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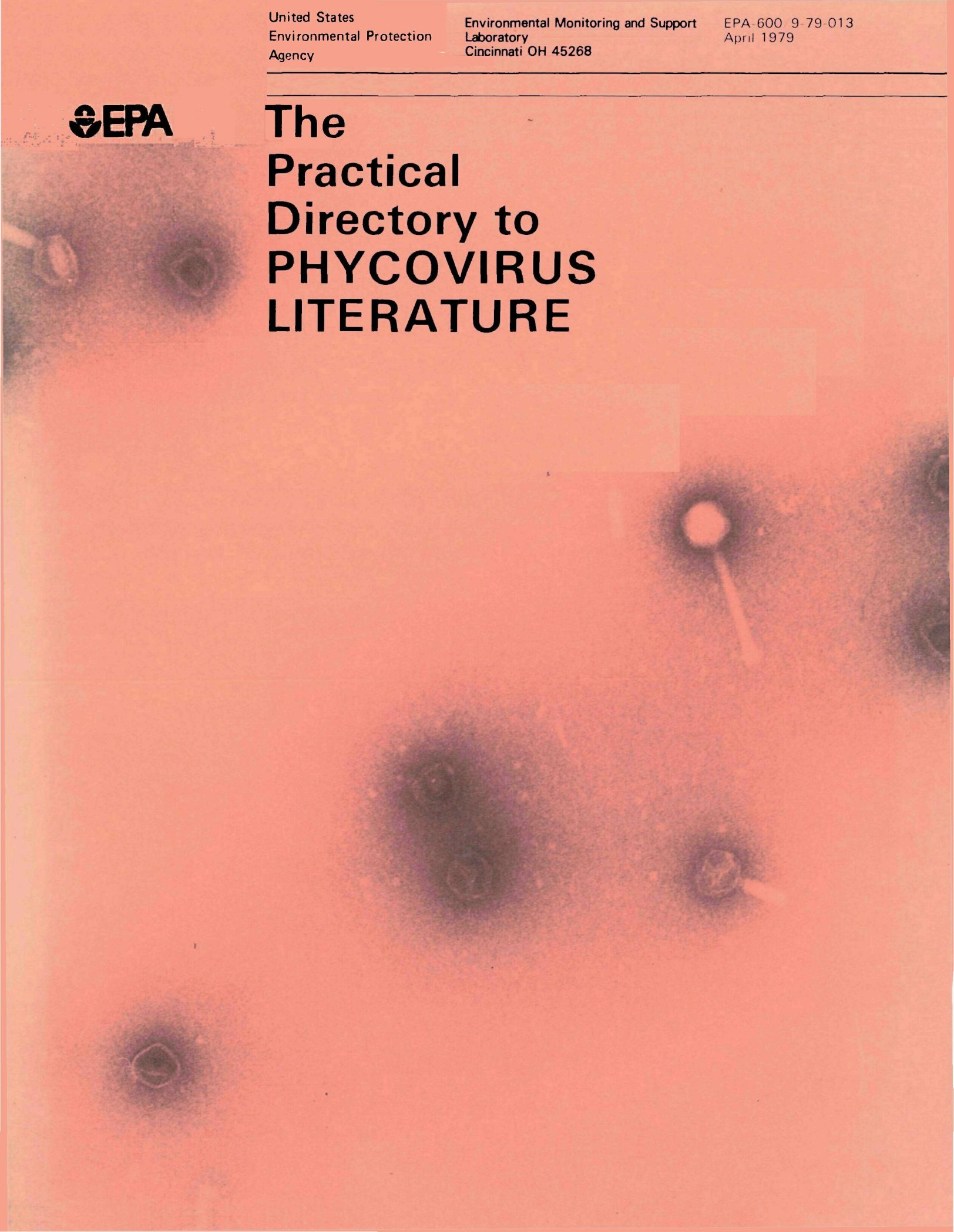
# The Practical Directory to PHYCOVIRUS LITERATURE



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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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# The Practical Directory to Phycovirus Literature

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# Preface

This literature search program is an outgrowth of our earlier efforts to achieve in-depth coverage of accruing developments in phycovirus research. Compilation of such material in a continuous and comprehensive form led to integrating traditional retrieval procedures with those of computerized literature searches. By 1974 inquiries on the subject had increased to where there was a need for a formalization of this index. Thus, 88 phycovirus reports on file at that time were compiled and referenced in a publication titled "Phycovirus Bibliography." Editions were updated in 1975, 1977, and now in 1979 with the present list of publications totalling more than 200 citations.

By compiling these bibliographic citations, we have set out to create an index that will fulfill the needs not only of those who require a general overview of the subject but also of those who require a comprehensive, practical reference source for their studies. We hope that it will also serve as a stimulus for future research and discussion on the subject, while at the same time enabling the reader to denote the different directions phycovirus research has taken. Every effort has been made to achieve an exhaustive indexing of phycovirus literature. In this endeavor, we have been fortunate in receiving indispensable support and cooperation from investigators who have been closely associated with research in this field.

The 1979 edition retains the organization and scope of preceding editions with citations divided into two sections. Section One lists citations that pertain to viruses of procaryotic algae, whereas Section Two contains those publications that deal with viruses of eucaryotic algae. In assessing the two sections, it is readily apparent that viruses of the procaryotic algae have been the more thoroughly researched and thus the better understood of the two groups. As a result, the term "phycovirus," introduced to denote algal viruses in general, has become almost synonymous with blue-green algal viruses.

Reflecting on procaryotic organization in common among bacteria and blue-green algae, it is evident that many morphological and chemical similarities are likely to exist between the viruses infecting them. As studies further document this relationship, more and more phycovirus researchers have used the term "cyanophages" when referring to viruses of blue-green algae. A parallel relationship might be foreseen between viruses of eucaryotic algae yet to be confirmed and those viruses known to infect higher plants. Unfortunately, researchers are faced with formidable obstacles in their attempts to isolate or even demonstrate the presence of viruses of eucaryotic algae. Evidence of these viruses is vague with one exception—a rod-shaped virus, which shares many properties with those of the tobamovirus, has been isolated from *Chara corallina*. In this connection, it is worth pointing out that the disposition of *Chara* poses a difficult problem to the taxonomist. Because of its unique features, it is unclear whether *Chara* appears to resemble more closely the characteristics of bryophytes or those of algae.

This edition is to be submitted to the Bacteriophage Subcommittee of the International Committee on Taxonomy of Viruses where it is to serve as a practical guide to viruses of the blue-green algae. In keeping with this new role, the title "Phycovirus Bibliography" has been changed with the 1979 edition to "The Practical Directory to Phycovirus Literature." Authenticating the growing number of reported phycoviruses is beyond the scope of this Directory. Nevertheless proper documentation of phycovirus strains should be comprehensively broached. Clearly, this increases the need for long-term preservation of these strains and their housing in a central depository from which they would be readily accessible to the scientific community.

# Acknowledgements

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# Introductory Remarks

These introductory remarks are intended to bring to the reader's attention significant trends in phycovirus research. Although research in 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 from which many early problems have yet to be resolved affording investigators a wide variety of basic and applied 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 an infestation 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 concerted effort to better understand the underlying factors responsible for algal degeneration. 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 natural balance of algal communities. Our knowledge is still too limited to attribute specific incidences of algal fluctuations directly to virus activity. 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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15. SUPPLEMENTARY NOTES

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

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| Viruses<br>Algae<br>Bibliography | Phycoviruses | 6M<br>5B |

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