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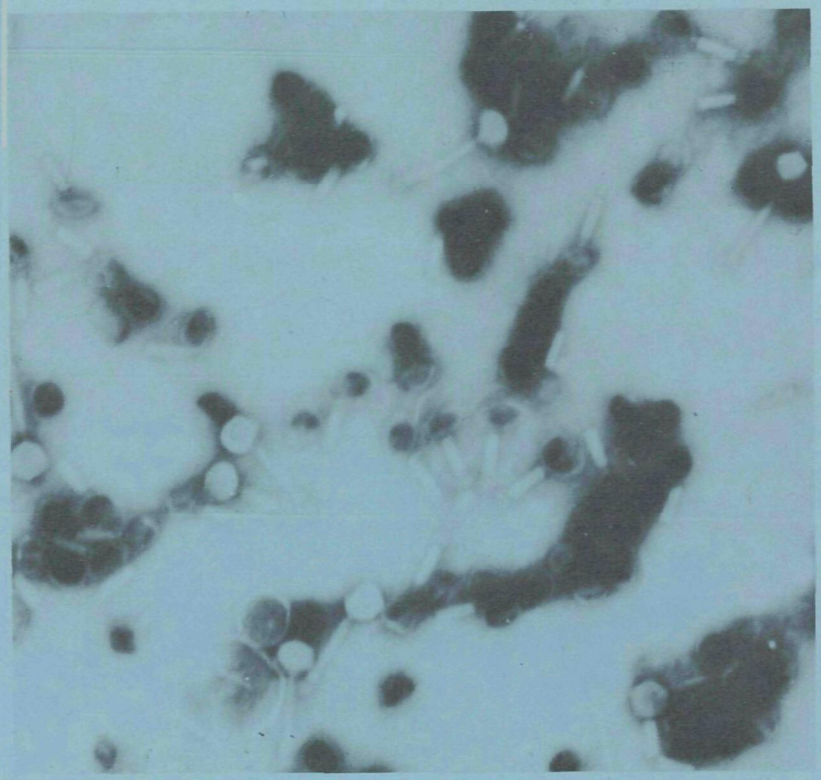

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COVER PHOTO:

Electron micrograph of the virus AS-1 which infects the unicellular blue-green algae *Anacystis nidulans* and *Synechococcus cedrorum*.

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PHYCOVIRUS BIBLIOGRAPHY

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PREFACE

A literature search program was developed for phycoviruses as part of earlier efforts to provide adequate coverage of relevant research. It was accomplished primarily through the use of an in-depth data base from which source material could be compiled in a continuous and comprehensive form. The citation index that resulted has been shared with those needing background information on algal lysing agents. The need for a formal publication soon became evident from the many requests for such material. The first edition of the bibliography was published in 1974 and updated in 1975.

The present edition retains the organization and scope of preceding editions with the citations divided into two sections. The first, pertaining to viruses of procaryotic algae, has been more thoroughly researched and thus is better understood. Owing to these advances, the term "phycoviruses", introduced to denote algal viruses in general, has become almost synonymous with blue-green algal viruses. The second section, dealing with viruses of eucaryotic algae, is virtually unchanged from that of the preceding edition. Clearly, isolation of these viruses has presented a formidable obstacle to researchers. Of the reports listed, none have penetrated the obscurity that has surrounded their identification and assessment.

Reflecting on the procaryotic organization shared by bacteria and blue-green algae, it is evident that many morphological and chemical similarities are likely to exist between the viruses infecting them. Some authors have in fact followed bacterial workers and used the term "cyanophage" for viruses of blue-green algae. As with "cyanophages" and bacterial viruses, a parallel relationship might be foreseen between viruses of eucaryotic algae yet to be confirmed and those viruses known to infect higher plants. At present, available evidence is plagued by vagueness and confusion with no promise of an early answer.

The number of citations in the bibliography has nearly doubled during the three years that have elapsed since publication of the first edition. This exhaustive survey of the literature reflects on the different directions that phycovirus research has taken. It provides an insight to the current state-of-the-art which we hope will serve as a stimulus for future research and discussions on the subjects.

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INTRODUCTORY REMARKS

These introductory remarks are intended to bring to the readers' attention the significant trends in the developing field of phycovirus research. Although this field may appear to be of limited scope in the overall context of virology, its domain is nevertheless extensive. It includes divergent lines of development that open to exploration the many facets of basic and applied virus research. Many early problems have yet to be resolved affording investigators a wide variety of research opportunities.

Although phycoviruses were still unknown in the early 1960's, we considered it unlikely that the biological characteristics of the algal cell were such that the entire group would be immune to viral infection. During this time waste stabilization ponds became the focal point of our search for this viral type. Supporting a dense and fluctuating algal population, these ponds offered a unique environment from which to isolate the elusive phycovirus. In 1963 a pond in Indiana yielded the first definite evidence that such a disease existed in algae. The discovered infectious agent was the LPP-1 virus which caused lysis in several blue-green algal species of the genera *Plectonema*, *Phormidium*, and *Lyngbya*. Confirmation of data supporting the existence of this virus group soon followed, as did the interesting aspect of their wide geographic distribution.

Historically, no notice was taken of phycoviruses during the nearly 50 years following the first description of a filterable virus of bacteria. This time lapse between the two discoveries was perhaps inevitable in that, unlike bacteria, algae had neither been closely associated with animal or human diseases nor had they been demonstrated as a pathogenic agent of agricultural crops. Also important was the fact that culturing was non-essential in many earlier studies as algae were readily recognizable in samples collected directly from their natural habitats.

The events which ultimately led to the detection of phycoviruses originated from a need to better understand the underlying factors responsible for algal decomposition. With the discovery of the phycovirus, a new concept in algal pathology evolved since these viruses had the capacity to exercise a far-reaching effect on the development of algal communities. Our knowledge is still too limited to relate their activity directly to specific incidences of algal fluctuations. However, the magnitude and distribution of one group of these viruses have led some to believe that their lytic activity precludes several susceptible algal species from attaining objectionable proportions. At a time of increasing concern about algal overabundance in the aquatic environment, the very nature of the phycovirus clearly points to its possible development as an alternative to chemical control. Such application has popular appeal and

support in offering a basic approach to algal population ecology and control. Early attempts to establish a broad collection of these viruses led to extensive surveys of the environment that consistently yielded the LPP viral types from which our early concepts were developed. Considering their distribution and ease of detection, it is difficult to comprehend the infrequency with which other phycovirus groups have been isolated. These ecological considerations, however, afford only one view of the experimental aspects realized from their discovery.

Much of the current interest is focused on the inherent properties of the phycovirus-host system. It is not surprising that this work has closely followed the lead taken by bacteriophage studies. Like the phage system, the phycovirus system can be manipulated with ease and provide clearly-defined conditions often not attainable in higher organisms. Its basic application as a model to further our understanding of the function and organization of photosynthesizing cells seems destined to lead to the numerous inroads in molecular biology that have already been realized through studies with phage-bacteria systems.

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16. ABSTRACT

The volume comprises a comprehensive survey of the phycovirus literature. It covers the period from their isolation to the present time.

17. KEY WORDS AND DOCUMENT ANALYSIS

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