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Project Summary

Chromosome Aberrations in Peripheral Lymphocytes of College Students as a Response to Photochemical Air Pollution

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This research project confirms and extends to a more homogeneous group the observations of Scott and Burkard in their study of chromosome aberrations in the peripheral lymphocytes of students attending the University of Southern California. This study compares whether the incidence of chromosome aberrations in students emigrating from and to an area with high levels of photochemical air pollutants versus an area of low levels differed significantly from students indigenous to the respective areas.

The data does not support the hypothesis that living (or attending school) in the South Coast Air Basin of Southern California significantly affects the integrity of peripheral blood lymphocyte chromosomes. Nor is there evidence that those living in areas of little or no photochemical air pollution have statistically significant fewer chromosome abnormalities.

This Project Summary was developed by EPA's Health Effects Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Conflicting evidence continues to accumulate that exposure of human, animal, and plant tissues to the constituents of photochemical air pollution may result in increased chromosome aberrations. Of particular concern is the potential danger that exposure of humans to existing ambient levels of photochemical smog may result in mutagenic changes leading to congenital anomalies. Although studies on ozone effects on human cells have been limited, considerable evidence does exist for the induction of both point and chromosome aberrations in several animal species.

Methods

Two-hundred and nine (209) male and female first-year students at the La Sierra campus of Loma Linda University (high smog) and two-hundred and six (206) male and female first-year students at Pacific Union College (low smog) were pre-enrolled after completing a lifestyle questionnaire or responding to a similar telephone-administered questionnaire. They were assigned to groups according to their previous life-time exposure to air

pollution and the college in which they were matriculating. This resulted in four groups: low smog to low smog, low smog to high smog, high smog to low smog, and high smog to high smog.

Blood samples and updated health histories were obtained from the students at the following times: September-October 1976 (410 students); November 1976 (407 students); April 1977 (369 students); and September-October 1977 (317 students). All blood samples were cultured and slides prepared by the Genetics Research and Chromosome Services, Loma Linda University Medical Center. One hundred cells from each student were analyzed for chromosome and chromatid aberrations at Utah Biomedical Test Laboratory.

Conclusions

Due to technical difficulties in blood drawings three and four, statistical analyses of all groups for all four blood sampling periods was not completed. It is felt that this study is significant, however, in that four contrasting groups, with respect to exposure to photochemical air pollution in the South Coast Air Basin of Southern California, were cytogenetically examined at the conclusion of the high pollution season and again two and six months later.

No statistically significant differences in the aberration rates for the types of chromosome abnormalities studied were observed between the four exposure groups of students at each of the sampling periods or among the same students over the duration of the study. The elevated rate of stable changes at the initial blood sampling period for males in the low-to-high group was, however, an exception of statistical importance. This group did not show a statistically significant elevation in rate when the initial criterion of allowing students to arrive on campus 15 days prior to blood drawing was applied, but the rate became increasingly elevated over the other groups and became statistically significant when two increasingly stringent criteria for arrival time were applied, namely within 3 days of blood drawing and then within 1 day. Increased differences were also noted for females in the same group, but these were not as significant as they were for the males. Moreover, these elevated rates dropped off by the second blood sampling 2 months later.

Recommendations

Future studies can reduce the intra-student variability by scoring a minimum of 200 metaphases.

Study group size could be reduced by using more stringent exclusion criteria such as those used for statistical analyses in this study.

An on-going validity study to check accuracy in chromosome scoring should be carried out at an independent laboratory paralleling any cytogenetic study.

A carefully controlled laboratory study exposing students having no previous exposure to significant levels of ozone could be carried out to test the "shock effect" hypothesis.

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The complete report, entitled "Chromosome Aberrations in Peripheral Lymphocytes of College Students as a Response to Photochemical Air Pollution," (Order No. PB 81-152 506; Cost: $14.00, subject to change) will be available only from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650

The EPA Project Officer can be contacted at:

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