale 25:430-6 (July-Aug.), 1964.

The increasing use of chemical products in all spheres of modern life has multiplied the sources

of possible intoxications. During 1962, the information center of Professor Gaultier in the Hospital Fernand Widai in Paris has had 4000 telephone calls, of which 292 referred to poisonings by industrial, household or agricultural products and 78 to occupational poisonings, 1 among them caused by Pb. Among hospitalizations for chronic poisoning during 1960 to 1962, 45 out of 50 cases, or 90% of all chronic intoxications, were attributed to Pb. During the same period, 128 workers of a total group of 670, needing consultation for occupational diseases, were Pb cases. Manifestations of intoxications and first-aid measures are discussed.

- 2707** Gaultier, M., Fournier, E., Gervais, P., and Cabrol, P. (F. Widai Hosp., Paris, France): L'augmentation des granulocytes sanguins après injection d'endotoxine, mesure de la réserve médullaire fonctionnelle, son utilisation chez les sujets exposés à un risque hématologique professionnel. (INCREASE IN BLOOD GRANULOCYTES AFTER ENDOTOXIN INJECTION, MEASUREMENT OF FUNCTIONAL BONE MARROW RESERVE, ITS UTILIZATION IN SUBJECTS EXPOSED TO OCCUPATIONAL HEMATOLOGIC RISK.) In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. III, pp. 1122-4.

The authors sought to evaluate the value, in the diagnosis of occupational neutropenias, of the endotoxin test for the measurement of the functional medullary reserve. The subjects studied were exposed to various occupational risks, principally benzene, radiation, and Pb. Contraindications for applying this test were: cardiac or respiratory insufficiency, adrenal or liver insufficiency, tuberculosis, recent gastroduodenal ulcer and current infectious diseases. The preparation used was Pyrexal (Wander Laboratories); 1 µg was injected iv. Immediately before, 2 hr and 4 hr after injection, red cell counts and leukocytic formula were performed. In the 7 Pb poisoning patients the test gave normal results.

- 2708** Gel'fon, I.A., and Zorina, L.A. (Inst. Ind. Hyg. Occup. Dis., Acad. Med. Sci., Moscow, USSR): Belkovye fraktsii krovi pri svintsovoi intoksikatsii i ikh izmene-niya pod vliyaniem kompleksoterapii. (BLOOD PROTEIN FRACTIONS IN LEAD POISONING AND THEIR CHANGES UNDER THE INFLUENCE OF COMPLEXON THERAPY.) Gigiena Truda i Professional'nye Zabolevaniya 8, No. 8:24-8, 1964.

The blood protein fractions were studied in 92 patients (59 men and 33 women) of whom 24 suffered from mild Pb poisoning, 42 from moderately severe poisoning, 10 had marked poisoning and 16 had residual manifestations of Pb poisoning. In mild poisoning, the content of β- and α- globulins was insignificantly elevated and the ratio of albumin globulin was decreased. In moderately severe poisoning, aside from these changes, the level of albumin was reduced and that of α-globulins increased. Severe poisoning compared with moderately severe poisoning was characterized by a decreased

content of total protein, globulins and mainly α-globulins. Complexon treatment in most cases caused an increase of total protein, albumin and α-globulin. (From author's English summary; 13 references)

- 2709** Gérard, A., Guerrin, F., and Roussel, P. (Regional Hosp., Lille, France): Diagnostic des ictères au cours des hémoglobinopathies. (DIAGNOSIS OF JAUNDICE DURING HEMOGLOBINOPATHIES.) Archives des Maladies de l'Appareil Digestif et des Maladies de la Nutrition 53:151-4 (Jan.-Feb.), 1964.

The diagnosis of hereditary hemoglobin anomalies has been greatly facilitated by the electrophoresis techniques. In cases of jaundice, this test is applied routinely, and was done in the 2 cases described. The 1st case was that of a 26-yr-old Senegalese man who presented mild jaundice and abdominal pains accompanied by vomiting of 15 days' duration before hospitalization. Pb poisoning was established on the basis of the presence of the Burton line, increased elimination of porphyrins in the urine (860 µg/l) as coproporphyrin III (determined by chromatography), blood Pb of 15 µg/l and urinary Pb of 48 and 76 µg/l in 2 analyses. After EDTA, Pb in urine increased to 189 µg/l. Since the patient had been employed only 2 mo in a company manufacturing batteries, the development of Pb poisoning in such a short time was considered remarkable. The jaundice was relatively mild and disappeared in 5 days when the bile pigment in blood markedly decreased. The bromsulphalein test at that time was normal. Hematologic examination revealed an erythrocytic defect, with anemia, anisocytosis, microcytosis, and reticulocytosis. Although cellular resistance was not disturbed, there were evident signs of hemolysis. Starch gel electrophoresis confirmed extremely high level (38.7%) of abnormal hemoglobin justifying the diagnosis of sickle cell anemia. This was regarded as a valid explanation for the rapid evolution of Pb poisoning, since it had been shown that the existence of a hemoglobinopathy increased the sensitivity of such subjects to Pb poisoning.

The 2nd case was a 60-yr-old European, hospitalized because of febrile jaundice and abdominal pains. History revealed that he had had dyspeptic troubles for the past 2 yr and that his brother had been operated for biliary lithiasis 2 yr before. Cholecystectomy in the above patient yielded stones consisting entirely of Ca bilirubinate. This finding did not surprise the authors as they had already found a high percentage (15%) of hemoglobin A<sub>2</sub> accompanying a mild anemia, reticulocytosis and hemolysis. They would have liked to have done a study of the brother's blood, but could not obtain permission. In conclusion they say that the electrophoretic techniques would probably reveal a much greater frequency of thalassemia which, as shown above, occurs not only among Mediterraneans but also in people of European extraction.

- 2710** Gérard, A., Guerrin, F., and Roussel, P. (Regional Hosp., Lille, France): Aspect particulier du saturnisme survenant chez

les malades souffrant d'hémoglobinopathie. (PARTICULAR ASPECT OF LEAD POISONING IN SUBJECTS SUFFERING FROM HEMOGLOBIN ANOMALIES.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 25:346-8 (June), 1964.

Two cases of Pb poisoning in Senegalese workmen, 25 and 27 yr old, of a storage battery factory, is described. Both patients developed abdominal colics and a Burton line after working for 2 mo. The Pb content of their blood and urine was essentially normal; urinary Pb increased only after perfusion with EDTA. An icteric or subicteric condition which was present during the first days, disappeared rapidly. Blood tests revealed the following data, respectively: erythrocytes, 3,800,000 and 3,940,000; reticulocytes, 47 and 66/1000; sideremia, 240 and 210  $\mu\text{g}$ , with saturation coefficients of 50 and 54%; bilirubin, 15 and 18 mg; subject 1: sickle-cell hemoglobin, 38.7%, subject 2: thalassemia, 17% hemoglobin A<sub>2</sub>. Neither of the 2 subjects had shown any clinical manifestations of hemolysis prior to the Pb poisoning which, however, seemed to bring forth hemoglobin disorders.

It is pointed out that the hazard of Pb intoxication is particularly great in subjects with hemoglobin disorders. This phenomenon should be considered in the employment of Mediterranean and African laborers who frequently show hemoglobin anomalies.

- 2711 Gerasi, L. (Dept. of Ind. Health, Kupat-Cholim, Haifa, Israel): Hakriterionim Leivchun haralot taasitiot. (THE CRITERIA FOR DIAGNOSIS OF OCCUPATIONAL INTOXICATIONS.) Harefuah 67:21-2 (July 1), 1964.

Some basic formulas to aid in the diagnosis of occupational intoxication, secondary to differential diagnosis are suggested. A schema of the development of chronic occupational Pb intoxication is presented in order to illustrate the importance of early detection of biochemical changes caused by Pb in the period when preventive measures may still be effective.

- 2712 Gherardi, M. (Univ. Parma, Italy): Aspetti clinici e patogenesi della intossicazione cronica da piombo tetraetile. (CLINICAL FEATURES AND PATHOGENESIS OF CHRONIC TETRAETHYLLEAD INTOXICATION.) Medicina del Lavoro 55:107-21 (Feb.), 1964.

A syndrome observed by the author in workers engaged in the production of TEL, either for a prolonged period of time or for only a few months, could not be designated by him as acute or subacute. The first symptoms noticed by the patients were usually fatigue, asthenia, decreased appetite or anorexia, headache, nausea, "indigestion," and vomiting. Some also complained of poor sense of taste, feeling of foreign object in the throat, dizziness, insomnia and excitation, inability to concentrate, dimmed vision. Objective signs were very few, one of the most striking being a greyish facial color and masklike expression. The other findings included gradual loss in weight and a hypotension which did not respond to therapy. Occasionally, there was a transitory bradycardia. Neurologic and mental functions were normal except for faulty memory and increased irritability.

Laboratory findings revealed no pathologic signs. Pb in the blood ranged from 50-100  $\mu\text{g}/100\text{ ml}$ , and in the urine from 0.15-0.25 mg/l; coproporphyrins were normal or slightly increased. Some patients showed a moderate hypochromic anemia without significant increase of stippled erythrocytes. The electroencephalogram was also normal. Two cases, one 27- and one 35-yr-old man, were described. Both had been exposed to moderate absorption of TEL. The 27-yr-old man, operating a distillation column, first showed loss in weight after 6 mo on the job. He had to give up this work completely, while the other patient also so employed for many yr, could return to his job after 2 mo of rest and treatment with liver extract, vitamin B, librium and largactil. Laboratory findings in the first case showed concentrations of Pb in urine in the first 6 mo of 0.113 mg/l which increased up to 0.243 mg l mo later. A year after removal from exposure Versene-provoked elimination showed 1.365 mg/l. The blood Pb at this later examination was 65  $\mu\text{g}/100\text{ ml}$ , and coproporphyrin, 75  $\mu\text{g}$  in the 24-hr urine sample. Aside from finding 132  $\mu\text{g}$  coproporphyrin in the 24-hr urine, the results were similar in the second case. Kidney and liver functions were normal.

The author points out that the most obvious symptoms are sleeplessness and vivid dreams, followed by asthenia, nausea, vomiting, headache, loss of weight, hypothermia, sweating and changes of the sense of taste. After any of these symptoms have set in, they do not easily recede. Removal from exposure for 10-15 days results only in their partial attenuation. Patients who returned to their former occupation showed a typical intolerance to the odor of TEL. Barbiturates were useless for combating the insomnia while phenothiazine gave better results. For want of a specific therapy, administration of liver extract enforced with polyvitamins and removal from exposure for 8-10 wk were recommended.

In his discussion the author considers the syndrome to correspond to that occurring in the initial stage of acute and subacute TEL intoxications, except that it is less pronounced and that the Pb concentration in blood and urine is not increased. While it does not seem probable that TEL in low concentrations passes the blood-brain barrier to cause irritation of the central nervous system, such irritation is undoubtedly the basis of the above syndrome. TEL is known to have a short biologic life, which had led to the belief that only high concentrations could cause the neurologic changes. The new theory, based on experimental findings, of Cremer and Gherardi, is that the tetraalkyllead molecule as such is not toxic, but once it has penetrated the organism, it is dealkylated by enzymes contained mainly in the microsomes of the liver cells, to form the relatively stable, hydrosoluble, highly ionizable and neurotropic triethyllead. According to Cremer, this process is reversible due to the interference of enzymes bound to sulfhydryl groups. This reversibility is confirmed in the findings of Kehoe and Machle that after severe intoxication, men recovered without appreciable psychic or neurologic sequelae, and that acutely poisoned experimental animals returned to a perfectly normal state and grew and reproduced the

same as controls. Kehoe's experiments also showed that the Pb content in the brain of experimentally poisoned animals was about the same in those sacrificed during the acute phase and in those killed after a certain length of time.

Similar experiments were carried out by the author who injected 15 male Swiss albino mice subcutaneously with 49.9 mg TEL/kg and sacrificed 5 animals each at 5, 25, and 45 days. While the concentrations of Pb in liver and kidney decreased progressively and rapidly, those in the brain decreased very gradually, indicating a slow elimination of Pb from the nervous system. This phenomenon is considered important in cases of repeated exposure to TEL. As complete recovery follows in time even after acute TEL intoxication, this might indicate that triethyllead that has reached the brain has been changed into a metabolite which is no longer toxic.

The problem of reporting the cases observed for compensatory purposes is discussed, in view of the absence of positive laboratory findings. For this reason, the necessity of frequent analyses of the urine for Pb content is stressed. The findings could then be correlated with signs and complaints determined upon medical examination. As there is a certain latent period between absorption of TEL and the onset of signs and symptoms, frequent urinalyses only during, and not after, exposure can provide proper diagnosis. The fact that in intoxications by Pb alkyls elimination of Pb is more rapid than in that by inorganic Pb, is illustrated by data obtained on 2 men, who had been exposed to considerable amounts of TEL, on the urinary excretion of Pb, blood pressure, pulse, onset of symptoms and body weight at 4 hr to 20 days after exposure. These showed Pb excretion to reach a maximum directly after exposure, while signs and symptoms appeared later and still persisted after the urinary Pb excretion had returned to normal. The Versene test also was not so conclusive as in poisoning with the more common Pb compounds.

The author proposes that the syndrome observed by him which was caused by the absorption of moderate but appreciable amounts of TEL, repeated at short intervals of time, be classified as chronic intoxication.

The signs are mainly subjective with few or no clinical or laboratory evidence, and last for quite some time. The outcome is always favorable; it results only long after exposure has been terminated. Once diagnosed, those affected should be removed from exposure immediately to avoid further absorption which might culminate in an acute stage. Wherever such cases occur in industry, control measures must be instituted to eliminate these hazards.

- 2713 Gofman, J.W., deLalla, O.F., Kovich, E.L., Lowe, O., Martin, W., Piluso, D.L., Tandy, R.K. and Upham, F. (Univ. of California, Berkeley): CHEMICAL ELEMENTS OF THE BLOOD OF MAN. Archives of Environmental Health 8:105-9 (Jan.), 1964.

Sixty-six chemical elements between the atomic numbers 15 and 92 were determined in the serum of 39 ostensibly healthy men, mean age 35.3 yr, working and residing in the California Bay area, by using X-ray spectrochemical analysis. This method

is not sufficiently sensitive to estimate levels below 1 ppm. Aside from Fe, Cu, Zn, and Br it is considered highly unlikely that any elements of atomic numbers higher than 20 approach a mean serum level of 0.5 ppm. The standard error of mean and the 99% confidence limit on the mean value for Pb were calculated as 0.09 and 0.07-0.53 ppm, respectively. The observed mean values for the elements at very low concentration are omitted, but standard error of the mean and the 99% confidence ranges are presented for the reason of focusing attention on the latter ranges.

- 2714 Gorlo-Shil'ko, A.I.: (EXPERIENCE IN THE TREATMENT OF PATIENTS WITH CHRONIC LEAD POISONING WITH THE SEQUESTERING AGENT EDATHAMIL CALCIUM DISODIUM.) In Materialy XXII Nauchnoi konferentsii Smolenskogo meditsinskogo instituta. (Proceedings of the 22nd Scientific Conference of Smolensk Medical Institute.) Smolensk, pp. 365-6, 1964.

Forty-seven patients were treated with edetate for a period of time depending on the degree of poisoning and the amount of Pb deposited in the body. The treatment was successful in alleviating or eliminating all clinical symptoms of poisoning. (From Referativnyi Zhurnal Otd Vypusk Farmakol. Toksikol. 1965, No. 2.54.346; Biological Abstracts 47:Abstr. No. 7321, 1966)

- 2715 Great Britain Ministry of Labour: ANNUAL REPORT OF H.M. CHIEF INSPECTOR OF FACTORIES ON INDUSTRIAL HEALTH, 1963. Presented September, 1964. London, Her Majesty's Stationery Office, 56 pp.

In Chapter 1, Review of the Year, on page 10, draft regulations covering workers in the Pb industry are discussed. These regulations, issued as a revised preliminary draft in March 1963, provide that the medical examination in every 3-mo period shall include an estimation by an approved method of the hemoglobin (Hb) in the blood. Where the Hb content is  $\leq 13$  g/100 ml of whole blood in the case of a male or  $\leq 12$  g/100 ml in the case of a female, another estimation should be made within a period of <3 mo. Further investigation whether any anemia is due to Pb poisoning, will be undertaken in specified hospitals under the normal National Health Service arrangements. A copy of the Health Register must be sent to the Inspector for the District monthly to enable him to take action in the case of unsatisfactory working conditions.

Details of statutory periodic medical examinations by appointed factory doctors are recorded in a table (page 17). In Pb processing plants (carbonate, etc), 14,674 examinations were made and 4 men were suspended. In Pb smelting, there were 28,921 examinations, 23 suspensions, 5 rejections on 1st examination and 14 certificates permitting return to work after suspension. In making of flaked litharge and of red and orange Pb, there were 1070 and 1437 examinations, respectively.

Chapter 2 deals with Industrial Diseases, Poisoning and Gassing (reference to Pb, pp 18, 20-29). A total of 407 persons exposed to Pb and its compounds were examined during 1963. Among 181 men and 12 women from 13 factories, 7 had Hb levels <12 g% and 4 of these also showed increased ex-

cretion of coproporphyrin (CP) ( $>1000 \mu\text{g/day}$  in 4, and  $>1500 \mu\text{g/day}$  in 3). Six of the 7 anemic males had a hemolytic anemia which was almost certainly due to Pb exposure. In 2 of the most anemic men, urinary CP was only moderately raised, but in 1 case had risen to  $1000 \mu\text{g/l}$  on reexamination 1 wk later. Tests of workers engaged in motor-car body building indicated that both diskers and men employed in finishing work after the bodies have left the diskings booth may be affected. CP was found to be  $>1500 \mu\text{g/l}$  in 12 men out of 214 so tested.

The total number of Pb poisonings notified and regarded as confirmed was 93 during 1963, compared with 80 in 1962. All but 11 had definite subjective effects, although symptoms were not marked in some. The opinion in the earlier years of this century that chronic Pb poisoning could progress to chronic nephritis or Bright's disease is generally less accepted today. A case, first diagnosed as kidney disease, then changed to Pb poisoning is described. This involved a 51-yr-old Pb smelter who had worked for 12 yr on the blast furnace and casting Pb. The findings included, aside from moderate hypertension, slight edema and a trace of protein in urine, a severe anemia with 62% Hb, 85  $\mu\text{g Pb/100 ml}$  blood and 132  $\mu\text{g Pb/l}$  of urine. About 6 mo after he returned to work his blood and urine showed Pb concentrations of 179  $\mu\text{g/100 ml}$  and 290  $\mu\text{g/l}$ , respectively.

Of 5 cases notified by ship-breaking firms, 4 had minimal symptoms, the 5th whose Hb level was only 9.5 g% and who suffered from abdominal pain and vomiting, was successfully treated with a chelate.

Five cases were reported from white and red Pb works and 21 cases among workers having contact with molten Pb, of which 5 were due to wire patenting. A survey showed that the Pb concentration in the working atmosphere was everywhere below the maximum permissible concentration of  $0.2 \text{ mg/m}^3$ .

In non-ferrous foundries, 18 workers with evidence of Pb poisoning were found. Atmospheric Pb levels were well  $>0.2 \text{ mg/m}^3$ . Two cases were notified from a foundry where an alloy of 30% Pb and 70% Cu was cast; the air in the breathing level of the casters contained  $>2 \text{ mg Pb/m}^3$ .

Three cases of Pb poisoning occurred in a firm making litho transfers, containing Pb color, for pottery decoration; 20 cases in the storage battery manufacture; 2 were due to spraying a Pb-based paint in the interior painting of an aircraft hangar and 31 were recorded under a miscellaneous heading (19 of these in the demolition of Pb-painted structures).

Of 3 cases of Pb poisoning in motor-car building factories, that of a man employed as a Pb disker for 14-15 yr ended in death due to uremia. Medical opinion was divided whether the renal failure was a direct result of Pb poisoning or of malignant hypertension, and an open verdict was returned by the jury.

**2716** Griggs, R.C. (Western Res. Univ., Cleveland, O.): LEAD POISONING: HEMATOLOGICAL ASPECTS. *Progress in Hematology* 4:117-37, 1964.

A review of 81 publications concerning the structural and metabolic alterations produced by Pb in

the human red blood cell is presented and the causes and consequences of such effects are discussed.

After briefly presenting the history of Pb poisoning, the author lists averages and ranges of hematological values in 20 male adults with chronic occupational Pb poisoning to illustrate the mild to moderate microcytic hypochromic anemia: red blood cells, 4.21, 3.45-5.36 millions/ $\text{m}^3$ ; hemoglobin (Hb), 10.7, 8.1-12.8 g%; hematocrit, 35, 28.8-43%; mean corpuscular volume, 79, 70-92  $\mu$ ; mean corpuscular Hb concentration, 31, 27-36 g/100 ml; reticulocytes, 4.4, 1.5-11.6%; stippled cells, 1.8, 0.1-7.5%; icterus index, 6.5, 4-10.

Stippling is generally considered an unreliable criterion of Pb poisoning and should be used only as an indication to look for other signs of Pb intoxication. Information available at present suggests that there are 2 types of granulations in Pb-poisoned men and animals, one being ferritin deposits or accumulations of excessive Fe and the other enlarged and possibly damaged mitochondria without Fe content.

The common occurrence of changes in osmotic and mechanical fragility of the red cells is illustrated by measurements obtained by the author on 10 adult patients. All showed either increased resistance to lysis after incubation, a decrease in resistance which was less than expected for the normal, or a combination of these in which some cells became more and some less resistant to osmotic stress. Average unincubated mechanical fragility did not differ significantly from the normal range ( $10.5\% \pm 3.5\%$ ). During a course of therapy with EDTA, the red blood cells became even more resistant to osmotic lysis and more susceptible to mechanical lysis. After therapy and with time, the fragility tests gradually returned to normal. There was no consistent relation between degree of anemia, stippled cells, reticulocytosis and alterations in mechanical and osmotic fragility.

It has been shown by electrophoresis that in about 50% of Pb-poisoned children, an abnormal minor hemoglobin component is present. Animal experimentation does not produce this fraction.

Papers on the mechanism of anemia and red blood cell survival in Pb poisoning as well as the Coombs' test are discussed. There is no evidence at present that Pb interferes with Fe absorption, transport of Fe by the iron-binding protein of the plasma, Fe storage or transfer of Fe from protein to developing red blood cells. But there is evidence suggesting that Pb interferes with the intercellular metabolism of Fe and its incorporation into protoporphyrin during the synthesis of heme. The effects of Pb on the biosynthetic steps in heme synthesis are reviewed and the effects of Pb on porphyrin metabolism in man as evidenced by increased excretion of coproporphyrin, increase in free erythrocytic protoporphyrin, and increased serum concentration and urinary excretion of ALA are discussed. Published information indicates that Pb blocks the biosynthesis of heme at several steps with varying degrees of effectiveness.

**2717** Grippaudo, G. (Univ. Rome, Italy): I microelementi dei tessuti duri dei denti esaminati con il metodo della spettro-

grafia ottica. (TRACE ELEMENTS OF THE HARD TISSUES OF TEETH SURVEYED BY OPTICAL SPECTROGRAPHY.) *Annali di Stomatologia* 8, No. 3:185-92, 1964.

Healthy, decayed and impacted teeth were analyzed for 19 mineral components in a preliminary study. The results obtained were essentially qualitative. Pb was present in traces in the enamel, dentin and cement of the healthy and decayed teeth, and in somewhat greater amounts in the same tissues of impacted teeth.

- 2718** Grut, A. (Hellerup, Denmark): DUST IN PORCELAIN FACTORIES. In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. II, pp. 351-2.

Results of dust investigation in Danish Porcelain Factories showed that dust content in the breathing zone of men working with a 30% Pb-containing glaze was  $5 \text{ mg/m}^3$  with a Pb content of 0.7%, ie,  $13 \text{ ug Pb/m}^3$ . Dust concentrations at various working stages were tabulated. In no case was the maximum allowable amount of dust of  $1.5\text{-}2.0 \text{ mg/m}^3$  surpassed.

- 2719** Guépin, J. (Assoc. of Ind. Hyg. and Occup. Med., Nantes, France): A propos d'un cas de saturnisme professionnel. (A CASE OF OCCUPATIONAL LEAD POISONING.) *Ouest Médical* 17:570-3 (May 10), 1964.

The case described was that of a 25-yr-old worker in a storage battery plant, first seen by the author on November 26, 1962. The man complained of abdominal pain and constipation; the blood picture showed 2,600,000 erythrocytes, 5000 leukocytes (60% polynuclear), and 300 stippled erythrocytes/100 leukocytes (9400/1,000,000 erythrocytes). Oral treatment with 5 tablets of 0.25 g each of CaEDTA/day was begun. Acute abdominal pain occurred 2 days later (not witnessed by the author), followed by jaundice. Treatment was discontinued. Jaundice, without fever, persisted for 8 days. In mid-December, urine analyses showed 0.3 mg/Pb and 2.6 mg coproporphyrin/l of urine. The patient recovered rapidly without any treatment other than rest and returned to work. The author visited the workshop which consisted of a large room. The task of his patient was the mounting of plates into the battery cases. This involved soldering, but no appreciable volume of toxic fumes was apparent. He was neat, did not smoke or drink on the job. His employer, who did the same kind of work, had never noticed any indications of untoward effects. The patient soon again developed signs of Pb poisoning (300 stippled erythrocytes/100 leukocytes) with a mobilization test with EDTA confirming the diagnosis of Pb poisoning. The mild anemia was of hemolytic type; no associated blood dyscrasia was found. The gall bladder was normal upon X ray. At another examination 1 mo later, he showed 0.272 mg Pb and 0.360 mg coproporphyrin/l urine, 0.08 mg Pb/100 g blood and 150 stippled erythrocytes/100 leukocytes. Another visit to the shop revealed that a Pb hazard truly existed: The patient had failed to tell that he routinely brushed the plates. The need for adequate ventilation and other safety measures were discussed with the employer who instituted them.

Exposure to Pb at home was excluded. After iv treatment with chelating agents, the blood picture had returned to normal, and the man was permitted to return to his job. While soldering, he used a respirator, and at the most recent test, his blood picture was practically normal.

In reviewing the syndrome of Pb poisoning, the author points out that constipation presents an informative sign while the presence of stippled blood cells (evaluated according to the German method) is more convenient for the diagnosis. The determination of urinary coproporphyrins is difficult and not specific whereas estimation of the Pb content in blood and urine is more useful. The intercurrent jaundice observed in this case could not be attributed by the author to EDTA, but in the absence of simple tests for liver function, the question of the cause remained open. The importance of protection and prevention by amicable discussions between physician and employer, particularly of small industries is stressed.

- 2720** Guerrin, F., Havez, R., Gérard, A., and Roussel, P. (Fac. Med., Lille, France): Hémoglobino-pathie et saturnisme. (HEMOGLOBINOPATHY AND SATURNISM.) *Lille Médical* 9:547-9 (June-July), 1964.

The relationship between disorders of hemoglobin (Hb) content of the blood and Pb intoxication was studied in 2 Senegalese workers (26 and 27 yr old) of a storage battery plant who had been hospitalized because of abdominal pains. The 26-yr-old patient started to complain of abdominal disturbances and vomiting after having worked as a founder for 16 wk. Two wk later when he was admitted to the hospital, he showed a Burton line with urinary porphyrins up to  $860 \text{ ug/l}$ , blood-Pb of  $15 \text{ ug/100 ml}$ , and urinary Pb  $48\text{-}76 \text{ ug/l}$  before and  $189 \text{ ug}$  after provocation by a chelate. Jaundice was visible in the conjunctiva and anemia was distinctly present. The 27-yr-old man who was hospitalized 5 mo later, also exhibited jaundice, Burton's line, anemia, urinary Pb of  $30 \text{ ug/l}$  before and  $160 \text{ ug}$  after injection of EDTA. Tests showed that both patients suffered from sickle cell anemia. The conclusion was drawn that Pb poisoning promotes Hb disorders and, inversely, that Hb deficiency causes proneness to Pb poisoning.

- 2721** Gutniak, O., Koziolowa, H., and Kowalski, E. (Warsaw Med. School, Poland): FREE PROTOPORPHYRIN CONTENT OF ERYTHROCYTES IN CHRONIC TETRAETHYL LEAD POISONING. *Lancet* 1:1137-8 (May 23), 1964.

The content of free protoporphyrin in the red blood cells was studied in tetraethyllead (TEL) poisoning in order to gain information on the mechanism of the disease. The premise for this study was that ionic Pb inhibits incorporation of Fe into protoporphyrin with a subsequent rise in both free protoporphyrin and nonheme-Fe content in red blood cells. Free protoporphyrin in the erythrocytes was determined in 13 patients, 25 to 56 yr old, who were drivers or mechanics in garages and had been exposed to the fumes of Pb gasoline for >8 yr; 11 had been so exposed until admission to the hospital, 2 had contact with TEL for 2 yr. Forty-six healthy donors and 5 patients with inorganic Pb poisoning were used as controls. The mean ages of



the TEL- and Pb-poisoned groups were similar, 42.1 and 43.8 yr, respectively. The subjects suffering from TEL poisoning complained of headache and dizziness; 8 showed neurological signs of damage to the central nervous system, 5 had digestive and gastric disturbances, but none were anemic. The Pb content in the blood, as determined polarographically, ranged from 50-198 (mean 79.8)  $\mu\text{g}/100\text{ ml}$  in the patients with Pb poisoning and from 62-155 (mean 114.2)  $\mu\text{g}/100\text{ ml}$  in those with TEL poisoning. The mean protoporphyrin content in the 13 patients poisoned with TEL was in the normal range (21.12  $\mu\text{g}/100\text{ ml} \pm 2\text{ S.D. } 9.7$ ) and did not exceed the mean values in the 46 healthy blood donors (24  $\mu\text{g}/100\text{ ml} \pm 2\text{ S.D. } 11.06$ ). In the 5 patients with Pb poisoning, the protoporphyrin content was greatly increased (312  $\mu\text{g}/100\text{ ml} \pm 2\text{ S.D. } 143.1$ ).

As reported in the literature, inorganic Pb compounds inhibit the enzymes regulating heme-biosynthesis, with resulting increase in free protoporphyrin, and inducing hypochromic anemia. The authors conclude that since in TEL poisoning the protoporphyrin content of the erythrocytes was within the normal range, this mechanism of damage is absent in poisoning with organic Pb compounds which cause predominantly neurologic signs without anemia.

**2722** Gwizdek, E. (Krakow, Poland): Der Einfluss von Faktoren der Berufsgefährdung in der Industrie auf das Bild des Zahnfleischrandes. (THE EFFECT OF OCCUPATIONAL EXPOSURE IN INDUSTRY OF THE GINGIVAL MARGIN.) Zentralblatt für Arbeitsmedizin und Arbeitsschutz 14:25-7 (Feb.), 1964.

In an investigation of the effects of occupational exposure on the gingival margin, the author included in his statistical data workers referred to the clinic for occupational medicine in Krakow, and cases seen by specialists in industry. A total of 2319 male workers of approximately the same age were seen. Inflammatory and atrophic gingivitis were evaluated separately. The data were organized according to types of industry, and according to chemical exposure. A group of construction workers, active in the open and not exposed to chemical hazards, served as controls. Among those exposed to dusts and fumes (particularly Pb, Hg, fluorides, Co oxide, As compounds, CO, and high temperatures) a high percentage, 37% of those examined showed inflammatory gingivitis, and 18.8% the atrophic form. The length of exposure of men with lesions was about the same: ~10-15% of those examined had worked an av of 3 yr; 15-20%, 5 yr; 45-50%, 10 yr; and 20-25%, >10 yr. The data applying to Pb were as follows: of 285 workers of an av age of 34.2 yr, 122, or 42.8%, exhibited the inflammatory type of gingivitis, and 52, or 18.3%, the atrophic. Of the control group of 200 men, av age of 33.2 yr, 29, or 14.7%, had inflammatory gingivitis and 26, or 13.2%, the atrophic. In the case of workers exposed to Pb, examination for the presence of the Pb line was included. This phenomenon had been considered up to the present time as one of the most important criteria of a Pb hazard. The author points out that he has recently shown (Medycyna Pracy 5:371-3, 1962) that medical and laboratory tests of Pb-exposed workers do not confirm this theory.

**2723** Hanke, J.Z.: PRELIMINARY INVESTIGATIONS OF PROLONGED OCCUPATIONAL EXPOSURE TO TOXIC SUBSTANCES ON THE LEVEL OF SOME SERUM ENZYMES. Arhiv za Higijenu Rada i Toksikologiju 15:57-66, 1964.

The activity of aldolase, alkaline phosphatase, glutamic-oxalic and glutamic-pyruvic transaminase was studied in workers chronically exposed to benzene and Pb, respectively. Men exposed to Pb showed lower values of aldolase activity but a higher ratio of glutamic-oxalic to glutamic-pyruvic transaminase than the controls. (From author's abstract; Industrial Hygiene Digest 28: Abstr. No. 1086, 1964)

**2724** Hernberg, S., and Laamanen, A. (Inst. of Occup. Health, Helsinki, Finland): RESULTS OF DIAGNOSTIC LEAD MOBILISATION TESTS IN A FINNISH SERIES. Annales Medicinæ Internæ Fenniae 53:123-8, 1964.

Results obtained by Pb mobilization tests, using  $\text{CaNa}_2\text{EDTA}$ , vary widely even for normal individuals when measurements from different investigations are compared. This may be due to variations in the EDTA dosage, the commercial origin of EDTA used, different analytical techniques and particularly to different Pb burdens of the human organism in different countries. In order to obtain a basis for the test under Finnish conditions, a series of Pb mobilizations was carried out on a group of 25 unexposed subjects, living in the neighborhood of Helsinki, and the results obtained were compared with those in 2 Pb-exposed groups. The first of the latter ones, without present evidence of intoxication, consisted of 3 individuals with previous clinical symptoms of Pb poisoning and 3 working in an atmosphere where exposure had been established by air sampling. The other group consisted of 8 patients suffering from slight Pb poisoning as evidenced by pathological laboratory findings. Criteria employed in the interpretation of these laboratory tests were as follows: hemoglobin, <12 g/100 ml blood; stippled erythrocytes, >0.03%; reticulocytes, >1.5%; urinary coproporphyrin, >0.150 mg/24 hr. If 2 of the tests yielded pathological values, a diagnosis of Pb poisoning was made.

Each subject was infused, over a period of 1.5-2 hr, with a solution of 2 g EDTA in 500 ml of physiological saline. Urine was collected 24 hr before and after the infusion. Mean urinary Pb excretion, mg/24 hr, before and after mobilization, respectively, was: unexposed individuals,  $0.26 \pm 0.016$ ,  $0.157 \pm 0.097$ ; exposed subjects,  $0.029 \pm 0.022$ ,  $0.346 \pm 0.121$ ; Pb-poisoned group,  $0.108 \pm 0.042$ ,  $1.106 \pm 0.422$ . The statistical differences of the mean values for the 3 groups were significant. The relatively low Pb values in the unexposed group were probably due to low Pb levels in the air, the drinking water, the soil and the food. The Pb content in the air of Helsinki is considerably lower compared with other cities of the same size because of smaller traffic density, decentralization of industry and many green belts.

It is pointed out that the mobilization tests, together with other available data, are helpful in the diagnosis of past exposure to Pb but that an intoxication should rather be diagnosed by functional disturbances such as neurologic disorders



and by a high erythrocytic protoporphyrin content.

- 2725 Illinois State Medical Society: WATER COMPOSITION AND CARDIOVASCULAR HEALTH. Report of the Educational and Scientific Foundation of the Illinois State Medical Society. Illinois Medical Journal 125: 25-31 (Jan.), 1964; Journal American Water Works Association 56:369-77 (Apr.), 1964.

Six scientists (J.H. Dingle, M.D., Western Reserve University; Oglesby, Paul, M.D., Northwestern University; W.H. Sebrell, Jr., M.D., Columbia University; William H. Strain, Ph.D., University of Rochester; Abel Wolman, Dr. Eng., The Johns Hopkins University; James R. Wilson, M.D., Coordinator for the Educational and Scientific Foundation of the Illinois State Medical Society) oriented to various aspects of the problem, were invited to study the problem of cardiovascular health in relation to the composition of water and to prepare a statement of group opinion.

In the introduction, the panel states that attempts to relate environmental factors to causes of death among population groups is a popular but hazardous research technique, and that results must be critically examined. The evaluation of published reports associating cardiovascular deaths with inorganic constituents (including F and Pb in some) begins with J. Kobayashi's (1957) studies in Japan in which the highest incidence of "apoplexy," according to the 1950 vital statistics, was found in areas having a high content of sulfate in river water. Subsequent publications by H.A. Schroeder (1960-1961), Morris, Crawford and Heady (1961), and others, including reports of experiments with animals, related hard water to a lesser incidence of deaths by cardiovascular diseases, although exceptions found in areas of soft waters were admitted. In discussing these correlations, the panel points to difficulties in using death certificates and even pathological reports as undisputed evidence of the prevalence of a disease, citing from Paul's book on epidemiology that "differences in the precision and manner of labeling and the priorities ascribed to pathological syndromes may well reflect diagnostic interests or fashions." The necessity of defining the hardness or softness of water in terms of specific anions and cations is also pointed out, as is the fact that Americans travel a great deal and drink water from different areas at various times of the year, also that water used in bottled beverages and canned foods may come from various sources.

On the basis of available data, the panel concluded that no causal relationship has been established between the total dissolved inorganic constituents in water and cardiovascular disease, although it is evident that the minor constituents of the environment can influence human physiology profoundly (eg, Fe in anemia, I in goiter, F in dental decay). It then suggested that further work on the subject, if undertaken, should involve the study of comparable populations in which the water supply with respect to one or more given constituents is controlled; the length of time an individual is on a given water supply must be taken into consideration; uniform criteria for diagnosis must be established, and the study

must be continued over a period of years to obtain a definite answer.

- 2726 Jacobi, W. (Hahn-Meitner-Inst. Nuclear Research, Berlin, Germany): THE DOSE TO THE HUMAN RESPIRATORY TRACT BY INHALATION OF SHORT-LIVED  $^{222}\text{Rn}$  AND  $^{220}\text{Rn}$ -DECAY PRODUCTS. Health Physics 10:1163-74 (Dec.), 1964.

The deposition of radon daughters in the different regions of the human respiratory tract is derived from the particle size of their carrier aerosol in ordinary unfiltered air. The resulting mean distribution of the radioactivity in the respiratory tract is estimated taking into account the clearance from the alveolar tissue and the ciliary transport in the bronchial tree. The radiation dose distribution in the epithelium of trachea and bronchi is calculated, taking into account the  $\alpha$ -absorption in the mucus layer and the variation of stopping power with  $\alpha$ -energy. The resulting mean absolute  $\alpha$ -dose is given for each inhaled nuclide (RaA, RaB, RaC, ThA, ThB, ThC). The results indicate that a considerable fraction of the dose in the upper respiratory tract is due to the transfer of activity from the bronchioli and lower bronchi in the mucus stream. The highest dose should be expected in the lower bronchi.

- 2727 Jarcho, S. (Mt. Sinai Hosp, New York, N.Y.): LEAD IN THE BONES OF PREHISTORIC LEAD-GLAZE POTTERS. American Antiquity 30:94-6 (July), 1964.

In view of a report by Hauray (1932) about Pb-glaze pottery from the prehistoric Southwest, it appeared interesting to investigate whether the makers of such pottery suffered from Pb poisoning. Forty-six bone specimens from Kinishba Ruin where prehistoric people had painted pottery with a Pb-containing glaze, and 33 fragments of human bone from Point of Pines where such pottery was not known, were examined by X ray and X-ray diffraction, and the 11 most promising specimens of both series were subsequently analyzed by atomic absorption spectrophotometry. Many of the fragments came from flat bones, digits and vertebrae. Specimens from Kinishba contained 0.5-11 ppm Pb and bone fragments from Point of Pines 9-17 ppm. The 4 samples containing the lowest Pb concentrations came from Kinishba where Pb-glazed pottery was both made and used. The trial therefore did not reveal any correlation between the manufacture of Pb-glaze pottery and increased concentrations of Pb in the bones. The author points out that aside from the small size of the samples, the impossibility of differentiation between users and makers of the pottery, a more favorable selection of bone fragments according to skeletal region might have given different analytical data. Although no evidence was provided that Pb poisoning existed at either place, the author feels that such trials may point the way for future research by archaeologists who discover artifacts containing toxic materials.

- 2728 Jaworowski, Z. (Inst. of Nuclear Research, Warsaw, Poland): (EVALUATION OF RADIUM D HAZARDS IN AN URANIUM MINE.) Nukleonika 9, No. 1:57-66, 1964.

Statistical studies carried out on U miners from Czechoslovakia, Germany, and the US indicate a high incidence of lung cancer among the miners. As  $^{210}\text{Pb}$  (or RaD) and its parent and daughter elements are components of the mixture of radioactive substances inhaled by the U miners, it can be expected that the  $^{210}\text{Pb}$  chain may be one of the etiological factors in the disease.  $^{210}\text{Pb}$  is stored in the skeleton in a way similar to stable Pb. Since urinary excretion of  $^{210}\text{Pb}$  does not correlate with the amount of radio-Pb deposited in the lung, or in the whole body, and bone biopsies cannot be taken for routine control of exposure, the  $^{210}\text{Pb}$  content of hair was thought to be a suitable criterion for assessment of absorption (on the basis that the Pb content of hair is known to be similar to that of bone).

Analysis of 9 samples of hair obtained from unexposed subjects living in the Warsaw and London areas gave mean concentrations of stable Pb and  $^{210}\text{Pb}$  of 10  $\mu\text{g/g}$ , and 0.034 pCi/g hair, respectively; the corresponding values for bone as published previously by Hill and Jaworowski (1961) were 6.2 and 0.026. For the calculation of  $^{210}\text{Pb}$  in bone, the proportions between the mean concentrations in hair and bone were therefore 1.63 for stable Pb and 1.31 for  $^{210}\text{Pb}$ . Measurements of the  $^{210}\text{Pb}$  concentration in hair samples, from 57 U miners of a Polish mine gave a range of 0.34–3.72 pCi/g hair, mean  $1.42 \pm 0.93$ ; this mean concentration of  $^{210}\text{Pb}$  was  $\sim 50$  times higher than in an unexposed population. The  $^{210}\text{Pb}$  content of the hair depended on the duration of the underground work. The mean  $^{210}\text{Pb}$  concentration in the hair of men working  $>10$  yr underground was 2.5 times higher than in those working  $<10$  yr ( $1.83 \pm 0.96$  and  $0.73 \pm 0.33$  pCi/g, respectively). The  $^{210}\text{Pb}$  concentration was lower in the hair of older subjects than in younger ones. Based on an av  $^{210}\text{Pb}$  concentration of 1.42 pCi/g in hair of miners (av for all groups of ages and duration of underground work) and a hair-bone ratio of 1.31, the mean  $^{210}\text{Pb}$  level in the bones of miners was calculated as 1.08 pCi/g of wet bone, and for the longer working group, 1.4 pCi/g of bone.

Since inhaled  $^{210}\text{Pb}$  is deposited first in the lung and lymph nodes, the author concludes that the lymphatic nodes constitute the critical organ of U miners for the nuclide, and for the unexposed population, the skeleton. As based on the measured concentrations of RaD in the U mine air and in the hair of the miners it was calculated that the mean radiation-dose rate in the mediastinum lymph nodes and the skeleton is 277 and 100 mrem/wk respectively. It was also calculated that 62.5% of the RaD burden in the skeleton originated from the RaD in U mine air, 35.0% from  $^{222}\text{Ra}$  and 2.8% from natural contaminations.

- 2729 Johnstone, R.T. (Los Angeles, Calif.): CLINICAL INORGANIC LEAD INTOXICATION. *Archives of Environmental Health* 8:250-55 (Feb.), 1964.

Certain misconceptions regarding Pb intoxication are discussed in detail on the basis of personal experience. Although the incidence of occupational Pb intoxication has greatly declined in the US, the occurrence of the gastrointestinal type of plumbism is still fairly frequent. The number of

such cases occurring annually is not known due to inaccurate diagnosis and to the inefficient system of reporting occupational diseases. Although Pb intoxication occurs most frequently in small plants, it is incurred also in plants of nationally known industries. Industrially induced Pb intoxication is not difficult to diagnose, although there are few objective findings upon examination. The symptom which causes the patient to consult his physician is the intestinal colic. In establishing the history of exposure, not only occupational contact, but also home and any other source of exposure must be explored. The gastrointestinal type of Pb poisoning is usually not associated with peripheral neuritis, tremor or wrist drop. It is often cured solely by withdrawal from exposure. To relieve the pain of more severe colic, Ca gluconate iv is recommended. The author cautions against the use of chelating agents in the milder cases; these are indicated in severe intoxication, but only after a renal profile has been obtained. He also dispels the older beliefs of sequelae of Pb poisoning under the present-day usual conditions of exposure on the basis of sound epidemiologic studies.

In discussing laboratory findings as a diagnostic component, it is emphasized that Pb analysis in blood and urine be done in a laboratory qualified to do so and that the results be viewed judiciously for chance error; that the presence of basophilic stippled cells does not vouch for the existence of intoxication. Finally, it is important that the physician should differentiate between Pb absorption and Pb intoxication; that no diagnosis should rest on laboratory tests alone, and that the interpretation of results should be made only by a physician. Control and prevention of Pb poisoning requires supervision by an experienced physician and by effective engineering and industrial hygiene.

- 2730 Kalić-Filipović, D., Dodić, S., and Vidaković, A. (Inst. Ind. Med. Belgrade, Yugoslavia): Hematološki poremećaji u toku hronicnog trovanja olovom. (HEMATOLOGIC CHANGES IN CHRONIC LEAD POISONING.) *Medicinski Glasnik* 18:72-5 (Mar.-Apr.), 1964.

Among 80 hospitalized chronic Pb poisoning cases (typographers, storage battery workers, painters, and workers of several other trades) 18.5% showed no changes in the blood picture; 37% were affected by anemia, 16.7% by leukopenia, 9.2% by leukocytosis, 16.7% by lymphomonocytosis, 1.9% by polynucleosis. Pb poisoning was established on the basis of numbers of erythrocytes, leukocytes, basophilic stippling, reticulocytes, leukocytic formula, and % hemoglobin.

- 2731 Kar, A. (Government of West Bengal, Calcutta, India): A RARE CASE OF LEAD PALSY IN AN UNUSUAL OCCUPATION. *Industrial Medicine and Surgery* 33:884-5 (Dec.), 1964.
- The case described is that of a 50-yr-old man, resident of Howrah, West Bengal, who had been engaged  $>20$  yr in the reclamation of traces of Au and Ag from the trade wastes of goldsmiths. As is usually done, he did the work in his home, in 1 of the 2 rooms of a tenement where he lived

with his wife and 10 children. There was of course no exhaust over the furnace and the family normally occupied the room where the work was done. The waste products were washed with water and then placed in an earthen pot furnace together with lime, Pb and charcoal, with air being blown through the furnace. In this process all metals present with the exception of Au form a Pb amalgam, and the remaining Au is recovered from the bottom of the furnace. This is repeated several times until all traces of Au are removed. The work was done usually 10-15 days/mo, with active monthly exposure to Pb fumes amounting to ~30-45 hr/mo, excluding the chronic exposure from fumes remaining in the room after the furnace was stopped.

Beginning in 1947, the man had attacks of acute constipation. In 1960 he was hospitalized with severe abdominal colics, and Pb poisoning was diagnosed. After an injection of atropine and a saline enema on the 1st day, he was given iv injections of Ca gluconate and oral doses of vitamin B-complex. His symptoms disappeared and he was discharged from the hospital after a month. A short time later, an increasing weakness developed in his hands and he became unable to extend his fingers. Physical findings included loss of weight, anemia, constipation, tremor and muscular atrophy. The porphyrin test was negative but his blood contained 11 mg Pb/100 ml, 2.3% stippled erythrocytes, Hb, 128 g and erythrocytes, 4 million/mm<sup>3</sup>.

**2732** Kehoe, R.A. (Univ. Cincinnati, O.): NORMAL METABOLISM OF LEAD. Archives of Environmental Health 8:232-5 (Feb.), 1964. The first finding of investigations, conducted during the past 30 yr into the sources of Pb to which the population of the US is exposed, revealed that all persons investigated were excreting Pb in their urine. This led to investigations of the environment, beginning with food and beverages, feces, urine and tissues of seemingly "normal" populations. Also, in order to determine whether this environment was due to industrial and technologic developments, corresponding investigations were carried out in a primitive part of the Western Continent. The same general facts were found to be true under the conditions of primitive life, with only a moderate decrease in their quantitative data. Subsequently, a series of balance experiments with human subjects was undertaken in the Kettering Laboratory. Experiments were carried out under normal conditions and later the metabolic effects of the addition of measured quantities of Pb in the diet or in the respired air on the input and output of Pb was measured in 15 subjects over a period of weeks, months and years. Since the results of these studies have been presented in the Harben Lectures in 1960 (see Journal of the Royal Institute of Public Health and Hygiene 24:81-97 (Apr.), 1961), only a summary is given here. The average or normal adult ingests with his food and beverages quantities of Pb varying from somewhat <0.1 mg to somewhat <0.6 mg/day and occasionally, due to an excessive contamination of an item, up to several mg/day. The mean quantity of Pb ingested by 10 experimental subjects ranged from 0.12-0.35 mg Pb/day. The

concentration of Pb in the ambient atmosphere of a number of cities in the US varies from 1-5 µg/m<sup>3</sup>, with somewhat <2 µg/m<sup>3</sup> in Cincinnati.

The respiratory intake of Pb by the average normal adult in a city as Cincinnati was calculated to be of the order of 30-40 µg/day; of this, 70-75% is discharged in the expired air, and probably only 25-30%, at most not more than 50% is retained in the lung and absorbed. This makes the total intake of Pb from food, beverages and air of the order of 0.33 mg/day. Most of this intake is eliminated in the feces, the mean Pb content of the feces being ~0.3 mg/day and the mean in the urine ~0.03 mg/day. There is considerable variation from individual to individual, from day to day and even hour to hour. Necropsies have shown that Pb occurs in low concentrations in all soft tissues including the brain (0.04-0.28 mg/100 g fresh liver) while the highest concentrations are found in the skeleton (0.67-3.59 mg/100 g).

The available evidence provides little reason for believing that there is a progressive increase in the Pb content of the human body with age under strictly "normal" environmental conditions. Experimental evidence does suggest that there are relatively brief periods (as compared with a lifetime) during which such an increase may occur, that there are other periods during which there is a decrease, and that these periods tend to alternate, under somewhat variable environmental conditions, throughout life. If, therefore, there is a general trend toward progressive increase, it is slight and ill defined, being masked by the effects of the environmental variability.

**2733** Kehoe, R.A. (Univ. Cincinnati, O.): METABOLISM OF LEAD UNDER ABNORMAL CONDITIONS. Archives of Environmental Health 8:235-43 (Feb.), 1964.

Investigations of the absorption, excretion and retention of Pb under occupational and other conditions involving the exposure of man to unusual quantities of Pb are discussed. Both the incidence and the severity of occupational Pb poisoning were found to be related directly to the intensity and duration of the exposure, as revealed by the excretion of Pb in the urine. Subsequently, the severity of occupational exposure was found to be related even more precisely to the Pb concentration in blood. A sharp demarcation line could be discerned between safe and dangerous types of occupational exposure to Pb. When the individual excretes in the urine >0.15 mg Pb/l or when the Pb concentration in the blood ≥0.08 mg/100 g, the individual has absorbed a potentially dangerous quantity of Pb. (The precision of the analytical method used was ±0.01 mg/100 g of whole blood for samples of not <10 g.)

Experiments were designed in the Kettering Laboratory in which healthy adults were subjected to exposure of Pb under carefully controlled conditions. The ingestion of Pb was studied in 4 subjects who were given with their diet (which contained ±0.3 mg Pb/day) Pb quantities (usually as nitrate, for short periods as chloride or acetate) of 0.3, 1.0, 2.0 and 3.0 mg/day, respectively, divided into 3 doses to be taken with each meal. Daily ingestion of a sufficient quantity of a solution of a Pb salt resulted promptly in an in-

crease in the concentration of Pb in the urine and to a lesser extent in the blood, with a proportionally corresponding increase in the Pb concentration in the body tissues (body burden). At the end of 4 yr, the ingestion of 1.0 mg Pb daily, in aqueous solution, in addition to that in the diet, has not resulted in a dangerous degree of absorption of Pb, the mean concentration in the urine at that time being 0.08 mg/l and in the blood, 0.046 mg/100 g. The Pb accumulation in the body during this period amounted to ~118 mg. After ingestion of 2.0 mg Pb daily (added to that in the diet) for 2 yr in another subject the Pb levels in urine and blood were 0.11 mg/l and 0.065 mg/100 g, respectively. At the end of 4 mo, the ingestion of 3.0 mg Pb daily had increased the Pb levels in urine and blood to 0.08 mg/l and 0.05 mg/100 g, respectively. Based on extrapolation of the rates of increase, the potentially dangerous level of 0.08 mg Pb/100 g blood would be reached by daily ingestion of a total of 3.27 mg Pb/day for 8 mo, or of 2.35 mg/day in 4 yr, or of 1.27 mg in ~8 yr. The effect of daily ingestion of 0.6 mg Pb cannot be assessed with satisfactory precision because of the nearness of the results to the limits of error of the experimental procedures. But it may reasonably be concluded that a potentially dangerous concentration of Pb in the blood under such condition would not be arrived at within a lifetime. At the termination of the experimental ingestion of Pb in the larger doses (1-3 mg/day), the rate of loss of Pb accumulated in the body depended more on the length of time of the accumulation than on the quantity accumulated. The time required for elimination of the accumulated Pb was at least twice the time required for its accumulation.

In another series of experiments, healthy human subjects were exposed to an atmosphere containing Pb sesquioxide. These experiments were undertaken to determine the effects of dosage, of the size of particles dispersed, of the chemical composition of the dispersed compounds and of the duration of exposure on the retention of the particles within the respiratory tract. The following general results were obtained: Retention of Pb was  $35 \pm 2\%$  at a mean particle size of 0.05  $\mu$ , 54% at 0.75  $\mu$ , down to 43, 45 and 53% (in 3 subjects, respectively) at 0.9-1.2  $\mu$ . The Pb concentration in the urine increased promptly in these experiments and after several months reached a peak above which it did not go subsequently. At an atmospheric concentration of 0.075 mg Pb/m<sup>3</sup>, the stabilized Pb level in the urine approximated 0.048 mg/l; at about twice this atmospheric concentration, the plateau was at 0.071 mg/l. The Pb concentration in the blood in both instances was 0.04 mg/100 g of whole blood. No demonstrable portion of the inhaled Pb was deposited in the upper respiratory tract and diverted therefrom into the alimentary tract when the mean diameter of the particles was in the low range. When a significant proportion of the particles was >1  $\mu$  in diameter, the amount of Pb excreted in the feces was well in excess of that introduced by food and beverages consumed, which indicates that Pb derived from the air was absorbed from the respiratory and alimentary tract. The potential hazards

associated with regular ingestion of Pb on one hand and with intermittent respiratory exposure on the other hand are discussed. The highest concentration in the blood of any subject, following respiratory exposure to air containing 0.15 mg Pb/m<sup>3</sup> for 37.5 hr/wk, over 102 wk was 0.45 mg/100 g (0.74 mg/l in the urine).

Observations at necropsy are limited mostly to analyses of the tissues of fatally poisoned children. The clinical severity of the intoxication in these cases varies not so much with the total quantity of Pb in the body (body burden), as with the concentration of Pb in the soft tissues which is related to the immediate dosage and speed of absorption. The concentration of Pb in the brain in fatal encephalopathy may range from 0.2-0.6 mg/100 g. That of the skeleton in fatal Pb intoxication may be increased 20- to 30-fold and, as the result of the recent absorption of abnormal quantities of Pb, the concentrations in the flat bone exceeds that of the long bone; this is directly opposite to the relationship found under usual environmental conditions.

**2734** Kehoe, R.A. (Univ. Cincinnati, O.): TETRAMETHYLLEAD AS SUBSTITUTE FOR TETRAETHYLLEAD. USE IN GASOLINE FROM THE ASPECT OF RELATIVE HAZARD. Archives of Environmental Health 8:296 (Feb.), 1964.

A preliminary investigation was conducted over a period of months to determine the effects on workmen of TML, used as an antiknock agent in motor gasoline in place of TEL. The results of these tests demonstrated that no significant hazard had been introduced by the use of TML over the period of time involved in the investigation. When, subsequently, TML went into commercial use, representative groups of the personnel engaged in the several operations were investigated clinically and from the aspect of Pb content in urine and blood. This investigation was published in the Archives of Environmental Health 6:239-54; 255-72 (Feb.), 1963.

**2735** Kehoe, R.A. (Univ. Cincinnati, O.): AN ILLUSTRATION OF INDUSTRIAL HYGIENE. Archives of Environmental Health 8:378-83 (Mar.), 1964.

A brief consideration of early investigations and certain policies and procedures instituted in 1926 by the distributor and manufacturer of TEL, in cooperation with the United States Public Health Service, is presented. After a tragic start in 1924, the situation called for the investigation of toxicologic facts to be obtained by animal experimentation, including the magnitude of the lethal dose of TEL as compared with those of well-known inorganic Pb compounds, the nature of the potential human hazard and the speed of absorption.

After this information was acquired, all operations that involved human contact with, or hazardous exposure to TEL, were subjected to thorough hygienic control. Careful consideration was given to the development of a pattern of operations to which the essential hygienic regimen could be applied, and provision was made for effective means of detecting and correcting promptly any faults. Control of the problems in transportation of TEL

included the use of special containers, distinct labeling and special handling. The number of sites at which TEL was to be mixed with gasoline was limited to a minimum and detailed instructions for the mixing procedures were issued. No case of TEL poisoning has ever occurred in connection with these mixing operations in the US and Canada, nor in any country where this regimen has been followed consistently.

When, after some years, an unanticipated hazard in connection with the handling of Pb gasoline appeared in the refineries and storage plants (men engaged in cleaning and repairing storage tanks for Pb gasoline were found to be subjected to hazardous exposure to TEL and its decomposition products), adequate precautionary measures were devised. Where these precautions were applied faithfully, no further cases of poisoning developed. In addition, detailed operating manuals were distributed, which from time-to-time are reviewed and brought up-to-date. Compliance with the instructions of the manuals was closely supervised. Responsible authorities in other countries were constantly advised of all hygienic facts and a satisfactory international program of industrial medicine and hygiene was accomplished. The services of competent medical consultants are engaged in each country where the product is used, who act for the industry in seeing that the hygienic regulations and practices are complied with. A significant feature of the hygienic policy of this industry has been that of sanctioning the publication of medical and hygienic information for the benefit of the profession, so as to spread the full knowledge of occupational hazards to students and practitioners of occupational medicine and hygiene.

**2736** Kehoe, R.A. (Univ. of Cincinnati, O.): PROPER EVALUATION OF LEAD POISONING. Letters to the Editor. Journal of the American Medical Association 189:331 (July 27), 1964.

This letter was written in answer to M. Rubin's reply in Questions and Answers: Chelation in the diagnosis of lead poisoning. (Journal of the American Medical Association 188:478 (May 4), 1964.) Dr. Kehoe is sharply critical of the reply itself as well as of the fact that this question was referred to a person who is not a physician. A diagnosis cannot be made on the basis of "laboratory tests for Pb poisoning" but must be based on symptoms and physical findings, supplemented by hematologic tests, both morphologic and biochemical. Quantitative observations on Pb relate not to illness, but to severity of exposure in time and intensity. The clinical pattern was further confused by reference to "subacute" or "chronic" Pb poisoning, and to absorption through the skin which occurs only in the case of organo-Pb compounds. Also, "Pb lines" are never found, except in children. The "provocative" test of administering a chelating agent is difficult to perform and interpret and is strictly an empirical and not a recommended procedure. It does not replace the precise determination of the blood concentration of Pb which, under totally undisturbed conditions, is the most accurate and reliable index of the "body burden" of Pb. Since medicolegal conse-

quences may be involved, questions relating to clinical problems should not be handled by non-physician personnel.

**2737** Kehoe, R.A. (Univ. Cincinnati, O.): METHODS FOR THE PREVENTION OF LEAD POISONING IN INDUSTRY. Journal of Occupational Medicine 6:247-54 (June), 1964.

Dr. Kehoe points out that although Pb poisoning has been known for many centuries, laymen still know virtually nothing about it and comparatively few physicians outside of industry have had any experience that would qualify them to diagnose and treat the disease, or to make a valid appraisal of the conditions under which it occurred.

Due to the progress in industrial medicine and hygiene in the US during the past 40 yr, the familiar types of industrial intoxication have been brought under control in a number of industrial establishments. There are industries in which large quantities of Pb and its compounds are being used in potentially dangerous operations in which no cases of Pb poisoning, even of mildest type, have occurred for many years.

In contrast to this are plants in which exposure to Pb in operations that are well known to be dangerous occurs practically without control and in disregard of all principles of industrial hygiene.

The determination of the rate of Pb excretion in urine and of the concentration of Pb in the blood provide definitive means for establishing the approximate level of Pb absorption into the body and for estimating the severity and hygienic significance of an occupational exposure to Pb. By means of systematic observations of the workmen, criteria have been developed by which dangerous occupational conditions can be distinguished from those which are safe. Methods of analysis required for these determinations have placed this analytical service in the hands of highly competent chemists in specially designed laboratories. However, the collection of satisfactory samples of blood and of urine as well as the interpretation of the results and the handling and supervision of men threatened by disease, are the responsibility of the physician.

The establishment of tolerable limits of the concentration of Pb and its compounds in the atmosphere of industrial plants provides at best some "rules of thumb" in relation to degrees of hazard, as the latter vary with the physical and chemical characteristics of the particles dispersed in the air. Habits of cleanliness on the part of the workers are necessary so as to limit the possibility of swallowing the larger particles of Pb to which men are exposed.

Other criteria used to maintain a check upon the status of workers in Pb trades range from some form of periodic physical examination to the use of clinical laboratory tests among which microscopic examination of the blood for stippling of the erythrocytes and examination of the urine for the presence of abnormal quantities of porphyrin are the most common. However, none of these clinical procedures should be relied upon solely in an industry in which there is an actual hazard of Pb poisoning. Actual prevention of occupational Pb poisoning is delegated to the industrial hygiene engineer and his efforts must be implemented by

management either directly, or through the medical department. The duty of the physician in environmental control is the cultivation among workmen of the utmost in knowledgeable compliance with the requirements of the use of respirators and other methods of prevention of hazards.

The reasons for the continuing occurrence of Pb poisoning in industry despite the availability of adequate means of its prevention lie in the differences among industries in the recognition and practice of good industrial medicine and hygiene. There is an even greater divergence among states in their legislation in matters of industrial hygiene. Another reason for laxity in preventive measures in many Pb-using industries is the insidious and often mild character of the intoxication induced by absorption of moderate quantities of Pb. The severe type of disease is now relatively rarely seen and what has resulted in a fairly general reduction in severity of the cases and not in the incidence of the disease.

There is now available overwhelming evidence that when the rate of absorption of Pb is kept within certain well-defined limits, no intoxication occurs. Therefore, the combined armamentarium of industrial medicine and hygiene can be so applied as to eliminate Pb poisoning when the determination to do so has become a general policy of industrial management.

- 2738** Kehoe, R.A. (Univ. Cincinnati, O.): FREE PROTOPORPHYRIN CONTENT OF ERYTHROCYTES IN CHRONIC TETRAETHYLLEAD POISONING. Letter to the Editor. *Lancet* 2:594 (Sept.), 1964.

Referring to Gutniak's preliminary communication "Free protoporphyrin content of erythrocytes in chronic TEL poisoning" (*Lancet* 1:1137-8 (May 23), 1964), Kehoe points out that in 40 yr experience only an acute form of TEL poisoning has become known. More importantly, according to Gutniak, 11 patients with "chronic" TEL poisoning were drivers or workers in car workshops. This is in contradiction to repetitive and detailed investigations since 1925 in the United States of handlers of Pb gasoline, which have failed to locate a single individual who has developed symptoms of TEL intoxication. Pb contents in the blood of 62-155 µg/100 ml, as listed by Gutniak, have not been found even in acute fatal TEL poisoning. Indeed the concentration of 50 µg of whole blood has rarely been exceeded. The comparatively low level of blood Pb constitutes an important distinguishing feature in the differential diagnosis of TEL intoxication. For this reason, there is something obviously faulty in Gutniak's relating the findings to the absorption of TEL.

- 2739** Koelsch, F. (Erlangen, Germany): "Über die Hautresorption der organischen Blei-Verbindungen. (CUTANEOUS ABSORPTION OF ORGANIC LEAD COMPOUNDS.) *Arbeitsmedizin* 2:25-9 (July), 1964.

Cutaneous absorption of organic Pb compounds from pharmacologic preparations and in industry is discussed. Some Pb compounds are still being used in medicine though much less frequently than at the turn of the century. For instance, aqueous solutions of basic Pb acetate (*Plumbum aceticum*), Pb plasters with Pb oxide, and unguentum diachy-

lon or salicylic diachylon are still used. These are innocuous if applied to the intact skin but may be harmful to injured skin and for children when used in excess. Tests on 25 patients with eczema and 30 healthy controls, using unguentum diachylon, showed that after application of small amounts for a short period of time the urine contained no Pb or only traces; after 1 wk application, urinary Pb amounted to 100-200 µg/l and after 1 mo use, to 200-280 µg/l. No stippled erythrocytes or porphyrin were found (Hermann, dissertation, 1939 to 1943; Schmid, J., 1939; and Schmid, R., 1938, 1940). In a 2nd series of tests, when normal or salicylic diachylon was applied to 5 and 10 healthy individuals, respectively, average urinary Pb after 24 hr application was 115-148 µg/l and up to 268 µg after 48 hr application. The perspiration contained 17 and 20 µg% Pb, respectively. Pb penetrated through the epidermis via the cutis into the deeper layer, forming deposits of very fine grey-brown granules. One of the cited authors pointed out that though urinary Pb excretion was generally below the harmful threshold, damage to organs and fetus after excessive doses may occur.

Koelsch then reports a case from his own experience: A worker from a chemical plant who was hospitalized because of severe corrosion of the skin, complained of colic, constipation and anorexia; after 7 wk his erythrocyte count was low, hemoglobin 60%, with increased stippled erythrocytes, increased coproporphyrin and slight liver damage. The syndrome was explained as an autointoxication from resorption of decomposed protein. Then it was reported that for 25 yr previously the patient had been an automobile driver and during this time had been continuously exposed to leaded gasoline. The suggestion was advanced that a "latent Pb deposit" had formed which, due to the corrosion trauma and maybe excessive alcohol consumption, had been mobilized. But the final explanation was the fact that the wounds had been treated every 3 days with diachylon ointment containing 13% Pb oxide, for a total of 22 days. Koelsch states that with regard to indemnity, the accident had been caused by corrosion and the moderate Pb intoxication due to the treatment was only temporary. Effects by Pb-containing cosmetics are negligible today.

Cutaneous absorption of Pb in industry may occur by contact with Pb soaps, Pb stearate and naphthenate, and Pb alkyls. The literature relating to these hazards is reviewed and the importance of protective clothing particularly for workers engaged in the mixing of Pb alkyls, is pointed out.

- 2740** Konchalovskaya, N.M., and Zorina, L.A. (Acad. Med. Sci., USSR): *Izmeneniya sistemy krovi pri nekotorykh professional'nykh intoksikatsiyakh. (BLOOD CHANGES IN SEVERAL OCCUPATIONAL POISONINGS.)* In *Trudy 1-go Moskovskogo (Ordena Lenina) Meditsinskogo Instituta imeni I.M. Sechenova, E.M. Tareev, ed.* 28:148-59, 1964.

Thirteen cases are presented, of which 4 involved Pb: (1) a 29-yr-old man who developed a hemolytic process 4 yr after exposure to small amounts of

Pb as a linotypist. Pb was not detected in urine except after administration of  $\text{CaNa}_2\text{EDTA}$ , when excretion was 0.04 mg/l; coproporphyrin (CP), 2+.

(2) A 31-yr-old brass worker with 4-yr exposure to Pb. When seen, he exhibited a hemolytic syndrome. (Stippled cells in blood, 2-3/field; CP in urine, 4+, Pb, 0.01 mg/l). Positive reaction to urobilin. These 2 cases are concluded to be an acquired form of hemolytic anemia developing from Pb poisoning. The 2 other atypical cases were: (1) a 25-yr-old female worker in a storage battery factory with 7 yr contact with Pb who in addition to the usual signs of Pb poisoning (reticulocytosis, basophilic stippling, urinary Pb elimination, 0.1-0.25 mg/l, CP, 2+, spastic colitis, dyskinesia, asthenovegetative syndrome, exhibited a hepatolienal syndrome with incipient deficiency of liver function. (2) A 49-yr-old chauffeur who used as fuel a mixture of TEL-containing gasoline and benzene (50-75%). In him typical changes in the blood appeared, leading to a hemorrhagic syndrome at the climax of the illness which subsequently led to a typical "Verl'gof" syndrome. The diagnosis at the 1st hospitalization was severe benzene poisoning. The author remarks that the reason for the atypical courses of illness is not clear, but may depend on individual susceptibility to low concentrations of poisonous substances; the role of the complex action of a number of industrial chemicals cannot be excluded.

- 2741** Kondo, H. (Keio Univ. School of Med., Tokyo, Japan): THE SCREENING LEVEL OF LEAD INTOXICATION AMONG LEAD WORKERS. Japanese Journal of Public Health 11, No. 14:901-4, 1964.

The diagnosis of occupational Pb poisoning in Japan is based on the determination of urinary coproporphyrin (CP), stippled erythrocytes and specific gravity of whole blood. In order to establish a screening level between Pb absorption and Pb poisoning, a statistical analysis was made on Pb-poisoned and normal subjects. It was decided that positive urinary CP, an increase of stippled erythrocytes >0.5%, and a reduction of the specific gravity of the whole blood <1.0540 are reasonable criteria for the diagnosis of Pb poisoning. (From *Excerpta Medica*, Sect. 17, 11:Abstr. No. 3116, 1965)

- 2742** Kovnatskii, M.A., Vasil'eva, V.A., Velikson, I.M., Kogan, A.G., Konikova, G.S., Kuz'minskaya, G.N., and Cherednichenko, L.K. (Inst. Ind. Hyg. Occup. Diseases, Leningrad, USSR): Materialy o vliyani svintsya na razvitiye ateroskleroticheskogo protsesssa. (INFLUENCE OF LEAD ON THE DEVELOPMENT OF ATHEROSCLEROSIS.) Gigiena Truda i Professional'nye Zabolevaniya 8, No. 12:6-12, 1964.

is the significance of noxious substances in the working environment in the development of atherosclerosis has not been sufficiently defined, the authors undertook the examination of 63 workers (35 women and 28 men) who had had long exposure to Pb. The maximum age was 40, so as to exclude changes due to aging, and more than 1/2 were 30 yr old. Most of them had worked at torch cutting and weld-

ing, and more than 1/2 had been exposed to Pb for <5 yr. Chronic intoxication by Pb was diagnosed in 44. Among them were persons in the initial stages of poisoning as evidenced by an asthenovegetative syndrome and changes in the peripheral blood. Ten had Pb colic with anemia, a number of them showed bone-marrow changes. Six exhibited enlarged and damaged liver, 4 of whom had increased blood cholesterol levels, and lowered antitoxic function of the liver, and 1, a lowered prothrombin content of the blood. Nineteen workers showed no symptoms of Pb poisoning.

In 9 of the 63 persons, diagnosis of myocardial dystrophy was made. The arterial blood pressure was normal in most cases. Although pathologic EKG changes were found in only 9, they were interpreted to point to serious disturbance of the myocardium. EKG's were normal in those showing no symptoms. Heart index, determined on 47, 31 of whom had Pb poisoning (by mechanocardiography) was increased at rest or showed insufficient rise after physical work in 22 (13 with poisoning). Plethysmography on the same number as above, showed changes in only 9. Changes in the capillary tension (studied on 49 (35 with intoxication)) were seen in 37. The above changes were attributed to disturbed nervous regulation. X rays, done on 10 patients with poisoning, showed no changes in the abdominal aorta. Total cholesterol, determined on 49, was elevated in those exposed to Pb as compared with 15 controls not employed in industries. Levels of cholesterol, unbound or loosely bound with proteins were increased, and the ratio of phospholipids to cholesterol was decreased. The changes were more pronounced in persons with Pb poisoning.

In animal experiments, atherosclerosis was induced in rabbits by daily feeding of 600 mg cholesterol for 3.5 mo, whereupon the animals were sacrificed. Pb poisoning was by daily administration of 0.025 g Pb acetate (10% solution)/kg body weight for 4 wk, then, after an interval of 3-4 wk, for another 12 days. One group of untreated rabbits served as controls; Group 1 received cholesterol; Group 2, cholesterol + Pb; Group 3, Pb alone. The cholesterol level of the blood of rabbits of Group 1 was 313 mg% at the beginning and 611 mg% after 3.5 mo. In Group 2 the final value was 790 mg%. In Group 3, the cholesterol level did not differ markedly from initial values. Total lipids were increased in Group 1 and 2, especially in the latter. In Group 3 the aorta lipids were increased only slightly. In Group 1, atherosclerotic changes in the aorta, heart and kidneys, were found and these changes were more severe in Group 2 while in Group 3, the aorta walls and large arteries of the heart and kidneys were not damaged. Focal hemorrhages were observed in the myocardium.

The authors point out the fact that atherosclerosis may occur relatively early and assume a severe course in persons exposed to Pb for an extended period of time.

- 2743** Koziolowa-Lipska, H., and Gutniakowa, O. (1st Clin. of Internal Diseases (AM), Warsaw, Poland): Wydalanie porfiryn i ich prekursorów z moczem u osób narażonych na przewlekłe wchłanianie ołowiu i jego związków. (URINARY EXCRETION OF PORPHYRINS



- 2743** AND THEIR PRECURSORS IN SUBJECTS EXPOSED TO CHRONIC ABSORPTION OF LEAD AND ITS COMPOUNDS.) *Polskie Archiwum Medycyny Wewnętrznej* 34, No. 9:1213-22, 1964.

Urinary ALA, porphobilinogen, coproporphyrin (CP) and urinary porphyrin were determined in 41 subjects exposed to Pb and its compounds. Those exposed to TEL showed disorders of the central nervous system and usually a high Pb level in the blood, but no rise in urinary ALA excretion. Individuals exposed to inorganic Pb compounds showed an increase in certain heme precursors in the urine. The increase in urinary ALA was usually associated with an increase of CP while porphobilinogen was normal or only slightly elevated. A certain correlation was noted between the elevated excretion of ALA and changes in the gastrointestinal tract and the peripheral blood counts. There was no correlation between the urinary output of ALA and the nervous symptoms. Treatment with  $\text{CaNa}_2\text{EDTA}$  decreased urinary excretion of ALA to normal when determined 4 days after termination of the treatment.

- 2744** Krotkiewski, A., Juskowa, J., and Koziolowa, H. (1st Clin. of Internal Diseases (AM), Warsaw, Poland): Zmiany elektrokardiograficzne u chorych z ołowica. (ELECTROCARDIOGRAPHIC CHANGES IN PATIENTS WITH LEAD POISONING.) *Polskie Archiwum Medycyny Wewnętrznej* 34, No. 9:1223-8, 1964.

The electrocardiograms of 300 patients with Pb poisoning were compared with those of 291 individuals with no exposure to Pb. The conclusion was drawn that Pb does not damage the heart directly. The statistically significant prevalence of abnormal electrocardiograms in the Pb patients is believed to have been due to arteriosclerosis since they occurred only in persons 46 years and older. The authors consider it possible that Pb accelerates and increases arteriosclerosis.

- 2745** Kvirikadze, N.A. (Acad. Sci., Georgian SSR): Khimicheskaya forma margantsa, svintsa, medi, serebra, tsinka, titana i nikelya v zlokachestvennoy opukholi mochevogo puzrya. (CHEMICAL FORM OF MANGANESE, LEAD, COPPER, SILVER, ZINC, TITANIUM, AND NICKEL IN MALIGNANT TUMORS OF THE URINARY BLADDER. Soobshcheniya Akademii Nauk Gruzinskoi SSR 35, No. 3:579-86, 1964.

Finding no data in the literature on the chemical form of the trace elements mentioned in the title, as they occur in urinary bladder tumors, the author investigated by electrodialysis 9 surgically removed malignant tumors and 8 healthy bladders removed at autopsy. The results showed that in healthy tissue Cu, Ni, and Zn were bound in the organic substances, and in the malignant, Cu and Ni were transformed into the ionic form. Zn was present in both forms in equal amounts in both types of tissue. This is stated to result from the lowered capacity of organic substance of tumor tissue to combine with the trace elements under investigation. In malignant tumors the ratio of the chemical forms of Ag, Pb, Mn and Ti did not change. In healthy tissue and in tumors, Ag was predominantly bound in the organic components, Ti

and Mn were mainly found in the ionic, and Pb was present in equal amounts in both forms. (The concentrations of Pb found in tumors were:  $1.9 \pm 0.25$  mg% ash in bound,  $1.9 \pm 0.36$  in ionic form; in healthy bladder,  $1.7 \pm 0.17$  and  $1.77 \pm 0.15$  mg%, respectively.

In earlier work (1963), the author had found that the amount of Ag in blood and in tumors was increased, that of Pb was increased in blood and had a tendency to increase in tumors. He interprets these increased concentrations of Ag and Pb as follows: it is known that these metals exert a toxic action on almost all enzymes and block the sulfhydryl groups of the protein molecules. There are also literature data that tumors and blood of patients with malignancies contain lower amounts of sulfhydryl groups. Therefore, Ag and Pb could play a role in the pathogenesis of malignant tumors, particularly of the urinary bladder, by a blockage of sulfhydryl groups of proteins. The change in Cu bonding is assumed to impair the activity of Cu-containing enzymes.

- 2746** Lane, R.E. (Univ. Manchester, England): HEALTH CONTROL IN INORGANIC LEAD INDUSTRIES. A FOLLOW-UP OF EXPOSED WORKERS. *Archives of Environmental Health* 8:243-50 (Feb.), 1964.

Three points are discussed in this paper: (1) what legislation has achieved in the Pb industries in the 20th century in Great Britain; (2) the question at which level protection should be pitched and the need of follow-up studies; (3) the requirement of extension of legislative control of the British Pb industries.

Although the use of Pb has increased, the number of notified cases of Pb poisoning has steadily declined throughout the 1st half of this century. Smelting of Pb is still a hazardous job. However, Pb poisoning has disappeared in the pottery, paint and printing industry. Due to medical supervision and improved techniques, Pb intoxications have been eliminated in 90% of the storage battery industries while cases still occur in the other 10% of industry which does not employ modern methods and supervision. Some hazard exists in the automobile industry and in ship-breaking (torch cutters). It is pointed out that the statistics include only notified cases of Pb poisoning, ie, of persons experiencing a toxic episode; this does not include the "slightly poisoned" man who continues to work and whose condition may remain undetected unless he is cared for by an alert factory physician. The author believes that from this group come cases of chronic nephritis, cerebral hemorrhage and premature death, due to Pb. Chronic nephritis has long been accepted in Great Britain as a long-term result of plumbism for the purpose of compensation. Australian studies have shown that a relationship exists between contracted kidney and Pb content of bone. This fact is confirmed by the author's experience 12 yr ago, when he reported 9 deaths from renal failure in a group of 150 Pb workers who had been exposed for long periods to high levels of Pb absorption ( $0.5 \text{ mg/m}^3$ ). A study was made among pensioners from Pb industries to determine (1) whether their life expectancy was different from that of the general population and related to the degree of exposure;



(2) if so, what diseases accounted for the difference. An excess of deaths from vascular lesions affecting the central nervous system was noted. Furthermore, the occurrence of vascular lesions appeared to be associated with the degree and duration of exposure. It must, however, be considered that these pensioners had still worked under the old bad conditions and later during wartime. Further follow-ups are necessary to prove that present conditions are safe (as the author believes they are). Control measures should include (1) new standards for the interpretation of degrees of Pb absorption; (2) suitable biological control examinations and extended environmental and biological control by legislation. A healthy Pb worker, exposed to increased Pb absorption, should exhibit a blood Pb <80 µg/100 ml; urinary Pb <150 µg/l; hemoglobin (Hb) >13 g (90%); punctate basophils <10,000/10<sup>6</sup>; coproporphyrin (CP) 500 µg/l. In the danger area, these values are, respectively: >80; >200; <13 g or falling; 5-20,000/10<sup>6</sup>; 800 µg/l. According to the author's view, the CP test is too sensitive for most industrial situations. He prefers assessment by blood examination and urinary Pb whereby serial Hb values are most valuable. The estimation of Hb in all Pb workers in prescribed occupations, at regular intervals, is required by law in Great Britain as a screening operation. Men with high Pb absorption should be deleaded while still at work and removed to a less hazardous job.

- 2747 Lange, J. (Univ. Bonn, Germany): Zur Chemotherapie von Schwermetallspeicherungen und -vergiftungen. (CHEMOTHERAPY OF POISONING BY HEAVY METALS AND OF THEIR ACCUMULATIONS IN THE BODY. Proceedings of the 3rd International Congress of Chemotherapy, Stuttgart, July 22-27, 1963. Stuttgart, Georg Thieme, 1964, pp. 1313-8.

The chemotherapy of heavy metal poisoning with chelating agents was discussed on the basis of 41 references. For the treatment of industrial Pb poisoning, iv injection of CaNa<sub>2</sub>EDTA is recommended. D-Penicillamine is less effective in mobilizing Pb but has the advantage of oral application and less toxicity; it seems particularly suitable for prophylaxis.

- 2748 Larizza, P. (Univ. Perugia, Italy): Anemie sideroacrestiche. (SIDEROACHRESTIC ANEMIA.) *Minerva Medica* 55:2074-81 (June), 1964.

This is a discussion of the biosynthesis of protoporphyrin in normal persons and in those with erythropoietic porphyria, and in Pb poisoning. ALA is eliminated in the urine as a consequence of the poisoning of the enzymes which should convert it to uroporphobilinogen. Other types of enzyme poisoning which lead to anemia, and results of treatment with deferrioxamine are also discussed. (24 references)

- 2749 Lattimer, J.K. (Columbia Univ., New York): EFFECTS OF ENVIRONMENT ON GENITOURINARY TRACT. *Archives of Environmental Health* 9:8-13 (July), 1964.  
Lattimer, J.K. (Columbia Univ., New York): EFFECTS ON ENVIRONMENT ON GENITOURINARY TRACT. *Archives of Environmental Health*

9:8-13 (July), 1964.

Some of the environmental effects, resulting from changed living conditions of the 20th century, are presented as they impinge on the genitourinary tract, in the order of their frequency: trauma; changes in bacterial flora by antibiotics, and effects of new drugs (relaxants, tranquilizers); chemicals (limited to 2 brief paragraphs including the statement "industrial exposure to such chemicals as Hg, Pb, U, Ba, borate, arsenate, F, and iodide may all cause renal toxicity if absorbed in significant amounts"); factors in the formation of urinary stones; exposure to carcinogens; discussion of fertility, congenital malformations, and function in outer space. In closing, it is stated that while the external environment has been stressed, "the genitourinary system, like the rest of the body, is subjected to all the stressful impacts, hormonal, enzymal, etc., to which every other system is exposed. In the over-all picture, the harmonious response of the body to the changes imposed by the external environment is a major factor."

- 2750 Lazarini, H.J., l'Épée, P., Ortscheid, G., and de Larrard, J.: A propos de certaines intoxications médicamenteuses. (APPROPOS OF CERTAIN MEDICAMENOUS POISONINGS.) *Annales de Médecine Légale* 44:353-4 (July-Aug.), 1964.

Of the 2 cases of intoxication reported, one was a 50-yr-old kitchen helper who, in 1960, had contracted burns of the left leg by upsetting a pot containing hot water. Examination ~2.5 yr later showed no traces of the burns but a superficial scar and erosions on the leg, indicating a caustic lesion due to some cause. Upon questioning it was learned that for >2 yr she had been using a commercially available adhesive bandage containing 31% litharge, 55% peanut oil, 9.3% resin and 4.7% soap. The dermatitis was attributed to the litharge, the inclusion of which in a bandage is considered to be entirely unjustified.

- 2751 Loesch, D., Darocha, T., and Gregor, A. (Hosp. Neurol. and Psychiat. Diseases, Pruszkow, Poland): Rola zatrucia ołowiem w ujawnianiu się ostrej przerywanej porfirii. (ROLE OF LEAD POISONING IN THE APPEARANCE OF ACUTE INTERMITTENT PORPHYRIA. *Neurologia, Neurochirurgia i Psychiatria Polska* 14:775-80 (Sept.-Oct.), 1964.

Treatment with vitamins and vascular dilators was ineffective. Then adenosine-5-monophosphoric acid (AMP) was injected at doses of 100 mg/day at 1st, and every other day after 1 wk (total dose, 2 g). After ~10 days of treatment, gradual improvement started, accompanied by a decrease in the values of urinary porphyrin and its precursors (in April 1963, the previously listed values had changed to 7.1 mg, 13.1 mg, 315 µg, and 136 µg, respectively). Although these levels still remained abnormally high at discharge, the patient showed no psychic or neurologic signs except a slight degree of paresis in some parts of the limbs, which did not impair their motions.

When penicillamine was administered following the AMP treatment, at doses of 750 mg/day for 3 wk, the urinary porphyrin levels increased (to 21.5 mg, 44.0 mg, 410 µg, and 6314 µg, respective-

ly), but the improved clinical condition was not affected by this rise.

Examination of the 4 other members of the patient's family showed that 2 of them also had abnormally high urinary porphyrin levels, but no clinical signs or complaints. The role of the Pb intoxication in the case described in the clinical appearance of the congenital metabolic defect in porphyrin metabolism is discussed.

A 53-yr-old female, employed since 1954 in a factory producing radio tubes was admitted to the psychiatric hospital on January 6, 1963. For the previous 2 yr she had suffered periodically from anxiety, insomnia, and irritability. In September 1962, chills and fever had appeared, with severe abdominal pain and bloody diarrhea, which subsided on its own after several days. As Pb poisoning was suspected (the exposure to Pb is not made clear by the author), the patient was hospitalized, and a laparotomy was performed to investigate her recurrent epigastric pain. The level of Pb in blood serum was then 208  $\mu\text{g}\%$ . After the operation, severe pain in the limbs and the back appeared, as well as persistent constipation and a considerable decrease in general well-being. Her repeated suicidal attempts (the means of these are not given) had necessitated transfer to the psychiatric hospital. On the 2nd day there, she suddenly developed paresis with flabbiness of all limbs and severe difficulty in breathing. The findings included cyanosis of the lips; paresis of all limbs, mostly in the upper parts where pronounced muscular atrophy was observed; general weakening of the extensor reflexes; inability to sit down unaided; deep depression, restlessness, and insomnia. Cerebrospinal fluid and liver tests, as well as X rays gave normal results. The Pb content in blood serum was 101  $\mu\text{g}\%$ ; the protoporphyrin level in the red cells (determined by the method of Schwartz and Wikoff, 1952) was 256  $\mu\text{g}\%$ . Analyses of 24-hr urine, performed in February 1963, showed the following:  $\delta$ -aminolevulinic acid (ALA), 15.0 mg; porphobilinogen, 55.0 mg; coproporphyrin, 762  $\mu\text{g}$ ; uroporphyrin, 1538.0  $\mu\text{g}$ .

- 2752** Lucas, H.F., Jr., Holtzman, R.B. and Dahlin, D.C. (Argonne Natl. Lab., Ill.): THE CONCENTRATION OF  $\text{Ra}^{226}$ ,  $\text{Ra}^{228}$ ,  $\text{Pb}^{210}$ , LEAD AND FLUORIDE IN HUMAN BONE FROM INDIVIDUALS WITH AN OSTEOGENIC SARCOMA. Science 144:1573-5 (June 26), 1964.

(Also US Atomic Energy Commission Document No. ANL 6769, 1963, pp. 66-74)  
The concentrations of  $^{226}\text{Ra}$ ,  $^{228}\text{Ra}$ ,  $^{210}\text{Pb}$ , stable Pb and F were determined in bone specimens from 32 individuals, having a verified osteogenic sarcoma. The mean value of  $^{210}\text{Pb}$  was 0.080 pCi/g ash and that of stable Pb 16.1  $\mu\text{g}/\text{g}$  ash. These concentrations were not significantly different from those of individuals without osteogenic sarcoma.

- 2753** McCammon, C.P., and Roberts, D.P. (Tennessee Dept. of Public Health, Nashville): A COMPARISON OF LEAD OXIDE AND LEAD SILICATE ABSORPTION AMONG AN INDUSTRIAL POPULATION. American Industrial Hygiene Conference Abstracts, Philadelphia, Pennsylvania, Apr. 27, 1964, p. 113.

Using spot urinary Pb samples and conventional methods of evaluating atmospheric Pb concentrations to

which industrial workers were exposed during normal work routine, a comparison was made of the relative toxicity of Pb silicate and Pb oxide. The data suggest that Pb silicate is slightly less toxic than Pb oxide. Due to limitations of the study, a more definite statement could not be made.

- 2754** Magnus (Brussels): De electrophysiologie van het saturnisme. (ELECTROPHYSIOLOGY OF SATURNISM.) Journal Belge de Médecine Physique et de Rhumatologie 19:192-5 (July-Aug.), 1964.

The electromyographic technique described by Giovini (Milan) was applied in 14 cases of Pb poisoning, after the normal curve of the anterior tibial muscle had been established in 42 controls. In the 14 cases studied, 9 showed no neurologic signs, 4 of them showed a normal EMG curve, 1 a very slight chronaxia; 4 had relatively elevated chronaxia, of whom 3 had complaints of fatigue and subjective loss of strength. Only 1 patient showed manifest neurologic symptoms with a pathologic curve (paralysis).

The author concludes that the intensity/time curve confirms the existence of a "latent" neuritis in cases with Pb poisoning. The test showed that radial impairment is due to peripheral neurogenic disorder as indicated by the detection of all signs of it. "Latent neuritis" could be established by electromyographic findings. He suggests that further studies be done to establish the value of these signs for early diagnosis of Pb poisoning.

- 2755** Maikova, O.P., and Kharakhokina, K.D.: Opyt ispol'zovaniya obogaschennykh pektinom pishchevykh produktov v profilakticheskom pitanii rabochikh kontaktiruyushchikh so svintsom. (EXPERIENCE IN THE USE OF ENRICHED PECTINS FROM FOOD PRODUCTS IN THE PROPHYLACTIC NUTRITION OF PRODUCTION WORKERS IN CONTACT WITH LEAD.) In Materialy XV Nauchnoi sessii Instituta pitaniya Akademii meditsinskikh nauk SSSR. 1964 (Information on the 15th Scientific Session of the Institute of Nutrition of the Academy of Medical Sciences of the USSR, 1964) Moscow 2:111-12, 1964; Referativnyi Zhurnal, Otd. Vypusk. Farmakol. Toksikol., 1964, No. 23:54-468; Biological Abstracts 46:Abstr. No. 66375, 1965.

- 2756** Maljković, I. (Ind. Med. Center, Zadar, Yugoslavia): Slučaj kroničnog profesionalnog otrovanja olovnim stearatom i karbonatom. (A CASE OF CHRONIC OCCUPATIONAL POISONING BY LEAD STEARATE AND CARBONATE.) Arhiv za Higijenu Rada i Toksikologiju 15:393-7, 1964.

The case described is that of a man, born in 1939, who began work in a plastics factory in 1960, and from 1962 had been engaged in the mixing operations with exposure to Pb stearate and carbonate. In 1963 he was admitted to the hospital with colic which was attributed in view of other positive signs to Pb poisoning. It was also found that he had poor vision. Examination of the work site showed atmospheric Pb concentrations of 3 and 4.6  $\text{mg}/\text{m}^3$ . The author attributes this incident to insufficient safety measures in the factory as well as to the worker's bad physical condition and poor

eye-sight. He urges improvement in preventive measures in view of the increasing production of plastics in the country.

- 2757** Mallein, M.L., Baron, J., Bruel, M., and David, C. (Lyon, France): Les examens hématologiques systématiques. Étude comparative des résultats. Quelques conclusions pratiques. (ROUTINE HEMATOLOGICAL EXAMINATIONS. COMPARATIVE STUDY OF THE RESULTS. SOME PRACTICAL CONCLUSIONS.) Archives des Maladies Professionnelles de Médecine du Travail et de Sécurité Sociale 25:599-600 (Oct.-Nov.), 1964.

Of 19,000 routine hematologic studies performed at the Institute for Occupational Medicine in Lyon between January 1959 and December 1963, 2343 concerned cases (2242 men and 101 women) of exposure to Pb (Group 1), the remainder of the patients having been exposed mostly to benzene and some to radioactivity (Group 2). When the results were classified into normal and abnormal, 22.7% of the men and 24% of the women exposed to Pb showed abnormal values. Considering all cases examined, none of the abnormal showed any sort of aplasia of the bone marrow. Myeloid leukemia was found in 1 case. Comparison of both groups revealed that there were more abnormal male cases in Group 1 than in Group 2, while for the women the % was about the same. Anomalies of the red blood cells in benzene exposure were found in 25.2% of the women and in 7% of the men. This anomaly occurred in 13% Pb-exposed males compared with 7% of men exposed to benzene. Hyperchromia was rare. Hypochromia was more frequent, particularly in women and in Pb workers (16.2% males, 37.3% females).

Numerous cases of slight thalassemia were noted. Findings of leukocytosis and leukopenia were about the same in the women at both risks, but in men leukocytosis occurred more frequently than did leukopenia. Anomalies of the polynuclear neutrophils were frequent; in general, neutropenia was more frequent than polynucleosis. The % of anomalies of polynuclear eosinophils was also about equal for both sexes and risks. Basophilia was infrequent.

It is pointed out that the industrial physician should investigate the possibilities of nonoccupational causes for the blood anomalies before attributing them to occupational exposure. The blood tests should be repeated after 2 wk to 2 mo at the same laboratory to obtain comparable data. The number of polynuclear neutrophils should be determined. A count of 3000-2500 neutrophils/mm<sup>3</sup> requires surveillance of the worker, while values below 2500 indicate a true neutropenia. Chronic Pb poisoning can be prevented by following stippled erythrocyte counts. Benzene poisoning is more difficult to detect, although aplasia of the bone marrow usually develops. Future, more sensitive tests may perhaps reveal enzymatic changes in the cells or modifications in the granulocytes.

- 2758** Martin, S., Boudène, C., Truhaut, R., and Albahary, C. (Hospital Center of St. Denis, Paris, France): Action du sel trisodique et mono calcique de l'acide diéthylènetriamine-penta-acétique (Ca D.T.P.A. Na<sub>3</sub>) dans le saturnisme humain. (ACTION OF THE CALCIUM TRISODIUM SALT OF DIETHYLENETRIAMINE-

PENTAACETIC ACID (Ca D.T.P.A. Na<sub>3</sub>) IN HUMAN LEAD POISONING.) Archives des Maladies Professionnelles, de Médecine du Travail et de Sécurité Sociale 25:407-18 (July-Aug.), 1964.

Results of a study on ~100 subjects, using calcium trisodium diethylenetriaminepentaacetate (DTPA) in the treatment of Pb poisoning are reported. The group of subjects consisted of (1) 25 controls without known exposure to Pb, (2) 12 hospital cases with Pb colic, (3) 12 foundries in a Pb refinery plant and 16 men of a battery plant, all of whom were exposed to a high Pb risk, (4) 14 workers in various industries with a slightly smaller risk, (5) 19 men of a printing plant where the Pb risk was minor and (6) 5 persons suffering from alimentary Pb poisoning. The subjects were treated either with iv injections of 0.50 g EDTA or with iv or im injections or perfusions of 1 g DTPA. Urinary Pb excretion was measured during 24 hr prior to the 1st injection (basic excretion) and 5 and 24 hr after the injection. The results are tabulated in detail for each subject followed. Generally DTPA seemed to be a little more effective than EDTA. In the controls urinary Pb excretion was <1 mg/l after 5 hr and usually <0.6 mg and never >1 mg in 24 hr. In the other groups urinary Pb excretion was as follows: in Group 2, 10 mg/24 hr was exceeded only in 1 instance; in Group 3 who showed increase of stippled erythrocytes and of basic urinary Pb even in the absence of symptoms and clinical signs, urinary Pb reached a maximum of 10-12 mg/l at 5 hr after treatment and 5-6 mg at 24 hr; in Group 4, peaks of 8-9 mg/l were reached at 24 hr; in Group 5, concentrations >1 mg at 24 hr occurred only in 3 instances, and in Group 6, they ranged to 4 mg/l.

The authors summarize the results by stating that the chelating agent, DTPA or EDTA, is preferably administered iv. Recent experiments, using 3-3 dimethylcysteine or penicillamine orally, gave less satisfactory results. In treating Pb poisoning, a daily urinary Pb excretion of 5-8 mg is sufficient. Circulating Pb and Pb in the soft tissues are more easily mobilized than Pb in the bones. There seems to be no threshold dose for the chelating agent since in a given case, 0.50 g produced the same Pb elimination as 1 or even 2 g. Usually, a daily dose of 1 g, the same as in elimination of Fe, 2 or 3 times/wk or in repeated courses of 6-18 days was applied. The possibility that DTPA may have an inactivating effect on metals besides the chelating action, is mentioned. Tolerance of the chelating agents and possible adverse incidents caused by the treatment are discussed. The same precautions are advised in using DTPA as have been practiced with EDTA. (32 references)

- 2759** Meeroff, M. (Ministry of Social and Public Welfare, Argentina): Afecciones que simulan el abdomen quirúrgico agudo. (DISEASES WHICH SIMULATE THE ACUTE SURGICAL ABDOMEN.) La Semana Medica 124:255-61 (Jan. 16), 1964.

This review of diseases that may simulate acute abdominal conditions was prepared in order to reduce diagnostic errors. The diseases discussed are the infectious, intoxications, blood, metabolic, endocrine, nervous system, allergic pleuropulmonary, heart diseases, retroperitoneal

processes, and miscellaneous. The intoxications include food poisoning, Pb colic, congenital erythropoietic and hepatic porphyrias.

- 2760** Melkonyan, A.M., and Gasparyan, A.A.: A COMPARATIVE EXPERIMENTAL STUDY OF THE PATHOGENIC ACTION OF THE DUST FROM COPPER, MOLYBDENUM, AND LEAD MINES OF ARMENIA ON THE ORGANS OF RESPIRATION. In Materialy 2-i Itogovoi nauchnoi konferentsii Instituta gigieny truda i profzabolevani, posvyashchennoi voprosam gigieny truda i profpatologii, 1963. (Proceedings of the second scientific conference of the Institute of Labor Hygiene and Occupational Diseases on problems of labor hygiene and occupational pathology, 1963) Erevan 37-42, 1964.

Intratracheal administration and inhalation of dust from Mo and Pb mines produced coarser and more rapidly occurring pathological changes in the lungs of rats than did dust from Cu mines. Since the content of Si dioxide in the rocks of these mines was practically the same, the differences in reaction must be related to the effect of the metals. (From Referativnyi Zhurnal, Otd, Vypusk Farmakol. Toksikol. 1965, No. 24:54.668; Biological Abstracts 47:Abstr. No. 77968, 1966)

- 2761** Mel'nikova, N.D. (Inst. of Ind. Hyg. and Occup. Diseases, Gorki, USSR): Sostoyanie organa zreniya u rabotayushchikh s tetraetilsintom, po dannym dinamicheskikh nablyudenii. (THE STATUS OF THE ORGAN OF VISION IN WORKERS EXPOSED TO TETRAETHYL-LEAD ACCORDING TO DYNAMIC OBSERVATIONS.) Gigiena Truda i Professional'nye Zabollevaniya 8:41-4 (Aug.), 1964.

The effects of prolonged exposure to TEL on vision were investigated in the periodic examination of 180 workers (155 male, 25 female), most of whom (129) were >40 yr old. Most of them (139) had been in contact with TEL for >10 yr and 78 of these, up to 25 yr. The principal criteria of chronic TEL poisoning were the presence of an asthenic condition caused by pronounced vasovegetative disturbances. Forty-one persons showed variations in blood pressure with transient rise, and 14 had a tendency to marked hypertension. A number of patients exhibited the so-called angiospastic crises, occurring in apparently good health, ie, brief episodes of sharp headache, nausea, colicky pain, at times blurred vision.

Ophthalmologic examination revealed no marked decrease in the sharpness of vision; measurement of the range of vision showed in 29 an inconstant reduction in the limits of 3-10°. In 21, the fundus showed changes characteristic of vascular spasm and slight weakening of the optic nerve; however, the visual acuity usually remained normal. Particular attention was paid to a possible increase in intraocular tension, since Skripnichenko, having observed this phenomenon in TEL workers, assumed that exposure to TEL leads to glaucoma. Although 20 of the 180 workers examined showed a transient rise in intraocular pressure and 72 (40%) had an abnormal elastometric curve, the provocative "platyphyllin" test, to detect onset of glaucoma, was normal in all cases. The

author concludes that whatever reversible changes in intraocular pressure were observed, were those frequently encountered in any state of illness, and that this condition became normalized with return to general good health. In summary, as TEL principally affects the central nervous system and its vegetative apparatus, it also affects the functional condition of the eye. The changes are in the form of circulatory disturbances and the observed changes in intraocular tension can be attributed to disturbances in the reflex regulation of this tension, although they do not lead to decreased vision and optic nerve disorders typical of glaucoma.

- 2762** Meo, G., Martorano, G., Bonzanino, A., and Perrelli, G. (Univ. Turin, Italy): L'escrezione urinaria dell'aminocetone nel saturnismo. (URINARY EXCRETION OF AMINO-ACETONE IN PLUMBISM.) Bollettino della Società Italiana di Biologia Sperimentale (Napoli) 40:649-51 (June), 1964.

The heme synthesis in Pb poisoning is markedly altered since the metal acts as a blocking agent for the enzymes which induce the synthesis of protoporphyrin and the incorporation of Fe. Urinary excretion of coproporphyrin as well as of uroporphyrin and ALA is increased. ALA was determined by the method of Mauzerall and Granick (1956). These authors also showed that in the normal subject, part of the aminoketones which are eliminated consists of aminoacetone which may be separated by ether extraction at pH 8. Urinary elimination of total aminoketones, ALA and aminoacetone was determined in 34 normal and 13 Pb-poisoned subjects, respectively as follows,  $\mu\text{M}/24 \text{ hr}$ : 22.08, 199.56; 14.83, 183; 7.25, 16.56; ALA/aminocetone, 2.34, 6.30. Thus, aminoketones in Pb-poisoned subjects were 9 times the amount in controls; ALA was increased 11-fold and aminoacetone 6-fold. A study of the correlation of urinary coproporphyrin and aminoketones revealed that, though a significant relationship existed between coproporphyrin and total aminoketones on one hand and coproporphyrin and ALA on the other hand, no correlation was found with respect to aminoacetone.

The investigation confirmed that in Pb poisoning urinary elimination of ALA is markedly increased due to the inhibition of ALA dehydrase which promotes the condensation of ALA to porphobilinogen.

- 2763** Mlnářiková, J., Janková, J., and Hůzl, F.: Otrava olovem u klepačů tendrů. (LEAD POISONING IN TENDER ATTENDANTS.) Pracovní Lékarství 16, No. 1:24-6, 1964.

A study of 24 workers engaged in knocking out old paint inside engine tenders revealed chronic Pb poisoning in 9 and symptoms of increased exposure to Pb in 7 men. The dust concentration inside the tender during removal of old red Pb layers with pneumatic hammers was 328 mg/m<sup>3</sup>. Working conditions were improved by removing the pneumatic tools, and improved ventilation, alternating work shifts, and division of labor were recommended. The authors also proposed preventive administration of Ca disodium edetate to workers exposed to Pb hazards. The editors of the journal do not approve of that, maintaining that it would cause a neglect of hygienic measures. To this, the

authors answered that preventive treatment should not be used as a substitute for technical improvements but only as an auxiliary measure until the technical conditions have been changed.

- 2764** Moeschlin, S.: *Klinik und Therapie der Vergiftungen. (DIAGNOSIS AND TREATMENT OF POISONING.)* 4th ed., Stuttgart, Georg Thieme, 1964. Translated by J. Bickel. New York, Grune & Stratton, 1965).

Pb is the first of the inorganic poisons considered in this book; 30 pages are devoted to this subject. The discussion is limited to clinical and environmental aspects, and is introduced by the statement that Pb poisoning is still of great practical significance. It occurs despite precautionary measures in industries, where the danger to the workman is well known. In the US, poisoning in children due to paint scrapings is relatively frequent, while this form has practically disappeared in Europe.

The routes of absorption and exposure are first discussed, then the mechanism of action, metabolism of Pb, the significance of serum Pb; acute and chronic poisoning manifestations on the basis of the author's observation of 70 cases; Pb encephalopathy in the adult and in children; treatment of acute and chronic poisoning and of special forms, ie, palsy and encephalopathy. Organic Pb compounds are discussed separately, and are limited to TEL and the so-called leaded gasoline, followed by treatment; Pb stearate poisoning completes the section on Pb.

Several cases of poisoning are presented; in 1 of them, seen in 1955, an occupational type of exposure (garage mechanic and driver) was assumed, but later was explained by a plastic operation with insertion of small porcelain balls containing Pb into the maxillary bone, which had caused unusually high levels of Pb in blood.

- 2765** Moiseev, V.S. (Acad. Med. Sci., USSR): *K voprosu o klinike porfirinovoï bolezni. (DIAGNOSIS OF PORPHYRIA.)* In *Trudy 1-go Moskovskogo (Ordена Lenina) Meditsinskogo Instituta imeni I.M. Sechenova, E.M. Tareev, ed. 28:200-5, 1964.*

The clinical picture and etiology of porphyria is discussed on the basis of 2 cases: (1) a 56-yr-old man who developed porphyria upon prolonged exposure to sunlight. (2) A 43-yr-old man seen in 1961, who in 1952-53 had been employed in the extraction of Pb-containing ore. In 1953 he developed pruritus of the face, and 3 yr later, signs of internal and nervous system involvement occurred. The case is described in some detail. The diagnosis was: mixed form of porphyria with lesions of the skin, gastrointestinal tract, nervous system with paranoid syndrome. In discussing the case, the author says that diagnosis was not difficult. However, the onset of the illness occurred during the period when the patient was exposed to Pb. Even though there were no signs of either acute or chronic Pb poisoning, it is possible that even small amounts of absorbed Pb which would not have been hazardous for another individual, in this patient led to the development of porphyria. For this reason, this may be considered a secondary porphyria which may develop in poisonings by sulfanilamide, Pb, hemolytic

jaundice, posthemorrhagic regeneration, etc. These are easily distinguishable from porphyria by taking into account their characteristic symptoms. In secondary porphyrias coproporphyrin is found in urine, but only rarely porphobilinogen and uroporphyrin.

- 2766** Mole', R., and Pesaresi, C. (Univ. Naples, Italy): *Il comportamento dell'aladeidraasi nel saturnismo umano e sperimentale. THE BEHAVIOR OF ALA-DEHYDROGENASE IN HUMAN AND EXPERIMENTAL SATURNISM.* *Folia Medica (Naples)* 47:73-9 (Jan.), 1964.

Studies were carried out on 15 human subjects with established Pb intoxication and 10 rabbits, weight 2.8 kg, which had been poisoned by gastric administration of 3 cc of a 30% solution of Pb acetate, on 4 consecutive days. Five normal individuals and 5 rabbits served as controls. The blood plasma and urine were examined for their content of ALA and porphobilinogen (PBG), using the methods of Haeger-Aronson, and Mauzerall and Granick, and the red cells for activity of ALA-dehydrogenase by the method of Gibson et al, and expressed in  $\mu\text{M}$  of PBG synthesized/hr. The results showed the highest values for normal subjects and average values in the Pb-poisoned subjects, respectively, to be as follows: ALA-dehydrogenase, 1.03 and 1.08  $\mu\text{M/hr/ml}$  of red cells; ALA in plasma, 46 and 126.73  $\mu\text{g}\%$ ; urinary ALA, 2.5 and 19.07 mg/24 hr; plasma PBG, 30 and 29.10  $\mu\text{g}\%$ ; urinary PBG, 1.5 and 1.94 mg/24 hr. For the control and experimental rabbits the corresponding values were: 0.29 and 0.31; 34 and 63; 0.021 and 0.71; 22 and 23; 0.058 and 0.18.

In human Pb poisoning, both plasma and urinary ALA levels were increased in all cases, while urinary PBG was increased in only 50%. The findings in experimental poisoning were similar, except that the increase in urinary PBG was constant. As neither PBG in the plasma nor ALA-dehydrogenase were changed significantly in man and rabbit, there is no justification to assume that Pb has an inhibitory effect on this enzyme.

- 2767** Molyneux, M.K.B. (Univ. Manchester, England): *USE OF SINGLE URINE SAMPLES FOR THE ASSESSMENT OF LEAD ABSORPTION.* *British Journal of Industrial Medicine* 21:203-9 (July), 1964.

Because of the ease of obtaining spot urine samples for the assessment of Pb exposure, this technique continues to be used throughout industry in spite of the uncertainty of the results due to variability in uncorrected Pb concentrations of single specimens. The investigation reported has been carried out to study the variations encountered in the Pb concentration and excretion rate in samples collected from subjects with widely different exposures. The urinary specific gravity was used to correct for the variation in urinary volume, but the variation remaining in the Pb concentration after such correction indicated that a factor other than a change in urinary volume influenced the variation in concentration. The effect of creatinine correction was studied as an alternative but there was no statistical difference between either method of correction. The diurnal rhythm of the excretion of Pb was then studied in day and night shift workers and was seen to influence both the corrected and observed results. The rate

of excretion rose to a maximum at ~5 pm in the day workers but decreased in night workers, falling to a minimum at ~2 am. From this, it was concluded that the rhythm is independent of immediate exposure and of physiologic origin. The plasma-Pb clearance was estimated at 1.4 ml plasma/min, suggesting that only a small proportion of plasma-Pb may be unfilterable and that little Pb is secreted by the tubules.

The results of the investigation indicate that the diurnal rhythm of the rate of Pb excretion has a major influence on the variation in concentration. This was particularly true in subjects with a mean Pb concentration in excess of 200 µg/l. The collection of a single sample at a standard time is therefore considered essential. For any one man, when the time of collection and either method of correction is applied, the concentration of any one spot sample may still be an unreliable indication of the mean Pb concentration. When the results are being compared with a "maximum allowable concentration of Pb in the urine," collection late in the working day should increase the reliability. Attention is called to the fact that the correction of samples of a specific gravity of <1.010 was responsible for a considerable increase of variation after correction. This was less marked when creatinine concentration was used for the correction.

- 2768** Molyneux, M.K. (Univ. Manchester, England): LEAD EXCRETION. In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. II, pp. 507-8. See preceding abstract.

- 2769** Morgan, K.Z. (Oak Ridge National Laboratory, Tenn.): THE BODY BURDEN OF LONG-LIVED ISOTOPES. Archives of Environmental Health 8:86-99 (Jan.), 1964.

$^{210}\text{Pb}$  is one of the principal naturally occurring long-lived radionuclides of the U chain which are found in the human body. Its half-life is 22 yr. The experimental determination of the body burden of  $^{210}\text{Pb}$  and other radioisotopes is discussed. The aspect of radiation hazards in view of the body burden of radionuclides is pointed out. (31 references)

- 2770** Morris, C.E., Heyman, A., and Pozefsky, T. (Univ. North Carolina, Chapel Hill; Duke Univ., Durham): LEAD ENCEPHALOPATHY CAUSED BY INGESTION OF ILLICITLY DISTILLED WHISKY. Neurology 14:493-9 (June), 1964.

The clinical and laboratory findings of Pb encephalopathy in 17 adults (12 men and 5 women, aged 28-61 yr) admitted to the hospital between 1952 and 1963 were described. All subjects had been drinking illicitly distilled whiskey which had been contaminated by the Pb solder in the connecting pipes or in the discarded automobile radiators used as condensing units in the distilling apparatus. Only 2 of the regional revenue offices in various parts of the US found significant amounts of Pb contamination in their confiscated samples of spirits. In 1960, the Atlanta office reported

that some 174 of 540 samples contained 1.0 mg or more of Pb salts/l and during an 18-mo period beginning January 1962, 3.5% of some 1100 samples examined by the Cincinnati office contained 4-75 ppm Pb salts.

The initial manifestations of Pb encephalopathy included fatigability, lethargy, headaches, cramping pains of the limbs, nervousness. Thirteen of the 17 patients developed recurrent severe seizures, the remaining 4 exhibited acute delirium with auditory and visual hallucinations. Differentiation from alcohol withdrawal and delirium tremors was on the basis of increased spinal fluid protein, presence of papilledema and the characteristic hematologic and urinary findings. Marked anemia, basophilic stippling and reticulocytosis were almost always present. Among 14 patients tested, all but 2 showed urinary Pb levels in excess of 0.1 mg/l, and treatment with  $\text{CaNa}_2\text{EDTA}$  significantly increased urinary Pb excretion. Each of 4 autopsied patients showed levels of 2-7 mg Pb/100 g of brain or liver. Gross and microscopic examination of their brains revealed characteristic signs of cerebral edema, but none of them showed the histological picture usually seen in Pb encephalopathy of children. All showed hepatic and renal changes such as acid-fast intranuclear inclusions within the liver cells and the epithelial cells of the kidney tubules.

The majority of patients were given an iv infusion of 1 g  $\text{CaNa}_2\text{EDTA}$  daily for 10 days. The importance of administration of  $\text{CaNa}_2\text{EDTA}$  as a diagnostic test was pointed out.

In addition to the above cases, 7 adults and 7 children with Pb poisoning were seen. The adults had symptoms of Pb colic or anemia due to occupational Pb exposure; the children, all of whom had had pica or had inhaled fumes of batteries burned for fuel, exhibited symptoms referable to the central nervous system. While in the above 17 cases it was considered possible that the clinical syndrome was a combination of alcohol withdrawal with a high Pb content in the brain and tissues caused by long-term ingestion of Pb-containing whiskey, the absence of characteristic histologic findings of Pb encephalopathy suggests that the pathogenesis of central nervous symptoms differs from that in young children who inhale or consume large quantities of Pb. Encephalopathy caused by occupational exposure to Pb has become a rare occurrence.

- 2771** Neronskii, O.G. (Inst. of Med., Minsk. USSR): O toksichnosti aerolya krasok soderzhashchego svinets. (THE TOXICITY OF PAINT AEROSOLS CONTAINING LEAD.) Gigiena Truda i Professional'nye Zabollevaniya 8: 52-4 (June), 1964.

Paint aerosols are composed not only of finely dispersed particles, but larger ones (25-500 µ), and conglomerates as well. As it is difficult technically to bring into solution pigment in specified proportions to the solvent, the author studied the solubility of pure Pb chromate (Pb sulfochromate) and of the components of the dry residue of a commercial paint aerosol in gastric juice, in 0.1 N HCl, and 0.85% NaCl solution. The Fe minimum content was 20.7%. In the gastric juice, 28.2% of the Pb chromate was recovered, in HCl, 16.5%, and in

NaCl, 1.1%. The % of dry residue recovered in the same solutions was 7.8, 3.8, and 0.18, respectively.

Subsequently, the exposure of spray painters to Pb and their health status were investigated in an automobile factory. The Pb content of the air in the workroom was 0.004-3.452 mg/m<sup>3</sup> (>0.01 mg in 96.7% of the samples), benzene 0.02-0.45 mg/l, toluene 0.02-0.32 mg/l, naphtha solvent 0.04-0.71 mg/l. The content of aromatic hydrocarbons exceeded the permissible levels in 67.9% of the samples. Of the 216 painters examined (duration of employment from several months to 12 yr), 9.7% showed mild signs of chronic Pb poisoning with elevated number of stippled erythrocytes, 9% had increased counts of reticulocytes, and Pb in blood ash was 0.0005-0.026%. Increased urinary Pb (0.04-0.24 mg/l) was found in 16 of 59 painters examined. Very frequently observed were signs of chronic effects of benzene and its homologs in the form of leukopenia (34.2%), neutropenia (32.4%), lymphocytosis (40.7%), and thrombocytopenia (36.9%). Therefore, the health hazards are not by the pigment alone but also by the solvents contained in the paint.

The author recommends that for the prevention of hazards to painters, Pb-containing paints be substituted by Pb-free paints, and that solvents other than benzene and its homologs be used.

- 2772** Nowotny, B., Kliks, I., and Sikorski, M. (Przych. Med. Pracy, Poznan, Poland): Ołowica w zakładach porcelany. (LEAD POISONING IN PORCELAIN PLANTS.) Medycyna Pracy 15, No. 1:59-63, 1964.

Pb poisoning was confirmed in 4 among 15 men handling Pb-containing ceramic paints. There was no correlation with the length of service, but one was established between the frequency of the disease and the concentration of Pb in the dust at the workplace. (From Excerpta Medica, Sect. 17, 10: Abstr. No. 5241, 1964)

- 2773** Nuffield Department of Industrial Health, University of Newcastle upon Tyne: THIRD QUINQUENNIAL REPORT. Annals of Occupational Hygiene 7:75-8 (Jan.), 1964.

This report covers the period of June, 1956 to May, 1961. Research carried out in this period includes a study of Pb excretion in Pb smelters and the analysis of Pb in urine as an aid to the physician in the early diagnosis of intoxication. Samples of urine and blood were taken at regular intervals for 2 yr from 200 Pb workers. Those in the age group of 30 yr and below were found to excrete urinary Pb at about twice the rate of those aged 30-45 yr and over. Maximum Pb excretion appeared to occur in the 2nd yr of employment. Smelters had the highest rate of Pb excretion, followed by workers engaged in dusty jobs such as sinter plant, sweeper and mechanical shovel. No correlation between Pb excretion and punctate counts was noted, though there was a slight correlation between Pb excretion and coproporphyrin excretion. It was concluded that no single test is adequate for the diagnosis of Pb poisoning and that even a complete set of tests must be interpreted with care.

A rapid and accurate method for the determination of Pb in 20-ml samples of urine was devised,

permitting determination of a single specimen in 3 hr. The mean results of triplicate analyses by this method were within  $\pm 12.5$   $\mu$ g/l of the true concentration in 19 times out of 20.

Mention is made of an investigation of the Pb hazard in the manufacture of Pb glazes, which included recommendations on ventilation and handling of materials.

- 2774** Oettlé, A.G. (South African Inst. Med. Research, Johannesburg): CANCER IN AFRICA, ESPECIALLY IN REGIONS SOUTH OF THE SAHARA. Journal of the National Cancer Institute 33:383-440 (Sept.), 1964.

Striking differences were noted in cancer incidence, situation, and histopathological type between and within races of Africa, which suggested that 80% or more of the cancers affecting western races are environmentally induced and potentially preventable. Among the negriform races, cancers of stomach, large bowel, breast endometrium, ovary, brain, and leukemia are generally rare. Common to them are primary cancer of the liver, Kaposi's sarcoma, Burkitt's tumor, and, in some regions esophageal cancer. Before the termination of World War II the esophageal cancer was rare in Africa and still is in many regions, although the Bantu have experienced a remarkable increase. It was observed that esophageal cancer was more common in the Bantu than gastric cancer. The disease is now common in all the large cities of South Africa, Southern Rhodesia, Kenya, and Malawi, but not in those of Mozambique, Northern Rhodesia, Tanganyika, Uganda or West Africa. The same patchiness could be noted in the South African rural areas, in some of which it is very low while in others it is very high. Association with alcohol and smoking did not give a satisfactory explanation. Between 1941 and 1949 tin plating of kerosene containers was abandoned in South Africa in favor of Pb plating. These tins are commonly used as receptacles for brewing in some areas, while in others clay pots are preferred. Drums or even tea chests (which may be lined with Pb foil) are also used. The beverages certainly contain a wide variety of metals (as found by the author with Schutte in unpublished work) and local variations in use might explain the variation in incidence of the disease. The author notes that in the meanwhile there is a great increase in cases of this cancer, and that prevention would be better than cure.

Incidence of other cancers and their distribution, therapy and prevention are discussed. Since most cases of cancer in Africa are out of reach of methods of treatment other than chemotherapy, great need as well as opportunities exist for the study of carcinostatics. (229 references)

- 2775** Okhnyanskaya, L.G. (Inst. Ind. Hyg. Occup. Diseases, Moscow, USSR): O kharakternykh izmeneniyakh v deyatel'nosti vysshikh otdelov tsentral'noi nervnoi sistemy pri vozdeystvii razlichnykh proizvodstvennykh faktorov. (CHARACTERISTIC CHANGES IN THE ACTIVITY OF HIGHER SEGMENTS OF THE CENTRAL NERVOUS SYSTEM UNDER THE ACTION OF VARIOUS INDUSTRIAL FACTORS.) Gigiena Truda i Professional'nye Zabolivaniya 8:33-40 (June),

1964.

As summarized by the author, the discussion of the unconditioned and conditioned vascular, respiratory, wink reflexes, the activity of the olfactory, visual and motor analyzers, the biological activity of the blood and of the olfactory-humoral reflex, was directed to the elucidation of general regulations and as they portray the response of the higher segments of the central nervous system to the effects of Pb, Hg, carbon disulfide, Mn, and Si-containing dust. Examination as to response of reflexes should be carried out early, i.e., at the incipient stage of pathological processes by harmful irritants.

- 2776** Pacséri, I. (Natl. Inst. Occup. Health, Budapest, Hungary): A foglalkozási betegségekkel kapcsolatos időszakos orvosi vizsgálatok kérdéseiről. (PROBLEMS OF PERIODIC MEDICAL EXAMINATIONS IN OCCUPATIONAL DISEASES.) Nepegeszsegügy 45:71-5 (March), 1964.

The author believes that the task of periodical examinations should be primarily the responsibility of the industrial physician. However in factories with no such staff, or with a physician lacking facilities, the provision of medical supervision is still a major problem. A survey now being conducted in Hungary will probably offer solutions as to the type of establishment (specialty clinics, mobile laboratories) necessary to facilitate the execution and uniformity of the various examinations (laboratory and special clinical) needed to protect the health of workers exposed to dangerous materials in the course of their occupation. Pb is included in the tabulation of chemical hazards with the respective diagnostic tests and principal signs and symptoms.

- 2777** Pearce, W.G., and Reynard, W.A. (Oxford Eye Hosp., England): AN EARLY SIGN OF LEAD POISONING. British Journal of Industrial Medicine 21:247 (July), 1964.

N. Sonkin's article on "Retinal stippling - a new physical sign in the early diagnosis of Pb poisoning (New England Journal of Medicine 269:779-80 (Oct. 10), 1963)" is reported. Since in industries involving a Pb hazard every possible sign that might help in drawing the line between Pb absorption and Pb intoxication is important, this new test was included by the authors in the regular medical examination of a total of 102 workers of a factory manufacturing motor car bodies. The men were known to be exposed to Pb in varying degree. Based on Hb estimation, urinary coproporphyrin and punctate basophil count, 11 of these 102 men showed evidence of Pb absorption which caused their removal from exposure. Not 1 of the 102 men, including the 11 with signs of excessive of Pb absorption, showed the discrete grey deposits around the optic disk as described by Sonkin.

The authors conclude therefore, that an examination of the fundus has no place in the medical control of workmen exposed to Pb.

- 2778** Pearce, W.G., and Sonkin, N. (Oxford Eye Hosp., England; Pawtucket, R.I.): MORE ON RETINAL STIPPLING. Letters to the Editor. New England Journal of Medicine 270:533-4

(Mar. 5), 1964.

W.G. Pearce points out that in the factory of the Pressed Steel Company in Oxford, >800 men are exposed to Pb dust in the air in concentrations >0.3 µg/l. The workers are examined for evidence of Pb absorption every 2-4 mo. In addition to the usual routine tests for urinary coproporphyrin, Hb and basophilic stippling, the fundi of 102 randomly selected men were examined ophthalmoscopically. All these men had been exposed to Pb for over 2 yr and an av of 9 yr. Of those examined, 11 men had coproporphyrin levels of 4+ and >2000 stippled cells/million red blood cells. None of them and none of those with lower laboratory levels of Pb absorption had the discrete grey deposits around the optic disks as described by N. Sonkin (ibid 269:779-80, 1963). Pearce maintains that if these absorption levels of Pb were not high enough, the sign of retinal stippling is of no value in the early diagnosis of significant Pb absorption. He believes that it is highly unlikely that the deposits found by Sonkin in 8 patients were Pb and that all other ophthalmologists of the past 100 yr missed this finding in Pb intoxication.

In his answer, Sonkin states that (1) apparently fundusoscopic examinations have not been done for many years as a routine examination in early Pb poisoning, (2) that the exposure in Pearce's subjects was an extremely slow and subtle process, and (3) that he had not claimed that retinal stippling was either a pathognomonic or ubiquitous sign for Pb absorption or poisoning. Time only will corroborate the validity of this sign for early diagnosis of Pb poisoning. In the meantime, interest in fundusoscopic examination in suspected cases has been engendered.

- 2779** Piguet, H. (Hôpitaux de Paris, France): Les hémopathies toxiques. (TOXIC HEMOPATHIES.) Clinique (Paris) 59:459-66 (Sept.), 1964.

Blood diseases due to occupational exposure are discussed. In Pb poisoning, one of the earliest hematologic signs is the presence of stippled erythrocytes. A count of >200 stippled cells/million of erythrocytes is indicative of Pb poisoning. Pb anemia is rather infrequent, even though severe cases of isochromic type, of <2 million, have been reported. A diagnosis of Pb anemia is suggested by an increased content of Pb in the blood (normal, 30-80 µg Pb/100 ml blood), an increased level of urinary coproporphyrins (normal, <100 µg/24 hr) and such clinical signs as Pb colic, arterial hypertension with renal insufficiency and Burton's line. Although occupational Pb intoxication is usually recognized by industrial surveillance, alimentary Pb poisoning may occur without being diagnosed. Alimentary Pb poisoning may be caused by Pb pipes of the water supply, by flour which has been ground in mills repaired with Pb parts, by grape juice from vines treated with Pb arsenate, or by venison from deer shot with Pb. Recently, poisoning by Pb stoppers used for vinegar bottles has increased. There is no special treatment of Pb anemia. Workers demonstrating increased counts of stippled erythrocytes and even a moderate anemia should be removed from exposure.

- 2780** Pilat, L., Preda, N., and Muică, N. (Oc-



cup. Dis. Clinic, Bucharest, Romania): Diagnosticul saturnismului. (DIAGNOSIS OF LEAD POISONING.) Medicina Internă 16:1101-8 (Sept.), 1964.

The authors discuss the various diagnostic criteria for Pb poisoning on the basis of laboratory tests and the classical signs. The normal metabolism of Pb has been determined by them as follows: Pb in blood, from 10-40 µg, and in urine, 10-80 µg/100 ml; in feces, 0.2-0.4 mg/24 hr; in spinal fluid, 0-18 µg/100 ml. The body burden may range from 100-300 mg. Treatment is also discussed. In closing, they point to the extreme infrequency of the occurrence of radial paralysis and encephalopathy in adult Pb poisoning; for these forms, diagnosis has to be based on intense and prolonged exposure to Pb; clinical signs and laboratory results indicating excessive absorption. It emphasizes that only specialists in occupational diseases and in neurology can give the correct diagnosis.

- 2781 Pines, A.G.: Nekotorye pokazateli gumoral'noi regulatsii u lits, podvergayushchikhsya dlitel'nomu vozdeistviyu svintsa (Predvarit. soobshenie). (SOME VARIABLES OF HUMORAL REGULATION IN PERSONS SUBJECTED TO THE PROLONGED ACTION OF LEAD: A PRELIMINARY COMMUNICATION.) Gigiena Truda Zdorov'ya; Kiev. 179-85, 1964.

Examinations were made of 14 men and 18 women who had been subjected to the action of Pb (linotypists, printers, solderers, and molders). All of those examined were young or a little older and their work history ranged from 1-10 yr. The Pb content of the urine of the patients was 0.01-0.05 mg/l, the number of erythrocytes with basophilic granules reached 2-28/10,000 erythrocytes, and the number of reticulocytes was 33%. The concentration of 17-ketosteroids in the daily urine was low. The sc injection of 3 ml of a 5% solution of ephedrine increased the concentration of 17-ketosteroids in the urine and caused an intensified eosinophil reaction. After taking a standard meal (1200 cal) and also 45 min and 1-1/2 and 3-1/2 hr after the injection of 1 ml of a 5% solution of ephedrine, the leukocyte reaction proved to be inhibited or absent altogether (in 9). It was distorted in 15 persons. Patients with chronic Pb poisoning showed disturbances in the activity of the hypothalamic-hypophyseal-suprarenal apparatus. (From Ref. Zh. Otd. Vypusk. Farmakol. Khimioterap. Sredstva Toksikol., 1966, No. 1.54.806; Biological Abstracts 48:Abstr. No. 96297, 1967)

- 2782 Pokrant, H., and Witek, E. (Inst. Stomatol., Danzig, Poland): Stan błony śluzowej jamy ustnej u robotników mających styczność z ołowiem. (THE CONDITION OF THE MUCOUS MEMBRANE OF THE ORAL CAVITY IN WORKERS DEALING WITH LEAD.) Czasopismo Stomatologiczne 17, No. 5:451-6, 1964.

The influence of Pb on the mucous membrane of the mouth in chronic Pb poisoning was studied in 90 workers employed in shipbuilding in Danzig. These men who were occupied with preserving and painting ships and ship furnishings were continuously ex-

posed to Pb. A considerable number of these subjects showed an increased level of Pb in blood and urine, stippled erythrocytes and porphyrinuria. Some of those with prolonged exposure to Pb had a Pb line, gingivitis and inflammation of the oral cavity.

The authors concluded that a Pb line is not a constant and essential symptom of Pb poisoning though it may be significant in the diagnosis of chronic Pb poisoning. On the other hand, the absence of a Pb line does not exclude Pb poisoning. For a dependable diagnosis of Pb poisoning, clinical tests must be combined with laboratory tests.

- 2783 Preda, N., Lillis, R., Nestorescu, B., and Roventa, A. (Inst. Hyg., Bucharest, Romania): Valoarea descarcarii plumbului prin Ca-EDTA-Na<sub>2</sub> în vederea diagnosticului saturnismului. (THE VALUE OF ELIMINATION OF LEAD BY MEANS OF Ca-EDTA-Na<sub>2</sub> IN THE DIAGNOSIS OF LEAD POISONING.) Medicina Interna 15, No. 9:1109-12, 1964.

See Abstract No. 2611.

- 2784 Preda, N., Niculescu, T., and Rafaila, E. (Internatl. Metal Workers Federation, Bucharest, Romania): Tratamentul saturnismului prin agenti chelanti. (THE TREATMENT OF LEAD INTOXICATION WITH CHELATING AGENTS) Igiena (Bucharest) 13, No. 3:233-42, 1964.

Treatment of Pb-poisoned patients in the Clinic for Occupational Diseases, Bucharest, with iv injections of 2 g CaNa<sub>2</sub>EDTA/day for 2-20 days markedly increased urinary excretion of Pb. Oral doses of 4-6 g EDTA/day were less effective.

- 2785 Primakov, S.V., and Khaselev, Ya.P. (USSR): Klinika ostrogo otravleniya glazur'ya. (CLINICAL ASPECTS OF ACUTE POISONING BY GLAZED POTTERY UTENSILS.) Klinicheskaya Meditsina 42:128-30 (June), 1964.

The authors remark that acute Pb poisoning from glazed pottery occurs seldom, as very high concentrations are required to be leached into food, so that unusual circumstances would have to exist. A large role in the course of poisoning is played by individual sensitivity or susceptibility to Pb, by weakened defense mechanism, and other internal disturbances.

In illustration of the above statements, the authors had observed acute Pb poisoning in 3 individuals who had consumed homemade kvas that had been allowed to ferment in a glazed pottery container for 3-4 days. Analysis of the kvas showed a Pb content of 300 mg/l. One of the hospitalized patients, a 50-yr-old woman, died within 10 days following intense gastroenteric and urinary disturbances, anemia, and liver lesions with jaundice, despite heroic treatment. A 46-yr-old male, after developing signs of toxic hepatitis with jaundice, recovered after treatment. The third patient, who had consumed a small quantity of the kvas, refused hospitalization. He showed transient porphyrinuria, slight yellowing of the sclera, moderate albuminuria. He recovered after ambulatory treatment.

- 2786 Quer-Brossa, S., Estadella-Botha, S., Baselga Monte, M., and Fornells Martinez,

E. (Barcelona, Spain): El tratamiento de las manifestaciones neurológicas de la intoxicación por el plomo. (TREATMENT OF THE NEUROLOGIC MANIFESTATIONS IN LEAD POISONING.) In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. II, pp. 917-8.

Among 111 men with Pb poisoning (of a total of 1600 employees periodically examined) who had worked for an av of 15.8 yr as founders, printers, typographers or in a litharge and storage battery plant, 11 showed neurologic symptoms. One patient who was mentally deficient exhibited electroencephalographic as well as electromyographic changes. In patients who had had a paralysis of long standing, the mobilization test produced a 100- to 150-fold increase of urinary excretion of Pb. The electromyogram was particularly useful in revealing the neurogenic signs in Pb poisoning. These cases were treated with  $\text{CaNa}_2\text{EDTA}$  by a 2-hr iv infusion of 300 ml of an isotonic glycosaline solution containing 1 g EDTA. Tolerance to the drug was tested by giving this dose once daily for 3 days; after 1 wk, the dose was administered twice weekly for 3 mo to 1 yr. The highest total dose of EDTA administered was 50 g in 9 mo. The chemical laboratory tests gave normal results after treatment. Among 4 cases who had had severe encephalopathic lesions for a protracted period of time, clinical improvement was seen in 1 while the results in the other 3 were slight or nil. With the exception of 1 patient with paralysis of both extensors, all, including those with severe peripheral nerve damage, recovered clinically and functionally.

The authors state in conclusion that neurologic disorders caused by Pb and its compounds, should not be considered as mere complications in Pb poisoning but as clinical types of the disease. He also states that actually the peripheral nervous system is more affected than the central nervous system. An early diagnosis is indispensable so that an effective early treatment may be instituted.

**2787** Questions and Answers: TRACE ELEMENTS AND LEUKAEMIA. British Medical Journal 1:1237 (May 9), 1964.

The question is posed whether there is a possible association between trace elements and leukemia, whether there is any evidence of blood dyscrasia in metal poisoning, and whether a "leukemic picture" as a result of metal poisoning has ever been reported.

The answer states that no definite association has been proved between the absence or presence of trace metals in the etiology of leukemias. However, blood dyscrasias such as secondary thrombocytopenic purpura, aplastic anemia and agranulocytosis have been reported after exposure to or ingestion of compounds of Pb, As, Au, Hg and other metals. A leukemic picture has been observed following ingestion of or exposure to Pb and As and a case of agranulocytosis terminating in acute leukemia has been noted after exposure to Pb and treatment with sulfonamide.

**2788** Questions and Answers: CHELATION IN THE

DIAGNOSIS OF LEAD POISONING. Journal of the American Medical Association 188:478 (May 4), 1964.

The question concerning the accuracy of laboratory tests for Pb poisoning was answered by M. Rubin as follows: In subacute Pb poisoning resulting from the cumulative effect of Pb inhalation, skin absorption or ingestion in food or water, blood and urine levels of Pb are sharply elevated from the normal ranges of 1-90  $\mu\text{g}$  (mean 40  $\mu\text{g}$ )/100 ml and 0-100  $\mu\text{g}$  (mean 27  $\mu\text{g}$ )/l, respectively. There is stippling of the red blood cells and increased urinary coproporphyrin. Pb lines in bones occur seldom, except in children. In chronic Pb poisoning due to long-term, low-level increased Pb absorption, Pb concentrations in blood and urine are in the high-normal or slightly elevated range. There is marked stippling of the erythrocytes and a high increase of urinary coproporphyrins. Anemia occurs in both subacute and chronic Pb poisoning. A dose of 0.3-2.0 g of  $\text{CaNa}_2\text{EDTA}$  resulting in urinary excretion of >1 mg Pb within 24 hr confirms the suspicion of an excessive body burden of Pb. The accuracy of all these tests depends on the availability of a well-directed laboratory where competent studies can be done.

(See also letter by R.A. Kehoe, July 27, 1964 issue of the Journal.)

**2789** Raffi, G.B., and Alessandri, M. (Univ. Bologna, Italy): DEFERRIOXAMINE B AND CHELATION OF LEAD IN VIVO AND IN VITRO. Giornale Clinica Medica 45, No. 4:351-9, 1964.

For the in-vitro tests, urine containing  $\sim 1 \mu\text{g}$  Pb/100 ml, was reacted with 20  $\mu\text{g}$  Pb/10 ml. Then, 100 mg deferoxamine (DFO) and 50 mg  $\text{CaNa}_2\text{EDTA}$ , respectively, was added to 10-ml aliquots. Pb determinations showed that 50% of the Pb present was chelated with DFO and 100% with EDTA.

In-vivo tests were made with 1 normal individual and 2 subjects showing clinical signs of chronic Pb poisoning. After determination of the Pb level in blood and urine, the subjects were given 3 daily im injections of 1 g DFO and after a 3-day interval the normal subject and 1 patient received iv 3 injections of EDTA to a total of 1500 mg and the other patient up to 1000 mg. DFO produced diuresis, and only a modest urinary elimination of Pb; EDTA eliminated much more Pb. The use of DFO for treatment of Pb poisoning is considered to be of doubtful value. (From Chemical Abstracts 61: 15240, 1964)

**2790** Rasetti, L., and Pettinati, L. (Univ. Turin, Italy): Chelanti e metabolismo profirrico. (CHELATING AGENTS AND PORPHYRIN METABOLISM.) Minerva Medica 57, No. 7:219-23, 1964

The effects of EDTA and deferoxamine on the porphyrin metabolism were studied in 2 cases of Pb poisoning, 2 with hepatic cirrhosis and 1 with acute intermittent porphyria. Deferoxamine had no effect on urinary Pb excretion in Pb poisoning. Urinary coproporphyrin and erythrocyte protoporphyrin decreased by  $\sim 40\%$  with both drugs.

**2791** Rashevskaya, A.M., and Zorina, L.A.: (Central Inst. Advancement Physicians,

Moscow, USSR): Rol bazofil'no-zernistykh eritrotsitov v diagnostike svintsovykh intoksikatsii. (ROLE OF BASOPHIL-STIPPLED ERYTHROCYTES IN THE DIAGNOSIS OF LEAD POISONING.) Gigiena Truda i Professional'nye Zabolevaniya 8:20-6 (June), 1964.

Blood tests made on Pb smelters showed a great variability in the number of stippled erythrocytes even under continuous exposure to Pb. No correlation was observed between the number of stippled erythrocytes and other symptoms caused by Pb poisoning. (From authors' English summary)

- 2792** Richet, G., Albahary, C., Ardaillou, R., Sultan, C., and Morel-Maroger, A. (Hosp. Tenon, Paris, France): Le rein du saturnisme chronique. (THE KIDNEYS IN CHRONIC LEAD POISONING.) Revue Française d'Études Cliniques et Biologiques 9, No. 2:188-96, 1964.

A study was made on 8 men, aged 29-58 yr, who had been exposed to Pb occupationally and who displayed definite signs and symptoms of Pb poisoning. Excessive Pb absorption was confirmed by iv injection of 500 mg EDTA which resulted in urinary excretion of 800-6000 µg Pb/24 hr. Six of the patients showed neither proteinuria nor abnormal urinary sediment; however, light or electron microscopy revealed interstitial, vascular or tubular lesions in 5 of them. Severe glomerular lesions were found in the 2 patients who had proteinuria. Arterial pressure was normal during rest in 6 patients, but immersion of the forearm in cold water caused hypertension in 4 of them. Global renal insufficiency was observed in 4 subjects who had been exposed to Pb for 8-25 yr. A discrepancy was noted always between the creatinine and urea clearances; uric acid excretion was impaired selectively; 3 men suffered from gout. Biopsies of the right kidney were made in 7 individuals. Light microscopy of these samples showed no particular lesions. Three of 4 samples, examined by electron microscopy, showed characteristic tubular lesions similar to those found in chronic experimental Pb poisoning. These observations suggest that there is a chronic Pb nephropathy which can be recognized even after some years' duration, and that possibly some forms of Bright's disease can be shown to be of saturnine origin. The importance of treatment with EDTA is emphasized. (18 references)

- 2793** Rodríguez Navarro, M. (Caracas, Venezuela): Limpieza de tanques de gasolina (con tetraetilo de plomo) en el medio tropical Venezolano. (THE CLEANING OF GASOLINE TANKS (WITH TETRAETHYLLEAD) IN THE TROPICAL ENVIRONMENT OF VENEZUELA.) In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. II, pp. 732-4.

Observations made in storage and distribution plants for TEL-containing gasoline, belonging to the Shell Company in northern and central Venezuela where the temperature ranges from 31-16° C and the humidity from 93-61%, are reported. Of a total of 96 tanks, 23, of a capacity of 619-6826 m<sup>3</sup>, are used for TEL-containing gasoline. Every tank has

a door through which a man can enter for cleaning the tank; these doors are kept open for 8 days before the cleaning begins. Every man who starts on this job is subjected to a thorough medical examination with detailed clinical and laboratory tests and is then furnished with special protective clothing and masks, which are carefully inspected after use. A companion-worker checks the length of time spent in the tank, which is limited to 15 min, whereupon the companion then enters the tank. Work within the tank (15 min) is alternated with a stay of 25-30 min outside it. Since the temperature in the tank is very high (from 32.7-33.3° C) and the clothing of the worker very heavy, pulse and arterial pressure are checked before and after the work. The man has to inspect first the technical parts of the tank and then to remove the sediment which, upon analysis, was found to contain 0.29% inorganic Pb as oxide and 0.24% organic Pb as TEL. The men assigned to this job are under constant surveillance of an industrial physician. They are rotated in their work and if any alarming signs are found, they are given weekly medical checks and removed from exposure. An educational program has been effective in having workers recognize the serious nature of risks involved.

- 2794** Rogulski, J., Senezuk, W., and Zegarski, W. (Med. Acad. Gdansk, Poland): (BEHAVIOR OF THIOL GROUPS IN THE SERUM OF MEN EXPOSED TO LEAD POISONING.) Gdanskie Towarzyst. Nauk. Wydział Nauk Mat., Przyrodniczych, Rozprawy Wydziału III No. 1:49-56, 1964.

The concentration of sulfhydryl (SH) groups in serum proteins was determined in 84 shipyard workers who had been working with paint containing ~80% red Pb for 2.8-4.5 yr. Based on values of blood and urinary Pb, urinary coproporphyrin and Hb, the subjects were divided into 3 groups: (1) 10 men showing symptoms of Pb poisoning, (2) 36 showing insignificant symptoms of Pb poisoning and (3) 38 exposed to Pb but showing no symptoms. Taking a serum SH content of 61.7 µM/100 ml, found in healthy young men, as the reference standard, 19 of the workers had normal serum SH values (57.94 µM/100 ml) and 65 workers lowered ones (52.44-45.01). Lowered SH values were found in all 3 groups; there were 8 in Group 1, 22 in Group 2 and 29 in Group 3. The decrease in serum SH concentration was not due to a decrease in the total concentration of serum proteins. (From Chemical Abstracts 64:16518, 1966)

- 2795** Roth, B., et al: (ON THE EFFECT OF CHRONIC EXPOSURE TO INDUSTRIAL POISONS ON THE ELECTROENCEPHALOGRAPH IN MAN.) Československá Neurologie 27:40-7 (Jan.), 1964. See Abstract No. 2616.

- 2796** Rotta, C., and Parigi, A. (Med. Dept. FIAT, Turin, Italy): Sulle variazioni della quantità di piombo assorbito da leghe Pb-Sn a diversa composizione percentuale. (VARIATIONS OF THE QUANTITY OF LEAD ABSORBED FROM A Pb-Sn ALLOY OF VARIOUS COMPOSITION.) In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International

Men working with a Pb-Sn alloy are exposed to metallic dust which may enter the organism by way of the digestive tract or by inhalation. The commonly used alloy contains 97% Pb and 3% Sn. The possible hazards of intoxication in men involved in this work were studied in vitro and in vivo. In-vitro experiments carried out with alloys containing 97% Pb-3% Sn, 75% Pb-25% Sn and 50% Pb-50% Sn, respectively, showed that the Pb amounts, dissolved after 6 hr in 0.1N HCl, were 17, 3.6 and 2.2%, respectively, of the total Pb present. In the in-vivo experiments, dogs were fed alloys containing 97 or 75% Pb. The Pb level in the blood of dogs fed the 75% Pb-containing alloy was <50% of that in the dog fed the 97% Pb-containing alloy. When 50% Pb-containing alloy was fed, the further decrease in the Pb level in blood was only slight. Similar results were obtained when dogs were exposed to the inhalation of the 3 alloys.

Studies were also done on 36 men engaged in filing alloys containing 97 and 75% Pb, respectively. The following data were obtained for the 2 groups, respectively (% in whom the abnormalities occurred): <4,000,000 red blood cells, 52.78 and 16.67%; Hb <80%, 69.45%; presence of stippled erythrocytes, 47.22 and 11.11%; Pb in blood >70 µg%, 61.12 and 19.45%; coproporphyrin >300 µg/l of urine, 61.12 and 25%. The greatly lesser hazard of using an alloy containing 75% Pb is pointed out.

- 2797** Russanov, E., and Balevska, P. (Bulgarian Acad. Sciences): Semiquantitative spektrochemische Bestimmung der Spurenelemente in Blut und Plasma. (SEMIQUANTITATIVE SPECTROCHEMICAL DETERMINATION OF TRACE ELEMENTS IN BLOOD AND PLASMA.) Comptes Rendus de l'Académie bulgare des Sciences 17, No. 5: 519-21, 1964.

Aside from their importance in the function of the liver, the trace elements have become of interest in more recent years because of the use of radioactive substances and nuclear technology.

Blood was collected from 17 male and female residents of Sofia, Bulgaria, age 20-40 yr. The blood and plasma samples were dried at 105°C and concentrated at a temperature not exceeding 500°C which resulted in a 100-fold concentration of the trace elements. A mixture of 66% NaCl, 4.4% CaO, 7.2% basic K phosphate and 22.4% powdered spectrochemically pure C was used as a comparison preparation. An ISP-22 spectrograph with electrodes of spectrochemically pure C was used for the measurements. The following data, in µg%, were obtained for blood and plasma, respectively: Cu, 50-150, 50-150; Al, 50-150, 10-45; Zn, 500-1500, 100-500; Mn, 0.5-2, 0.5-2; Ti, 5-15, 5-15; Pb, 15-50, 5-20; Ni, 0-0.20, 0.2. The high Pb values may have been caused by the high Pb content of most soils in Bulgaria attributed to the occurrence of Pb ores.

- 2798** Russanov, E., and Balevska, P. (Bulgarian Acad. Sciences): Razpredelenie na mikroelementi v serumnite proteini. (DISTRIBUTION OF TRACE ELEMENTS IN SERUM PROTEINS.) Izvestiya na Instituta po Fiziologia, Bulgarska Akademiya na Naukite 8:201-7,

1964.

The distribution of Cu, Ti, Al, Ni, Mn, Cr, Pb and Zn in the serum proteins and in dialyzed and native serum of 605 normal men and women was determined by a semiquantitative spectrochemical method. An acetone precipitation method was used for the fractionation of the serum proteins. Depending on the strength of the bond between the metal and the protein in the precipitation with acetone, the metal-protein complexes were divided into the unstably and stably bound ones. The concentrations of Pb were as follows, in µg%: serum, 15-45; dialyzed serum, 2-6; total protein, 1.5-4.5; albumin, 0.3-1; globulin, 1.2-3.5. The globulin fraction, therefore, contained the basic quantity of Pb bound with the proteins.

- 2799** Rustagi, J.S. (Univ. Cincinnati, O.): STOCHASTIC BEHAVIOR OF TRACE SUBSTANCES. Archives of Environmental Health 8:68-76 (Jan.), 1964.

The lognormal distribution is proposed for the random phenomena of the intake and output of trace substances in the human system. Experimental data on Pb and other trace metals entering the human organism through food, beverages, and air, and excreted through feces, urine, and air are utilized to fit this distribution. Graphical procedures are employed to test the assumption of lognormality. Some results of queueing theory in probability are indicated. Through their use a mathematical model for the amount expected to be stored in the body is presented. (From author's summary) (30 references)

- 2800** Sagara, M., Dodo, H., Munaka, M., and Yoshinaga, F. (Hiroshima Univ. Med. School, Japan): (STUDIES ON LEAD POISONING FOLLOWING THE USE OF OXYACETYLENE TORCH CUTTING OF LEAD-PAINTED STEEL ON A SHIP. 4.) Hiroshima Medical Journal 12:5-10 (Feb.), 1964.

Statistical studies were made on hemograms and urine coproporphyrin content of 73 oxyacetylene-torch cutters of Fe, 8 gas cutters of nonferrous metals, 10 helpers for gas-cutting workers and 6 other workers not engaged on metal cutting work, Pb poisoning having been found to occur in workers using oxyacetylene torches for cutting Pb-painted steel. Differences of Pb content in the blood were found among the various grades of workers, with 1% of error. The Pb content in the blood of Fe-gas-cutters, nonferrous-metal cutters, helpers and clerks was 76.6 µg/100 ml, 42.8 µg/100 ml, 36.6 µg/100 ml, and 30.2 µg/100 ml, respectively. Although some evidence of anemia was found in the hemograms of some Fe-gas-cutters, no case of coproporphyrin-positive urine was found in any of the worker groups. The results obtained suggest that workers engaged in breaking-up ships incur a danger of Pb poisoning, and periodical physical examinations of such workers are advisable. (From Excerpta Medica, Sect. 17, 11:Abstr. No. 6471, 1965)

- 2801** Saita, G., and Moreo, L. (Univ. Milan, Italy): La determinazione dell'acido deltaaminolevulinico sierico ed urinario ai fini della diagnosi di progressa in-

tossicazione da piombo. (DETERMINATION OF BLOOD AND URINARY DELTA-AMINOLEVULINIC ACID IN THE DIAGNOSIS OF PAST LEAD POISONING.) *Medicina del Lavoro* 55:357-64 (May), 1964.

The authors were among those who have in recent years investigated behavior of ALA in blood and urine in Pb poisoning. Since it is difficult to recognize certain symptoms as being due to prior Pb poisoning after exposure to Pb had been discontinued for some time, and the usual tests (ie, coproporphyrinuria, stippled erythrocytes, blood and urinary Pb concentrations) no longer give abnormal values, the authors wished to explore the value of determining ALA in blood and urine in such cases. Concurrently, the following were determined: Pb level in blood and urine, erythrocytic protoporphyrin, urinary coproporphyrin, blood counts, stippled erythrocyte counts as well as urinary Pb excretion after administration of 2 g of EDTA. Mobilization of Pb by EDTA was included because this test had already been found useful in demonstrating past abnormal exposure to Pb for up to 10 yr. Twenty-six subjects chosen for this purpose were divided into 3 groups: (1) 9 cases who had been removed from exposure to Pb 3 mo-1 yr; (2) 11 cases, 1-3 yr; (3) 6 cases, >3 yr to a maximum of 9 yr. The following av values were obtained for the 3 groups, respectively: ALA in blood, 0.065, 0.043, 0.032 mg/100 ml (normal maximum 0.026); ALA in urine, 29, 15, 4.56 mg/24 hr (normal, 1.3-2.8); free protoporphyrin IX in erythrocytes, 232, 225, 159  $\mu$ g/100 ml (normal 35-55). The results showed that ALA remained at significantly increased levels for up to 3 yr after cessation of exposure. For periods >3 yr, the values were only slightly higher than normal and therefore could not be used for diagnostic and medico-legal purposes. The inhibition of ALA-dehydrogenase by Pb is evidently shorter than that of heme-synthetase. The values of erythrocytic protoporphyrin remained significantly increased. While levels of Pb in urine, especially in groups 2 and 3 remained within or scarcely above normal, those provoked by EDTA were regularly increased even in the cases that had been free from exposure to Pb for the longest period of time. The other criteria examined showed deviations consistent with the length of time away from exposure to Pb, with Groups 2 and 3 exhibiting almost normal values.

**2802** Samuels, S. (New York Univ. Med. Center, N.Y.): HIGH-RESOLUTION SCREENING OF AMINO-ACIDURIAS. *Archives of Neurology* 10:322-6 (March), 1964.

High-voltage paper electrophoresis alone or in a bidimensional system with a fairly rapid chromatographic solvent gives excellent resolution of the amino acid components of tissue samples or unsalted urine specimens. This procedure carried out for 1 hr at pH 1.9 is sufficient to distinguish the urinary amino acid patterns in phenylketonuria, maple syrup disease, histidenemia and Pb poisoning. Detection is enhanced by using a ninhydrin reagent. (From author's summary; 22 references)

**2803** Sanders, L.W. (Univ. Cincinnati, O.): TETRAETHYLLEAD INTOXICATION. *Archives of*

*Environmental Health* 8:270-7 (Feb.), 1964. In discussing TEL intoxication, the author first points out that, considering the toxicity and the volume of TEL produced and used, no other product has had a better record with respect to illness associated with its handling and distribution. Almost all, if not all, cases of intoxication on the American continent have been reported to, or investigated by, the staff of the Kettering Laboratory. Not counting the cases that had occurred in the development and early manufacturing years, there have been 88 cases, among them 16 fatal, in the US and Canada.

A sound history of valid evidence of the absorption of dangerous quantities of TEL is of utmost importance in the diagnosis of TEL intoxication as the signs and symptoms are not specific for the disease. Unlike the inorganic Pb compounds, TEL is confined in its distribution to only 1 industry, the petroleum, and to only 1 use, that of anti-knock agent, thus confining generally the possibilities of exposure. These are in the cleaning and repairing of tanks for the storage of gasoline, in the TEL manufacturing plant, in handling TEL in gasoline refineries, and in the transportation of antiknock compounds containing TEL. Exceptional circumstances involving exposure have ranged from the ingestion of TEL accidentally or with suicidal intent, to its mistaken use as an insecticide; also, in the emergencies of World War II, carelessness in observing precautions had led to unauthenticated cases of poisoning. A history of exposure in any of these occupational situations is not necessarily or even probably associated with a dangerous degree of exposure to TEL. Inquiry must be made as to the possibility of absorption of TEL. The approximate permissible concentration of TEL in the air in areas where men work >40 hr/wk, is of the order of 75  $\mu$ g Pb/m<sup>3</sup>. Concentrations of 1.00, 0.6, 0.4, and 0.28 mg/m<sup>3</sup> will be tolerated without risk for 1, 2, 3, and 4 hr, respectively. Illness may be induced by continuous respiratory exposure for 1 hr to 100 mg Pb/m<sup>3</sup>. Washing with kerosene followed by soap and water within 15 min after contact eliminates the danger of percutaneous absorption of toxic quantities of TEL. The period between exposure and onset of the earliest symptoms may be as long as 10 days or as short as 6 hr. The more severe the exposure, the quicker is the onset of symptoms. The 1st symptoms of poisoning are of nervous irritability, insomnia, excessive dreaming, followed by anorexia, diarrhea, pallor, lowered blood pressure and tremor. Constipation has not been seen. There is no change in the blood picture nor in the porphyrin metabolism, as in inorganic Pb poisoning. In TEL poisoning, the Pb concentration in the blood is only slightly elevated or normal; in the urine it is appreciably higher than in poisoning by inorganic Pb. TEL intoxication exhibits itself purely as a psychotic state. Although recovery is uncertain when a patient has gone into a deep coma, no residual damage has been seen in patients who have recovered from the most severe forms of poisoning. Treatment is essentially symptomatic and supportive, with heavy and prolonged sedation, although the short-acting barbiturates are more easily controlled. The patient must be restrained. Shock therapy has been used with seemingly excellent results.

- 2804** Savićević, M., and Petrović, Lj.: O novijim pogledima na terapiju industrijskog saturnizma. (NEW VIEWS ON THE TREATMENT OF OCCUPATIONAL LEAD POISONING.) Vojnosanitetski Pregled 21:173-7 (Mar.), 1964.

The effectiveness of EDTA therapy using Mosatil in various strengths iv, im or as tablets was studied on groups of patients with chronic Pb poisoning and compared with nontreated controls. The following criteria were examined over 7 days of treatment: basophilic stippling, Hb content of erythrocytes, number of reticulocytes, urinary excretion of Pb and coproporphyrins, and blood Pb, as well as subjective complaints. The conclusion reached was that it be considered the drug of choice in the treatment of Pb poisoning.

- 2805** Schales, F. (Max-Planck-Inst., Frankfurt/M., Germany): THE EXCRETION OF THORIUM X AND ITS DAUGHTER PRODUCTS AFTER INTRAVENOUS INJECTION IN MAN. In Assessment of Radioactivity in Man. Vienna, International Atomic Energy Agency, 1964, Vol. 2, pp. 267-76.

ThX is used in Germany for the therapy of Spondylarthrosis ankylopoietica, whereby 250-350  $\mu$ Ci are injected intravenously in weekly doses of  $\sim 32$   $\mu$ Ci. The body burden was checked by means of a whole-body counter by moving a NaI crystal along the body axis and feeding the pulses of the crystal to a multichannel analyzer. Exhaled thoron was measured with a vibrating-reed-electrometer; feces and urine were measured without chemical treatment under a NaI crystal in a steel and Hg shield. The body burden decreased by  $\sim 40\%$  during the 1st 8 days and more slowly thereafter. Because of the rather long sojourn time of the feces in the intestine, fecal excretion reached a maximum 1-2 days after injection; excretion by urine started shortly after injection. The decrease of the body burden, the amount of excreted ThX and ThB, and the exhalation of thoron can be described by power functions in the 1st period and by exponential functions in the 2nd period. It is suggested that the therapeutic use of ThX may serve as a test in vivo of the behavior of the short-lived Ra daughter products  $^{220}\text{Rn}$ ,  $^{212}\text{Pb}$  and  $^{212}\text{Bi}$ .

In the discussion, C.J. Maletskos commented that in similar work he found that most of the  $^{212}\text{Pb}$  remained in the blood after injection and, until this decayed, the  $\gamma$ -output of the body would be more representative of the activity distributed in blood than of Ra going to or distributed in bone. The lack of equilibrium between  $^{212}\text{Pb}$  and  $^{224}\text{Ra}$  due to the injection procedure might cause additional complications in the  $\gamma$ -output of the body, although the effect of this could be minimized.

- 2806** Schilling, R.S.F. (London School of Hygiene and Trop. Med., England): OCCUPATIONAL HEALTH UNDER NATIONALIZED SYSTEMS OF MEDICAL CARE. Bulletin of the New York Academy of Medicine 40:591-9 (Aug.), 1964.

In introducing his address, the author states his intention of outlining some of the major defects in the British health services which result from a "laissez-faire attitude towards the health of

people at work" rather than from a nationalized system of medical care. Following a discussion of the latter, the program of prevention of chronic disease, and the role of the occupational physician therein, the British occupational health services are discussed. These are: services provided voluntarily by the employer as he pleases and with no set standards; the nationalized industries (coal, gas and electricity) required to establish occupational health services, and the Factory Inspectorate of the Ministry of Labour which maintains minimal standards of health, safety and welfare in certain types of operations through the Factories Act. The deficiencies of the latter services are briefly stated, and after describing the example of the successful control of Pb poisoning by the Chloride Battery Company and by other large companies belonging to the Battery Manufacturers' Association through their own services since 1930, the author wonders if it is possible for services run by the state to maintain their enterprise after the pioneering days are over. In the factories above between 1930 and 1961 there were 24 notified cases of Pb poisoning while in the remainder of the battery companies and small firms dependent on governmental services, there had been 346 notifications for the same period. In closing, the author sees no reason why Britain and US should not follow the recommendations of the International Labour Conference (1959) which had been accepted by the European Common Market countries in 1962, and urges that in the interests of the employee and efficiency of industry, some provisions must be made at the work place for both medical care and environmental hygiene.

- 2807** Schlenker, F.S., Taylor, N.A., and Kiehn, B.P. (Veterans Admin. Hosp. Memphis, Tenn.): THE CHROMATOGRAPHIC SEPARATION, DETERMINATION, AND DAILY EXCRETION OF URINARY PORPHOBILINOGEN, AMINO ACETONE, AND  $\delta$ -AMINOLEVULINIC ACID. American Journal of Clinical Pathology 42:349-54 (Oct.), 1964.

Twenty-four hr urine samples were obtained from a group of 57 adults and 63 children, 5-16 yr old, chosen randomly. Urinary porphobilinogen (PBG), amino acetone (AA) and  $\delta$ -aminolevulinic acid (ALA) were separated by adsorption on Dowex 2, Amberlite CG-50 and Dowex 50W, respectively. After elution, the latter 2 metabolites were converted to pyrroles with acetyl acetone and all 3 reacted with p-dimethylaminobenzaldehyde. When known amounts of the 3 metabolites were added to urine and analyzed by the above described method, recoveries ranged from 89-94%. Ranges of daily urinary excretion values of PBG, AA, ALA and total porphyrins of this group were tabulated and used as controls. Excretion rates of the 3 metabolites were also studied in 3 cases of acute intermittent porphyria, 2 of porphyria cutanea tarda, 2 of Pb poisoning and some patients with cirrhosis, Hodgkin's leukemia, multiple myeloma, sickle cell anemia and cancer. In 1 of the Pb patients, the daily urinary excretions before and after treatment with  $\text{CaNa}_2\text{EDTA}$  were, respectively,  $\mu\text{g}$ : PBG, 1000 and 190; AA, 652 and 648; ALA, 21,250 and 2110; total porphyrin, 1400 and 143. Corresponding values for

the 2nd subject who had a longer exposure to Pb paint were: 3500 and 807; 414 and 613; 57,000 and 16,417; 1930 and 1600. The results show that the excretion of PBG and ALA was increased in Pb poisoning and in acute intermittent porphyria whereas AA remained within control limits in all of the diseases studied in this investigation.

- 2808** Simpson, J.A., Seaton, D.A., and Adams, J.F. (Northern Gen. Hosp., Edinburgh, Scotland): RESPONSE TO TREATMENT WITH CHELATING AGENTS OF ANAEMIA, CHRONIC ENCEPHALOPATHY, AND MYELOPATHY DUE TO LEAD POISONING. *Journal of Neurology, Neurosurgery and Psychiatry* 27:536-41 (Dec.), 1964.

A case of chronic Pb poisoning in a 39-yr-old acetylene burner, who showed unusual neurological and hematological abnormalities, was reported. The man, who had been in his job for >20 yr, was treated in 1949 for abdominal pain and constipation caused by Pb poisoning, and in 1955 developed giddiness and occasional blackouts which in 1957 became more frequent. Simultaneously he noticed weakness and wasting of his right hand. When admitted to the hospital in January 1960 he stated that while burning Pb he rarely washed. He showed general psychologic impairment without specific defects, occasional twitching of muscles in all limbs. Among the laboratory findings, Hb was 8.8 g%, blood Pb levels were 27 and 28 µg%, urinary Pb 87 µg/24 hr, urinary coproporphyrin (I and III) 280 µg/24 hr. An electroencephalogram revealed no focal or paroxysmal disorders. Upon electromyographic examination it was concluded that there was evidence of denervation without significant collateral re-innervation (giant polyphasic units) and with normal nerve conductivity and neuromuscular transmission. The evidence pointed to a central lesion (myelopathy) rather than to a peripheral neuropathy. Subsequently (in January 1960) his urinary Pb output became 378 µg/24 hr. He was given oral penicillamine treatments of 300 mg every 6 hr, for 2 days, and subsequently 4 g EDTA daily for 9 days. The latter course was repeated at intervals during the next 3-4 wk. During this time, his Hb rose to 13.5 g%, and by October, to 15.1 g%. Blood Pb at that time was 18 µg% and urine Pb 106 µg%. One yr later, his muscle power was practically normal again and some clinical improvement continued when he was last seen in 1963, though electromyographic damage remained. The long-term follow-up (4 yr) suggests that the diagnosis of chronic Pb encephalopathy with toxic myelopathy was correct. It is believed that this case is the 1st in which Pb myelopathy has been reversed by treatment and that the small risk of mobilizing bone Ca by chelating agents in view of the danger of exacerbation of toxic symptoms was worth taking in this case.

- 2809** Singerman, A. (Univ. Buenos Aires, Argentina): STUDIES ON LEAD POISONING IN ARGENTINA. In *Forensic Immunology, Medicine, Pathology and Toxicology, Report of the Third International Meeting*, April 16-24, 1963. Amsterdam, Excerpta Medica Foundation, 1964, p. 133.

See following abstract.

- 2810** Singerman, A. (Columbia Univ., New York; Univ. Buenos Aires, Argentina): STUDIES ON LEAD POISONING IN ARGENTINA. *Archives of Environmental Health* 9:464-72 (Oct.), 1964.

Industry has developed markedly in Argentina over the last 40 yr, with metallurgy representing ~21% of it, of which ~2% involves Pb and Pb compounds. Although in several large-size establishments hygienic principles are respected, this is not the rule in numerous small workshops where the hazard of handling such material is either ignored or underestimated. The purpose of the present study was to establish a program for the early diagnosis of excessive absorption of Pb in people working in Pb industries and in those living in the neighborhood of Pb plants. The author considers blood counts and a finding of basophilic stippling only of relative diagnostic value since he found several cases with clinical evidence of Pb poisoning where stippled cells were not present and the anemia was rather slight. According to his experience, the most important tests are determination of the Pb level in blood, of the urinary ALA, and of coproporphyrin. A discussion of methods for the determination of the above criteria is followed by a report of analyses made on 10 workmen of a factory where Pb from galena is refined and molded into ingots, 2 workers and 2 administrative employees of a battery plant, and a group of people living in the neighborhood of a plant manufacturing Pb oxides. Good correlations were always found between urinary ALA, coproporphyrin excretion and Pb concentrations in blood. From this, the author concludes that both ALA and coproporphyrin estimations are able to reflect an abnormal Pb absorption. In some cases, an increase in excretion of ALA proved to be an earlier sign of impaired heme synthesis due to Pb than did an increase of coproporphyrin excretion. There was also an increase in the total aminoaciduria in almost every case of Pb poisoning. However, further studies are believed necessary to obtain reliable data. (47 references)

- 2811** Sinha, J.K. (Centr. Mining Research Station, Dhanbad, India): STUDIES ON THE NATURE AND SIGNIFICANCE OF ERYTHROCYTE STIPPLING IN LEAD WORKERS. *Indian Journal of Industrial Medicine* 10, No. 4:159-67, 1964.

Seventeen Pb workers were examined for stippled erythrocytes. The blood film was stained with methylene-blue and the stippled cells were counted both under dark-ground illumination and transmitted light. The data obtained by dark-ground illumination were twice as large as those obtained by transmitted light and varied in the range of 400-2600/million erythrocytes. Since there is an individual variation in susceptibility to the toxic action of Pb it is not possible to establish the level of stippled cells which may be considered to be the deciding factor for the diagnosis of industrial Pb poisoning. Other tests, such as red blood cell count and determination of Hb and urinary coproporphyrin could not be done. In such cases where only the stippled cell count can be undertaken, the author feels strongly that counts up to 2600 stippled cells/million erythrocytes

found by dark-ground illumination may not be considered unsafe in Pb workers. (From *Excerpta Medica*, Sect. 17, 11:Abstr. No. 6697, 1965)

- 2812** Skripnichenko, Z.M. (Ukrainian Sci.-Res. Inst. Eye Dis., USSR): Kliniko-eksperimental'nye issledovaniya patogeneza toksicheskoi glaukomy. (CLINICAL AND EXPERIMENTAL INVESTIGATION OF THE PATHOGENESIS OF TOXIC GLAUCOMA.) *Oftal'mologicheskii Zhurnal* 19:597-603, 1964.

Following a review of the literature on the subject, the author describes the results of clinical studies performed in the Institute on 563 workers exposed to TEL. Pathologic intraocular tension was found in 38%. As observed in the out-patient department, irregular diurnal fluctuations of the tension were found in 88 workers. These disturbances were followed in 53 workers for 2-5 yr. The maintenance of visual acuity and visual field in these persons could be explained by the presence of high intraocular tension in the central artery of the retina.

In experiments with rabbits, TEL caused disturbances of the regulation of intraocular tension, a decrease in the cholinesterase activity in blood, and an increase of protein in the aqueous humor. Compression of the eye produced a decrease in intraocular tension and increase in the outflow of the aqueous humor. The author concludes that the disturbance of regulation of intraocular tension in the workers under observation and in the experimental animals appeared to be one of the symptoms of TEL intoxication and was accompanied by the presence of general vasovegetative disturbances. Tonographic data, indexes of functional conditions of the eye, and the clinical course of TEL poisoning point to the hypersecretory character of congestive toxic TEL glaucoma. (From author's summary; 26 references)

- 2813** Sluka, F., and Stenzel, E.: Bleigefährdung in Akkumulatorenfabriken. (THE LEAD HAZARD IN ACCUMULATOR FACTORIES.) In *Die Amtstätigkeit der Arbeitsinspektorate im Jahre 1963*. Vienna, Austria, Zentral-Arbeitsinspektorat, June, 1964, p. 106-11. A study was carried out in 4 factories. Along with the determination of the Pb concentration in the ambient air, the workers were subjected to medical examination. Since many of the men were employed in different workplaces with varying Pb exposure, it was difficult to decide whether pathological symptoms accompanied high atmospheric Pb concentrations. However, there was a definite correlation between the results of the medical examination and the atmospheric Pb concentrations. (From *Occupational Safety and Health Abstracts* 3, No. 7: 419, 1965)

- 2814** Sroczyński, J. (Clinic of Internal Diseases, Zabrze, Poland): Kryteria kliniczne i biochemiczne rozpoznawania zatrucia ołowiem. (CLINICAL AND BIOCHEMICAL CRITERIA OF LEAD POISONING.) *Polski Tygodnik Lekarski* 19, No. 15:541-45, 1964.

The results of clinical and laboratory examinations done on 150 persons were analyzed in an attempt to correlate the findings with the clinical signs and

forms of Pb poisoning. Since this disease may be considered as resulting from an interference with the activity of enzymes, the author proposes that the milder forms, in which clinical signs have not yet appeared, be designated as "Pb poisoning prodromes," instead of "signs of Pb absorption."

The various degrees of poisoning are discussed and tabulated as to the following diagnostic criteria: stippled erythrocytes, coproporphyrinuria, aminolevulinic acid in urine, Pb in blood and urine, red-cell count, Hb, glutathione in blood, phosphatase, and the clinical findings observed. Aside from giving values in healthy individuals, those in the "prodromal stage," in the mild, moderately severe and severe chronic forms of poisoning as well as in the acute, are tabulated.

- 2815** Sroczyński, J., Buczkowski, M., and Wieczorek, M. (Inst. Occup. Med., Lodz, Poland): Wpływ zatrucia ołowiem na nerki. (THE EFFECTS OF LEAD POISONING ON THE KIDNEYS.) *Medycyna Pracy* 15, No. 3:139-44, 1964.

Thirty rabbits experimentally poisoned with Pb and 118 human subjects with occupational Pb poisoning were studied. Severe injury of the kidneys, particularly lesions in the tubular epithelium, but no alterations in vessels and glomeruli were seen in the rabbits. The clinical observation performed on the patients, which included laboratory tests (creatinine clearance, examination of urine, etc) demonstrated only a slight % of pathogenic changes.

The authors conclude that kidney injury depends on the degree of exposure and that the differences observed between experimental and occupational poisoning are due to this fact. (From authors' English summary)

- 2816** Sroczyński, J., and Urbanowicz, H. (Clinic for Internal Diseases, Zabrze, Poland): Perturbations de la synthèse de l'hème dans l'anémie saturnine. (DISTURBANCES OF THE SYNTHESIS OF HEME IN ANEMIA IN LEAD POISONING.) *Archives des Maladies Professionnelles, de Médecine du Travail et de Sécurité Sociale* 25:487-93 (Sept.), 1964.

Hemoglobin content, number of red blood cells and of stippled red cells, excretion of urinary ALA and presence of coproporphyrinuria were determined in 25 Pb-poisoned workers, aged 23-60 yr, and 16 controls without known exposure to Pb. Urinary ALA in the controls and in Pb-exposed subjects without clinical manifestations averaged  $1.8 \pm 0.08$  mg/l, while the patients with Pb anemia showed a range of 4.7-64 mg/l. (However, in the tabulation of the 25 patients, for 3 indicated as showing no clinical syndrome ALA of 3.6, 11.9, and 49.8 mg is given.) A correlation was noted between the amount of excreted ALA and the number of red blood cells as well as the number of stippled cells, the coefficients of correlation being -0.76 and 0.61, respectively. As the anemia improved upon treatment with  $\text{CaNa}_2\text{EDTA}$ , the number of stippled red cells and the excretion of urinary ALA decreased at a parallel rate. The mechanism of these phenomena with regard to reports in the literature and the authors' own results is discussed. The conclusion is drawn that the present studies indicate that in Pb poisoning the synthe-



sis of heme is disturbed at an early stage. The investigations are being continued. (33 references)

- 2817 Stahlhofen, W. (Max-Planck-Inst. for Biophysics, Frankfurt, Germany): MEASUREMENT OF THE NATURAL CONTENT OF  $\text{Th}^{228}$ ,  $\text{Ra}^{226}$  AND ITS DAUGHTERS IN THE HUMAN BODY. Vienna, International Atomic Energy Agency, 1964, Preprint SM-52/60, 22 pp.

The content and distribution of  $^{226}\text{Ra}$ ,  $^{228}\text{Th}$ ,  $^{210}\text{Po}$  and  $^{210}\text{Pb}$  were determined in the bones and soft tissues of persons ranging in age from 5-70 yr. The ratio of  $^{210}\text{Po}$  and  $^{210}\text{Pb}$  in the skeleton was found to be 0.8 on the av. (From Nuclear Science Abstracts 18:Abstract No. 36944, 1964)

- 2818 Stantschew, S. (Regional Hygienic Inst., Warna, Bulgaria): Prophylaxe des chronischen Saturnismus durch orale Anwendung von Kalzium-Natrium-EDTA. (PREVENTION OF CHRONIC SATURNISM BY ORAL USE OF CALCIUM-SODIUM-EDTA.) Zeitschrift für die Gesamte Hygiene und Ihre Grenzgebiete 10:180-6 (Mar.), 1964.

Since in Bulgaria, EDTA has not yet been used for the treatment or prevention of Pb poisoning, the author reports his observation on 24 workers engaged in the manufacture of Pb pigments. All showed signs of excessive absorption of Pb and all had earlier received treatment. The "test" group of 14 workers received orally twice a day for 8 days a 10% solution (10 ml) of the  $\text{CaNa}_2$  salt of EDTA, and 10 received no EDTA. Of the test group 4 had no complaints; 4 had periodic abdominal cramps; the others complained of various sorts of digestive discomfort, 1 had joint pain and in 1 the liver could be palpated. All showed facial pallor. Detailed blood and porphyrin tests and determinations of urinary Pb were made 1 day before administration was started, on the 5th day and 1 day after treatment was discontinued. Average urinary Pb excretion increased from an initial value of 0.149 mg/l to 1.174 on the 5th day and returned to 0.150 on the 11th day, that is, each man excreted a total of 7.894 mg Pb on the av over the 8 days of treatment. The control group that was not given EDTA, excreted an av of 0.115 mg Pb/l or a total of 0.920 mg over the 8-day period. In 3 men, urinary Pb was measured every 2 hr for 24 hr. Pb excretion had doubled within 2 hr after EDTA administration, increased 4- to 7-fold after 6-8 hr and kept on increasing up to the 24th hr. Coproporphyrin was positive in all 14 men before treatment; after treatment it was negative in 7, decreased in 5 and unchanged in 2, while there were no changes in the control group. Hemoglobin increased an av of 5.1% after the EDTA doses, stippled erythrocytes disappeared in all but 2 of the 14 patients. Objective and subjective improvement was obvious in all treated workers. The men were observed for 6 more mo. When 2 of them after 4 mo again showed indications of Pb poisoning, EDTA treatment was repeated and again was successful. Generally, no harmful effects of the treatment were noted and its use is recommended. It is contraindicated in cases of renal damage.

- 2819 Sterling, T.D. (Univ. Cincinnati, O.):

EPIDEMIOLOGY OF DISEASE ASSOCIATED WITH LEAD. Archives of Environmental Health 88: 333-48 (Feb.), 1964.

In introducing his discussion, the author distinguishes between classical and statistical epidemiology. Classical epidemiology deals with a relation between environmental characteristic and specific disease, which has an element of invariability, such as an investigation of the occurrence of signs and symptoms associated with Pb intoxication in a population exposed to appreciable amounts of Pb. Statistical epidemiology deals with a variable relation between environmental characteristics and subsequent disease, in which the environmental characteristic is one of many alternatives that may lead to a specific disease, for example, an investigation into the occurrence of neoplasia in a population exposed to Pb in their environment. Epidemiological methods and criteria for proof of association have been examined for application to investigations as to the effects of environmental Pb on exposed populations by covering the following topics: observations on the relationships of Pb in the environment and in the body, on the relation of Pb in the urine and blood to Pb intoxication, on the relation of the cumulative absorption of Pb to diseases other than Pb intoxication; and on the effects of prolonged exposure to low levels of Pb. The author concludes that while epidemiologic methods have been highly successful in helping man master his environment, it must be noted that epidemiology has never been applied with success, unless it has led to crucial laboratory experimentation. The tools available by epidemiology narrow down the conditions causing disease. However, the methods are neither infallible, nor easy, nor conclusive. The only conclusive proof is furnished by the fully described and reproducible experiment. In view of the known causal relationships between Pb and its effect on the body, the need for epidemiologic investigations may be much reduced.

- 2820 Sterling, T.D., Kehoe, R.A., and Rustagi, J.S. (Univ. Cincinnati, O.): MATHEMATICAL ANALYSIS OF LEAD BURDENS. Archives of Environmental Health 8:44-51 (Jan.), 1964.

Mathematical models illustrating the intake and output of Pb are presented. The mathematical analysis coincides with data found experimentally for 2 healthy subjects whose pattern of Pb ingestion and excretion was established for normal conditions and for prolonged exposure to Pb in a respiratory chamber. Urinary excretion of Pb was stable in the pre-experimental period. When the subject spent 3 hr every other day in the chamber, urinary Pb excretion increased rapidly and then reached a new level of equilibrium. When another equal increment of Pb was added to the subject's body burden by increasing the time of exposure to 6 hr, urinary Pb excretion increased again. The differences in the levels at which equilibrium was established and re-established were approximately equal. From the fit of the data to the mathematical model, appraisal of the body burden of Pb may be made by working with practical equilibrium states. When known increments of absorbed Pb result in stable rates of increased elimination, it is possible to ascertain: the amount of this Pb

retained by the body and that eliminated; and amounts of Pb actually absorbed from the amount excreted. It is pointed out that data obtained from 2 subjects are not sufficient to provide bases for general application and that experiments are now under way with additional subjects. However, investigations with 12 subjects showed patterns of the Pb metabolism to be remarkably uniform.

- 2821** Stich, W. (Univ. Munich, Germany): Physiologie und Pathologie der Häm-synthese. (PHYSIOLOGY AND PATHOLOGY OF HEME SYNTHESIS.) *Folia Haematologica* 9, No. 3-4:197-216, 1964.

The title subject is reviewed in detail on the basis of the metabolism of porphyrin and precursors generally and in respect to pathologic states, such as aplastic anemias, erythropoietic porphyrias, deficiency anemias, and sideroachrestic anemias. The latter occurs particularly in Pb poisoning. (31 references)

- 2822** Suleimenov, B.N.: (CHANGES IN SOME PHYSICO-CHEMICAL PROPERTIES OF THE BLOOD IN LEAD POISONING.) *Izvestiya Akademii Nauk Kazakhskoi SSR, Seriya Meditsiny Nauk* 1964, No. 3:54-9.

Workers showing symptoms of Pb poisoning had a decreased number of thrombocytes while the speed of blood coagulation and clot retraction was increased. (From Chemical Abstracts 62:9676, 1965)

- 2823** Takhchi, K.G.: K voprosu o klinike ostrogo otravleniya tetraetilsintom. (CLINICAL ASPECTS OF ACUTE POISONING WITH TETRAETHYL LEAD.) *Sb. Nauch Rabot kievskii voennvi gosptial'* 5:92-4, 1964. (From Referativnyi Zhurnal otd. Vypusk Farmakol. Toksikol. 1964, No. 20:54. 292; Biological Abstracts 46:Abstr. No. 103311, 1965)

- 2824** Tareev, E.M. (Acad. Med. Sci., USSR): Nespetsificheskie sindromy pri professional'nykh zabollevaniyakh. (NONSPECIFIC SYNDROMES IN OCCUPATIONAL DISEASES.) In *Trudy I-go Moskovskogo (Ordена Lenina) Meditsinskogo Instituta imeni I.M. Sechenova*, E.M. Tareev, ed. 28:7-22, 1964.

The discussion of the title subject is illustrated in tables of cases with benzene poisoning, silicosis, berylliosis, vibration sickness, TEL and TEL-gasoline exposure (15 yr, with 5 yr since removal from exposure), and Pb (10 yr exposure). In the TEL case, the primary disease was mild TEL poisoning with asthenovegetative syndrome; the secondary nonspecific syndrome was systemic scleroderma with lung, joint, and skin involvement; the course of illness was rapidly progressing systemic scleroderma. In Pb case, the primary disease was chronic poisoning; the secondary, nodular periarteritis; the outcome, remission after symptomatic treatment.

- 2825** Teisinger, J. (Clinic of Occup. Diseases, Prague, Czechoslovakia): (PRACTICAL SIGNIFICANCE OF DIAGNOSTIC MOBILIZATION OF LEAD.) *Arhiv za Higijenu Rada i Toksikologiju* 15:243-8, 1964.

In 1961, Teisinger and Srbova' introduced in Czech-

oslovakia a diagnostic mobilization test for Pb in which a urine sample was taken 6 hr after ingestion of 1 l. of tea and iv injection of 10 ml of "Edtocal Spofa" (containing 2 g  $\text{CaNa}_2\text{EDTA}$ ). Since the amount of Pb excreted during the 1st 6 hr after administration of EDTA represents 50% of the total Pb eliminated within 24 hr, the total daily amount can be calculated. In subjects not exposed to Pb, this daily amount does not exceed 0.350 mg.

In order to establish which amount of Pb excreted in the urine after injection of EDTA can be considered as indicative of a Pb hazard, 50 Pb workers in whom excessive Pb absorption was evidenced by such tests as count of stippled erythrocytes, porphyrinuria and blood Pb level, were studied. A finding of >1000 stippled cells/million erythrocytes, porphyrinuria exceeding 0.150 mg/l and Pb concentrations in the blood of >0.070 mg% were considered as positive. Statistical analysis showed that in 88% of the subjects with at least 2 positive tests, the urinary Pb excretion after the mobilization test was higher than 3 mg/24 hr or 1.7 mg/6 hr; only in rare cases was the 24-hr Pb excretion lower, for instance 1.8 mg/24 hr. The author concludes that when 2 tests are positive, the mobilization test need not be carried out routinely. However, it is useful for the examination of individuals treated for Pb intoxication in order to decide whether they may return to work. Persons with negative laboratory tests and a Pb excretion of 3 mg/24 hr after mobilization were not tested further, although this might be recommendable since they rank among the so-called Pb carriers. Of the 50 subjects studied, 28 had no subjective complaints while laboratory tests were positive in all 50. Pb intoxication was considered only in cases with subjective complaints and anemia. Thus, the diagnosis was based largely on information given by the patient, even in cases of a positive mobilization test. Since the patient may "simulate or dissimulate" symptoms, the trustworthiness of the patient should be investigated in the presence of subjective complaints. In the 18 patients with anemia, urinary Pb excretion averaged 5.05 mg/24 hr, compared with 3.77 mg in the cases without anemia. The author points out that administration of penicillin shortly before the mobilization test will distort the results since penicillin in the organism changes into penicillamine which mobilizes Pb deposits in the body.

Based on present experience, Pb excretion exceeding 0.350 mg/24 hr signifies close contact with Pb, and an excretion of 0.8-1 mg/24 hr does not yet manifest any effects of Pb. At a Pb excretion of 3 mg/24 hr, 2 tests are positive in at least 90% of cases and often signs of intoxication are evident; excretions of 5 mg/24 hr are usually accompanied by anemia. Therefore the author recommends that in out-patients, for a decision as to treatment and return to work, urine samples be taken 6 hr after injection of EDTA, and that Pb concentrations of 0.8-1 mg/24 hr be considered as the maximum permissible concentration. He also points out that urinary Pb excretion should be expressed in absolute values rather than as concentration/l of urine until the relation between excretion of Pb and diuresis is clarified.

- 2826** Teisinger, J. (Karlova Univ., Prague, Czechoslovakia): Zkušenosti s ambulantním vyšetřováním diagnostické mobilizace olova. (EXAMINATION OF DIAGNOSTIC LEAD MOBILIZATION IN OUT-PATIENTS.) Pracovní Lékařství 16, No. 4:145-7, 1964.

Based on experience over a period of several years, the author recommends the collection of urine samples 6 hr after injection of 2 g CaEDTA for the diagnosis of suspected Pb poisoning. According to the author, the maximum permissible Pb concentration in urine is 0.8-1 mg during 24 hr after the EDTA injection or 0.45-0.56 mg within 6 hr. When the Pb content exceeds 3 mg in 24 hr, at least 90% of the patients will show a positive reaction for 2 of the following 3 laboratory tests: urinary porphyrin, blood-Pb or stippled erythrocytes. If urinary Pb excretion amounts to 5 mg, anemia is present. The test is recommended for the diagnosis of atypical cases, for controlling treatment and for deciding whether the patient may resume work involving Pb exposure. (From author's English summary)

- 2827** Teisinger, J., and Srbová, J. (Klin. Nemocí Povolání, Prague, Czechoslovakia): Vliv D-penicilaminu na vylučování rtuti a olova v moči. (EFFECT OF D-PENICILLINAMINE ON THE URINARY EXCRETION OF MERCURY AND LEAD.) Pracovní Lékařství 16, No. 10:433-5, 1964.

Seven patients with chronic Pb poisoning were treated with daily oral doses of 150 mg D-penicillinamine for 4-7 days. Urinary excretion of Pb increased about 4-fold which is practically as much as after administration of 0.5-g tablets of CaEDTA, 4 times/day. If future studies confirm its lower toxicity in long-term administration, D-penicillinamine may replace EDTA.

- 2828** Tipton, I.H., and Shafer, J.J. (Univ. Tennessee, Knoxville): STATISTICAL ANALYSIS OF LUNG TRACE ELEMENT LEVELS. Archives of Environmental Health 8:58-67 (Jan.), 1964.

Tissues from 200 victims of instantaneous death, aged 0-70 yr, from 9 cities in the US (Baltimore, Chicago, Dallas, Denver, Miami, New York, Richmond, San Francisco, Seattle), were analyzed for 22 trace metals. Nonparametric statistical methods were used in the analysis of the data, with calculations made by computers. Pb concentrations in the lungs of adult subjects from 8 cities in the US ranged from 5-550 µg/g of tissue ash (mean of  $67 \pm 5.8$ ) and from 20-250 µg/g (mean  $58 \pm 12$ ) in the lungs of 27 individuals from San Francisco. Significant correlations were found between the Pb concentrations in the lungs and in almost all other tissues. None of the other metals except Fe showed such correlations. Pb appears to enter the lungs in soluble form and to be quickly carried to other parts of the body. Tests of variations were made for age, sex, and geographical location. Many elements, including Pb, increased with age; significantly higher concentrations of Cr, Fe, Mn, Ni, Pb, and Ti were found in males; there was no apparent consistent pattern of variation with geographical location. A word of caution is expressed against the acceptance of data in the analysis of variation by the procedure used.

- 2829** Tompsett, S.L. (Univ. Edinburgh, Scotland): LEAD POISONING. In Methods of Forensic Science, A.S. Curry, Editor. New York, Interscience Publishers, 1964, Vol. III: 1-45.

A review on Pb poisoning, with 244 references, is presented. The following subjects are discussed in separate chapters: Factors associated with the causation of Pb poisoning in nonindustrial and industrial exposure, such as contamination of food and water, use of Pb-containing ointments, burning of battery cases in homes, etc., for the former, and the different industrial processes for the latter; determination of Pb in biological materials; Pb in human excreta, with normal range estimated at 0-70 µg/day in urine and 0.5 mg in feces; distribution of Pb in human tissues; normal Pb values in human blood, an estimated  $\leq 40$ -70 µg/100 ml, with Pb in milk and spinal fluid also given; Pb in tissues and excreta in Pb poisoning; mobilization of Pb; factors that influence the absorption of Pb from the alimentary tract, such as the composition of the diet; treatment of Pb poisoning; porphyrin metabolism in Pb poisoning including determination of coproporphyrin and ALA in urine; laboratory examinations in Pb poisoning. Under the heading of control of the Pb hazard, the marked reduction in the number of industrial cases in Britain from 1058 reported in 1900 to only 48 in 1952 is attributed to the efforts of Sir Thomas Oliver and others, and to the establishment of regulatory measures which are cited. The nonindustrial hazards are controlled in part by the Food and Drug Acts of Great Britain and recommendations by the Ministry of Food. TEL poisoning, and the determination of volatile Pb in tissues are briefly reviewed.

- 2830** Truhaut, R., Boudène, C., and Albahary, C. (Univ. Paris, France): Rôle possible de la consommation exagérée de vin dans l'étiologie du saturnisme. (POSSIBLE INFLUENCE OF EXCESSIVE WINE CONSUMPTION IN THE ETIOLOGY OF LEAD POISONING.) Bulletin of the World Health Organization 31, No. 1: 127-9, 1964.

Albahary et al (1961) had found, in an earlier study on the detection of Pb absorption by a mobilization test, using CaEDTA, that heavy wine drinkers excreted excessive amounts of Pb in their urine. Potential sources of Pb in alcoholic beverages have been listed by Jaulmes et al (1960). Analyses of several French wines by various authors have shown that the Pb content of wine exceeds 200 µg/l, which is the maximal limit proposed in 1955 by the subcommittee on metallic contamination of the British committee for food standards, and is even  $>300$  µg/l, adopted as the maximal limit by the Society of Chemical Experts of France in 1950. It was estimated that the normal Pb concentration in wine ranges between 25 and 400, with a maximum of 600 µg/l; this was considered to be permissible from the standpoint of health. Truhaut and associates agree with this, in so far as moderate drinkers are concerned. However, this limit is too high for alcoholics who drink 4-5 l of wine/day, since Pb poisoning may occur after prolonged ingestion of  $>1$  mg daily.

Since the wines analyzed by Jaulmes et al were

vintage wines, Truhaut and his group decided to determine, by a polarographic method, the Pb content of inexpensive commercial table wines. The following results were obtained: 13 samples of white wine, alcoholic content 11%, contained 60-250, av 145  $\mu\text{g Pb/l}$ ; 4 rose wines, 11-13%, 105-255, av 189; 21 red wines, 10-12%, 85-160, av 132. These concentrations were considered as harmless at a daily consumption of not more than 500 ml of wine, but not so for alcoholics who drink up to 5 l of wine/day, thereby ingesting an av of 800 and sometimes  $>1250 \mu\text{g Pb}$ .

The authors point out that Pb poisoning should always be considered in alcohol intoxications since at relatively small concentrations Pb acts as a poison on certain enzymatic systems, notably dehydrases which are important in the intermediate metabolism.

- 2831** Tsuchiya, K. (Keio Univ., Tokyo, Japan): COPROPORPHYRINS IN LEAD AND MERCURY WORKERS. *Industrial Health* 2:162-71 (Dec.), 1964.

In the place of urinary Pb analyses, the author proposes the determination of coproporphyrin by a modification of the Askevold method (1951) for the screening of Pb workers where facilities for reliable Pb analyses are not available. Ninety urine samples were collected from workers in a storage battery and a Pb oxide plant where atmospheric Pb concentrations ranged from 0.2 to several  $\text{mg/m}^3$ . In addition, urinary Pb and coproporphyrin of a 42-yr-old hospitalized Pb worker were analyzed almost daily for 40 days, and normal excretion of coproporphyrin was determined in male physicians and students of the laboratory. Excretion of Pb and coproporphyrin in the hospitalized patient (who was not under treatment at the time of analyses) started to increase on about the 10th day after admission, reached a peak on the 16th day, then decreased and rose to a 2nd peak on the 30th day. There was a significant correlation between both coproporphyrinuria and urinary Pb excretion, and atmospheric Pb concentration. In normal subjects, the upper limit of urinary coproporphyrin was found to be 53.1  $\mu\text{g/l}$  (95% confidence level). When Pb concentration in air was plotted against urinary coproporphyrin and the percentages transformed to the Bliss probit values, a threshold limit value (TLV) for Pb in air of 0.08-0.12  $\text{mg/m}^3$  was found (at a TLV of 0.08, 5% showed coproporphyrin  $>50 \mu\text{g/l}$ ).

Since in Hg absorption, coproporphyrin was found to increase also to some extent, the author concludes that the determination of coproporphyrin is important for the periodic medical examination of Pb and Hg workers.

- 2832** Unseld, D.W. (Municipal Hosp., Ulm, Germany): Diagnostische Erfahrungen mit Chelatbildnern bei vermehrten Blei- und Eisendeponierungen im Körper. (DIAGNOSTIC EXPERIENCES WITH CHELATING AGENTS IN THE PRESENCE OF INCREASED DEPOSITION OF LEAD AND IRON IN THE BODY.) *Verhandlungen der Deutschen Gesellschaft für Innere Medizin* 70:401-4, 1964.

The use of chelating agents such as CaEDTA and desferrioxamine for the diagnosis of the accumula-

tion of Pb and Fe, respectively, in the body is discussed. The tests for Pb were made on 12 patients who had a Pb content in the blood ranging from 6-74  $\mu\text{g\%}$ . No residual Pb intoxication was found in the 1st 2 patients since urinary Pb after administration of EDTA remained  $<300 \mu\text{g/l}$ . In patients 3-6, urinary Pb excretion after an EDTA dose ranged from 480-2400  $\mu\text{g/l}$ , indicating more or less increased Pb deposits in the organism. Patients 7, 8 and 9 had formerly been exposed excessively to Pb and the question was whether they could be exposed to it again without risk. The tests showed that patients 7 and 8 were not ready for another exposure since their urinary Pb after mobilization with EDTA was still 840 and 440  $\mu\text{g/l}$ , respectively, while patient 9 with a urinary Pb after mobilization with EDTA of 120  $\mu\text{g/l}$  had fully recovered. Also fully recovered after EDTA therapy was patient 10 while 11 still showed a small increase of urinary Pb (400  $\mu\text{g/l}$ ). Patient 12 had suffered an acute Pb intoxication and excreted 1440  $\mu\text{g Pb/l}$  of urine. In his case the mobilization test would normally not have been necessary since his blood Pb level of 74  $\mu\text{g\%}$  already definitely indicated a greatly increased Pb absorption. The author concludes that the EDTA mobilization test presents a useful means for the diagnosis of Pb deposits in the body.

- 2833** Vavra, J.D., and Mayer, V.K. (Washington Univ., St. Louis, Mo.): IN VITRO PORPHYRIN SYNTHESIS BY HUMAN BLOOD: PORPHYRIN SYNTHESIS BY THALASSEMIC ERYTHROCYTES. *Journal of Laboratory and Clinical Medicine* 63:754-71 (May), 1964.

The porphyrin synthesis from glycine, aminolevulinic acid and porphobilinogen by red blood cells and hemolysates from patients with thalassemia major and other types of anemia, and the effects of Pb on the synthesis of porphyrin were studied. Pb was found to inhibit conversion of aminolevulinic acid to porphobilinogen and of heme formation from glycine and protoporphyrin. Red blood cells from patients with Pb poisoning showed just as marked an inhibition of heme synthesis as red blood cells exposed to Pb in vitro. The hemolysates of 2 patients with Pb poisoning incubated with aminolevulinic acid showed reduced total porphyrin synthesis. (29 references)

- 2834** Veronese, A. (Univ. Padua, Italy): Quadri oto-vestibolari nei postumi di intossicazione da piombo tetraetile. (THE OTO-VESTIBULAR PICTURE IN PATIENTS WITH TETRAETHYLLEAD POISONING.) *Minerva Otorinolaringologica* 14:123-7 (Nov.-Dec.), 1964.

After reviewing the signs and symptoms of TEL poisoning the author describes his own investigation in the Otorhinolaryngologic Clinic on 21 male patients, age 21-52 yr, who after exposure to TEL (most probably inhalation) in a TEL-producing or mixing plant were already in the state of recovery and presented a nonspecific and transient symptomatology consisting mainly of anemia, vertigo, apathy, insomnia, and impotence. Objective signs involving the central nervous system were moderate or absent. All these patients were subjected to an examination of the cochlear and vestibular apparatus and in some of them an electronystagmo-

graph of the vestibular response to a thermal and an accelerating stimulus was recorded.

Audiometric tests showed normal function in 18 individuals and some loss of hearing in 3 who were in an advanced age and had worked for some years in a noisy environment. Spontaneous vestibular signs were absent except in one case. Vestibular reflex activity was somewhat lowered with respect to thermal and rotatory stimuli. The electronystagmograph revealed uni- or bilateral arrhythmia of nystagmic movements.

On the basis of his findings the author concludes that TEL does not cause lesions in the cochlear or the acoustic nerve. The diminished function of the labyrinthine reflexes can hardly be due to an involvement of the receptors or the acoustic nerve because a selective effect of TEL on the vestibular and not the cochlear apparatus appears improbable. The hypothesis is advanced that the vestibular lesion is located at the brain stem. Although the oto-vestibular syndrome described in this study occurs also in other intoxications of endogenous and exogenous origin, the author believes that a test of the hearing function will be a helpful diagnostic tool in patients showing late effects of TEL poisoning.

- 2835** Verveen, G. (Mycofarm-Delft, Holland); Elskamp, D.M.W.: Het gebruik van penicillamine en N-acetyl-dl-penicillamine als antidotum bij intoxicaties met koper, lood en kwik. (THE USE OF PENICILLAMINE AND N-ACETYL-DL-PENICILLAMINE AS AN ANTIDOTE IN COPPER, LEAD AND MERCURY INTOXICATIONS.) Letters to the Editor. *Pharmaceutisch Weekblad* 99:547-54 (May 15); 577-8 (May 22), 1964.

Verveen takes exception to Elskamp's review of the relative merits of penicillamine and its acetyl derivative as compared with EDTA. After reviewing the literature, Verveen holds that penicillamine is the most reliable therapeutic agent in the treatment of Cu, Pb and Hg poisoning. Elskamp replies that while penicillamine has been shown to be effective in Cu poisoning, it has not yet been proved to be so in chronic Pb poisoning. Also, the acetyl derivative was reported to have serious side effects.

In the second correspondence, Verveen resumes his debate and concludes that (1) D-penicillamine is very effective in controlling poisoning by some metals (Pb, Cu, Au) (N-acetyl-D-penicillamine in Hg poisoning); (2) D-penicillamine is an antidote of very low toxicity; (3) the advantage of D-penicillamine lies in that it can be given orally, ie, to ambulant patients. To this, Elskamp replies briefly that he agrees with items 2 and 3.

- 2836** Viala, J.J., Lejeune, E., and Gate, A.: Brûlure par plomb fondu. Inclusions sous-cutanées de plomb séquellaires. Appréciation du risque de saturnisme. (BURNS DUE TO MELTED LEAD. SUBCUTANEOUS INCLUSIONS OF LEAD PARTICLES. EVALUATION OF THE LEAD HAZARD.) *Archives des Maladies Professionnelles, de Médecine du Travail et de Sécurité Sociale* 25:449-52 (July-Aug.), 1964.

The case of a 32-yr-old man who was hospitalized

for accidental burns of the face due to molten metal while working in a factory producing Pb pipes, is reported. After several months the patient's face appeared only slightly tattooed, but X rays revealed inclusions of Pb fragments under the skin. This finding suggested the possible presence of Pb intoxication. Tests yielded 5 millions of red blood cells, 80% Hb, 6600 white blood cells, urinary coproporphyrin up to 225 µg/l, Pb in the blood <100 µg/l, urinary Pb 33 µg/24 hr before administration of chelating agents and up to 2288 µg/24 hr following their administration. These results were typical for subjects exposed to Pb but without clinical signs of Pb intoxication. No similar case has been reported so far in the literature. Generally, in burns the molten metal becomes embedded only at the surface of the skin. In the present incident, solid Pb particles may have been projected into the sc layer or Pb droplets may have penetrated the skin.

In view of the great number of sc Pb particles the possibility that the patient may develop Pb poisoning over the years is considered doubtful and continued treatment with chelating agents is not advised. However, special surveillance is recommended.

- 2837** Vigliani, E.C. (Milan, Italy): ADVANCES IN THE PATHOGENESIS OF SOME OCCUPATIONAL DISEASES. In XIVth International Congress of Occupational Health, Madrid, Spain, Sept. 16-21, 1963. International Congress Series No. 62, Amsterdam, Excerpta Medica Foundation, 1964, Vol. II, pp. 126-36.

Silicosis and other pneumoconioses, pulmonary disease due to the inhalation of vegetable dusts, toxic hemolytic anemias, metal fume fever and other miscellaneous diseases are discussed. Toxic hemolytic anemias may be caused by heavy metals, the best known example of which is Pb. Inorganic Pb acts both on the red cell membrane and the erythrocytes. It blocks some sulfhydryl enzymes of the porphyrin synthesis as well as heme synthetase, thereby causing an increased urinary elimination of ALA and coproporphyrin and a diminished production of heme with accumulation of protoporphyrin and ferritin in the red cell. Red cells altered by Pb are rapidly destroyed mainly in the spleen after having been coated with δ-globulins. The mechanism of production of stippled cells is reviewed. Part of an erythrocyte from a Pb-poisoned guinea pig is illustrated.

TEL and TML have a different effect on the organism than inorganic Pb. Cremer (1962) showed that both TEL and TML are not toxic per se but become so after having been converted by the liver into trialkyl compounds which inhibit glycolysis with subsequent reduction of oxygen consumption and synthesis of adenosine triphosphate and other high energy substances. Magistretti-Peirone and Majoni (1961) showed that TEL and TML also inhibit the cerebral monoamine oxidase, thus blocking the conversion of serotonin to 5-hydroxyindoleacetic acid, and Galzigna-Brugnone and Corsi (1963) found a decreased output of 5-hydroxyindoleacetic acid in rabbits poisoned with TEL. (38 references)

- 2838** Vinogradova, O.M. (Acad. Med. Sci., USSR):

K voprosu o vliyanií svintsá na razvítie uzelkovogo periarteriíta. (THE INFLUENCE OF LEAD ON THE DEVELOPMENT OF PERIARTERITIS NODOSA.) In Trudy 1-go Moskovskogo (Ordéna Lenina) Meditsinskogo Institúta imeni I.M. Sechenova, E.M. Tareev, ed. 28:92-5, 1964.

A 41-yr-old worker in a nonferrous industry was referred to the author's clinic in 1960 with a suspected periarteritis nodosa. From 1950-1960 he had worked in a smelter and had begun being troubled with tingling of extremities in 1956 which progressed with time together with other disorders. When seen, he complained of headaches, weakness, numbness in legs, abdominal pain, anorexia, vomiting, blood-streaked stool, periodic pain in the heart region, diminished vision. The findings are described in detail. The diagnosis was periarteritis nodosa and mild degree of Pb poisoning. In discussing the case, the author observes that the diagnosis of periarteritis nodosa was unquestionable, but that the assumption of Pb polyneuritis was not substantiable since the cardinal signs of Pb poisoning were absent except for the presence of Pb in the urine which were not related to proved signs of Pb poisoning. She suggests that perhaps the prolonged contact with Pb had given rise to a state favoring the development of periarteritis, but that this question would have to be further elucidated.

**2839** Waldron, H.A. (Med. Dept., Vauxhall Motors Ltd., Luton, Gt. Britain): PLASMA PORPHYRINS IN LEAD WORKERS. British Journal of Industrial Medicine 21:315-7 (Oct.), 1964.

Plasma porphyrin, urinary coproporphyrin and Hb concentrations were determined on a group of 50 workers exposed to Pb and on a group of persons with no industrial exposure. Porphyrin was determined by the method of Schlenker et al (1961, 1963) with slight modifications. Values obtained for plasma porphyrin in test and control subjects, respectively, ranged from 0.0-2.9 and 0.0-0.9 µg/100 ml (means 0.7 and 0.2). In 74% of the Pb workers, the plasma porphyrin levels were higher than 0.2 µg/100 ml and in 22%, they were >0.9 µg/100 ml. Urinary coproporphyrin ranged from 0.7-69.8 µg/100 ml (mean 10.6) in the Pb workers and from 0.3-7.8 (mean 2.7) in the controls. There was no correlation between plasma porphyrin and urinary coproporphyrin concentrations. Chromatography of the plasma porphyrins from Pb workers showed that some protoporphyrin was present whereas only coproporphyrin was found in the plasma from the controls. The Hb values ranged from 86-106% in the test subjects and from 86-110% in the controls.

**2840** Waldron, H.A. (Med. Dept. Vauxhall Motors Ltd., Luton, Beds., England): SERUM ASPARTATE AND ALANINE TRANSAMINASE LEVELS IN WORKERS EXPOSED TO LEAD. Journal of Clinical Pathology 17:149 (Mar.), 1964.

Serum aspartate and alanine transaminase levels were studied in a group of 46 workers at Vauxhall Motors Ltd., who had been exposed to Pb for at least 11 mo. Most of them had worked with Pb for ≥5 yr, but none of them showed any clinical evi-

dence of Pb poisoning. A group of 50 healthy workers without industrial exposure to Pb served as controls.

The following mean values, in international units /l, were found for Pb-exposed and control subjects, respectively: serum alanine transaminase, 6.8, 5.5; serum aspartate transaminase, 11.1, 9.8. Mean blood-Pb concentrations for the 2 groups were 0.42 (9 men had >0.8) and 0.16 µg/ml, respectively. The author points out that in none of the Pb-exposed workers was an increase of either serum aspartate or alanine transaminase observed and that no correlation between these levels and the blood-Pb concentration was noted.

**2841** Williams, J.D., and Leigh, D.A. (Edgware General Hosp., Middlesex, England): LEAD POISONING. Letters to the Editor. British Medical Journal 1:1511 (June 6), 1964.

This letter was prompted by the leading article in the May 9 issue of the Journal. The authors had carried out a series of tests on men working with Pb in the Hemel Hempstead area. The test included stipple-cell and reticulocyte counts, and determination of urinary coproporphyrin and of Pb in blood and urine. Often a discrepancy was found between the results of the tests in the same individual, some indicating excessive absorption and some giving results in the normal range. In order to assess the amount of absorbed Pb, a test dose of 1 g CaNa<sub>2</sub>EDTA was administered orally and urinary Pb was determined before and 8 hr after the dose. In normal persons, unexposed to Pb, very little change occurred before (30-40 µg Pb/l) and after the dose (45-80 µg/l). In cases of mild and moderate Pb absorption and in Pb poisoning, urinary Pb excretion before and after EDTA was in µg/l, respectively: 70-140 and 160-700; 180-240 and 600-1000; 200+ and 900-2700. The authors point out that the CaNa<sub>2</sub> salt of EDTA and not the acid is used. In their experience, a 7-day course of oral EDTA resulted in as good a Pb excretion as a 5-day course of iv administration, was considerably more convenient to use in industry, and should be even more so for children. It appears to them that the amount of Pb removed by EDTA salts is greater than that following treatment with penicillamine, and that their toxicity is probably low, according to experience reported by others.

**2842** Wilson, A.T. (Innerleithen, Peeblesshire, Gt. Britain): METHODS OF PROSPECTING FOR LEAD EFFECTS IN GENERAL PRACTICE. Proceedings of the Royal Society of Medicine 57:257-9 (Apr.), 1964.

The possibility of injurious effects of water carried in Pb pipes dates back to Roman times (Vitruvius, ca. 20 B.C.). The US Public Health Service Drinking Water Standards of 1946 adopted a maximum limit for Pb of 0.1 ppm; this figure was also proposed by the World Health Organization in 1958. Although the US Standards of 1960 lowered the limit to 0.05 ppm, a Committee of the American Water Works Association in 1962 recommended a maximum allowable amount of not more than 0.03 ppm; at this concentration, Pb intake from water would be ~15% of the maximum allowable total daily intake. There is no statutory legal limit in Britain. Almost all public supplies in Britain were

stated by Wood (1961) to be capable of dissolving  $>0.1$  ppm Pb from Pb pipes under certain conditions. These include acidity, soft waters, although certain types of very hard water with high nitrate content may dissolve Pb. Various tests are mentioned, the simplest of which is placing 2 drops of bromo-thymol blue indicator into 10 ml of water in a test tube, a yellow color indicating acidity and thus providing warning of the possibility of dissolution of Pb.

From the clinical aspects, the usual signs and symptoms of Pb poisoning would give a general practitioner great difficulty in diagnosis, and tests for punctate basophilia require special microscopes. However, determination of coproporphyrin in urine as a screening test can be done conveniently by use of a simple apparatus described by Donath (1956). Confirmatory tests of the Pb content of blood and urine and others should then be sought.

The author has been screening for 2 yr maternity patients in a neighborhood where the water supplies have the prerequisites for dissolving Pb. In the 1st yr, 10 out of 40 maternity patients reached a coproporphyrin level of 100-200  $\mu\text{g/l}$  and were therefore told to restrict their water intake. After a stillbirth with evidence suggesting excessive Pb exposure had occurred, all maternity patients were instructed to limit their total water intake to 1 pint/day and to increase their milk intake correspondingly. After this regulation, only 1 patient out of 50 on restricted water intake reached a coproporphyrin range of 100-200  $\mu\text{g/l}$ ; as she lived on a top floor, the length of the Pb pipe might have had some effect. Two other patients, who had not obeyed the instruction on restricted water intake, also showed the high coproporphyrin level.

The author concludes his discussion by stating that testing the urine of the maternity patient, for long regarded as specially sensitive to Pb, may prove the simplest way of estimating any hazard from Pb in water supplies.

**2843** Winterhalter, K.H. (Univ. Washington, Seattle): HEMOGLOBIN SYNTHESIS. *Pathologia et Microbiologia* 27:508-20, 1964. The biosynthesis of heme and the possible control mechanism of this process are discussed. The pathology of heme biosynthesis is illustrated by examples of pyridoxin deficiency, Pb poisoning and erythropoietic porphyria.

In Pb poisoning several blocks in heme synthesis have been reported. Although the total heme synthesis is decreased, a number of heme precursors are increased in the erythrocyte and in the urine of Pb poisoned individuals. In children the fluorescence of porphyrin-laden cells under the UV microscope has been used as a diagnostic test for Pb poisoning. (Whitaker et al, 1959). There is also inhibition of Fe-proto chelatase (Jandl et al, 1959; and Labbe et al, 1961), responsible for the accumulation of tetrapyrroles in the red cell precursors. Other blocks involve ALA synthetase (Dresel et al, 1956; Goldberg et al, 1956), ALA dehydratase, responsible for the increased urinary excretion of ALA, and coproxydase (Eriksen 1955). Globin synthesis is also impaired, but to a lesser degree (Kassenaar et al, 1957). The exact mech-

anism of this phenomenon has not yet been elucidated. (54 references)

**2844** Yaverbaum, P.M.: Vydelenie svintsa s mochoi pri kontakte s soedineniyami etogo metalla i pri khronicheskoi svintsovoi intoksikatsii. (THE EXCRETION OF LEAD IN THE URINE WITH EXPOSURE TO LEAD AND WITH CHRONIC LEAD POISONING.) In Problemy Gigieny Truda i Professional'nykh Zabo-levanii (Problems of Labor Hygiene and Occupational Diseases) Irkutsk 1:66-71, 1964.

The Pb content in the urine was determined in 29 persons with chronic Pb poisoning, in 17 subjects who had been exposed to Pb in the past, and in 220 essentially healthy workers in contact with Pb compounds. The av content found was  $\sim 208.44$  and  $128.96 \mu\text{g/l}$ , respectively. The duration of Pb exposure did not affect the urinary excretion of Pb. The mean total Pb in the urine could therefore characterize the plant environment. (From Referativnyi Zhurnal, Otd. Vypusk Farmakol. Khimioterap. Sredstva Toksikol. 1966, No. 1.54.816; Biological Abstracts 48:Abstr. No. 49268, 1967)

**2845** Yaverbaum, P.M.: (NORMAL LEAD CONTENT IN THE URINE.) Probl. Gigieny Truda i Profzabolevanii, Irkutsk, Sb. 1964, No. 1:72-6.

The urinary Pb concentration was determined in 58 individuals with no known contact with Pb. Upper normal limits were  $73 \mu\text{g/l}$  for total Pb, 35 for inorganic Pb and 65 for organic Pb. (From Referativnyi Zhurnal, Khimiya 1965, Abstr. No. 191274; Chemical Abstracts 64:14681, 1966)

**2846** Yaverbaum, P.M.: Rezul'taty opredeleniya porfirinov v moche u rabochikh, imeyushchikh kontakt so svintsom. (THE RESULTS OF PORPHYRIN DETERMINATIONS IN THE URINE OF WORKERS IN CONTACT WITH LEAD.) In Problemy Gigieny Truda i Professional'nykh Zabo-levanii. (Problems of Labor Hygiene and Occupational Diseases) Irkutsk 1:77-80, 1964.

Urinary porphyrins were determined in 265 persons exposed to Pb. Hyperporphyrinuria was found in 41.4%. The duration of exposure to Pb had no effect on the degree of porphyrinuria and the latter was not related to the urobilinogen-forming function of the liver. There was a moderate correlation between the porphyrinuria and urinary Pb excretion. Determination of Pb and porphyrin in the urine was recommended for the early diagnosis of Pb poisoning. (From Referativnyi Zhurnal, Otd. Vypusk Farmakol. Khimioterap. Sredstva Toksikol. 1966, No. 1.54.815; Biological Abstracts 48:Abstr. No. 49269, 1967)

**2847** Zabugina, E.A., Los', L.I., Polyakova, E. G., and Pyatnitskaya, L.K. (Agricultural Inst., Saratov, USSR): Mikroelementy vo vneshnei srede i endemicheskoe uvelichenie shchitovidnoi zhelezy. (TRACE ELEMENTS IN THE ENVIRONMENT AND ENDEMIC ENLARGEMENT OF THE THYROID GLAND.) Hygiene and Sanitation (USSR) 29:112-5 (Mar.), 1964 (Published in 1965) *Gigiena i Sanitariya* 29:

91-3 (Mar.), 1964.  
Analyses for I and trace metals such as Mn, Mo, Cu, Cr, Pb and Ni in 123 samples of water and in 45 soil samples from the Saratov Region showed traces or absence of Cr, Pb and Ni. Aside from the inverse relationship found with I, there was no statistically significant relationship between the number of inhabitants with thyroid enlargement and content of these elements in water and soil.

- 2848** Zagarese, G., Turchetto, P., and Coltro, L. (Univ. Padua, Italy): Rilevi elettrocardiografici nell'intossicazione da Pb-tetraetile. (Contributo clinico). (ELECTROCARDIOGRAPHIC FINDINGS IN TETRAETHYL-LEAD POISONING (CLINICAL CONTRIBUTION).) Lavoro a Medicina 18:81-4 (July-Aug.), 1964.

Electrocardiography, in addition to detailed clinical tests, was performed in the University of Padua Institute of Industrial Medicine in 1959-1963 on 21 men, aged 20-60 yr, who had worked for 5 mo to 10 yr in various departments of a TEL plant. All patients complained of neuropsychic and digestive disorders. On the basis of the findings, particularly the presence of porphyrins, the diagnosis of subacute or chronic TEL poisoning was made. The presence of more or less accentuated bradycardia was seen in 67% of the group. The P-wave and the P-R interval were normal. In only 9 cases were abnormalities in the S waves with an

elevation of the S-T segment in the precordial Pb's observed. No signs of myocardial or coronary damage were noted. The changes observed are attributed to disturbances of vagal innervation by TEL.

- 2849** Zavon, M.R. (Univ. Cincinnati, O.): PROBLEMS IN RECOGNITION OF LEAD INTOXICATION. Archives of Environmental Health 8:262-5 (Feb.), 1964.

Difficulties encountered in the diagnosis of Pb poisoning are discussed. Pb intoxication resulting from excessive absorption of inorganic Pb may result in an abdominal, a neuromuscular or central neurological syndrome or any combination of these disease entities. Pb intoxication from excessive absorption of an organic Pb compound may lead to a neurological syndrome different from that caused by inorganic Pb. The manifestations of the various syndromes are discussed and similarities with those in other diseases are pointed out. Specific problems in diagnosis are presented by the gingival Pb line, basophilic stippling of erythrocytes and the radiographic Pb line. In conclusion it is said that the development of an illness in a person exposed to Pb should not automatically result in the diagnosis of Pb intoxication, and on the other hand, a history of Pb exposure should not lead to the abandonment of a proper medical diagnosis.





