Selected Papers on VIROLOGY

Nicholas Hahon

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edited by

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To

Katheryn Elizabeth

and

Nicolette Kay

"In nature's infinite book of secrecy
A little I can read"

SHAKESPEARE
Antony and Cleopatra
Act II, Scene 2

Preface

The purpose of this volume is to present a collection of papers on virology that contributed prominently to the elucidation of the nature of viruses and the manifold facets of their behavior. Papers were selected which are inclusive of the period from the inception of experimental virology to recent times and are arranged chronologically in the text. Many of the discoveries recounted by the papers influenced, in varying degrees, the direction of virus research and the subsequent development of virology as a science. In consequence, a historical theme pervades the volume. The collection, however, is not a history of virology.

As a convenience to the reader unfamiliar with the technical aspects of virus research, an annotation precedes the text of each paper which provides background information and stresses the significance of each report. To keep the volume within a reasonable size, it was necessary to limit the number of papers in the collection. The selection of papers from the enormous number that were published within the past decade, was difficult due to the momentous advances in virology. Enough outstanding material appeared during this period to justify a volume in itself. Regretfully, many excellent reports were omitted due to the limitation of space.

I hope that the majority of papers in the collection will be a source of erudition and motivation for individuals who, by chance, design, or through a variety of circumstances, have become interested in or recently integrated into virus research. For students, the volume may enrich their appreciation and comprehension of virus research by providing examples of outstanding historical and current reports. For workers active in the field, the volume provides an opportunity to peruse many historical reports on virology of which they have been cognizant but may have lacked the time to locate individually.

I am grateful to the authors of the papers, the editors, and the copyright owners of the different journals for granting me permission to reprint the original articles and translations. Specific acknowledgments appear with each paper where applicable. To the authors who supplied reprints of their papers, my sincere appreciation.

NICHOLAS HAHON

Frederick, Maryland

Table of Contents

Introduction

Virology is a dynamic biological science. Within the span of approximately a little more than a half century, our knowledge of the infectious entities termed "viruses" has progressed from the mysterious concept of a "contagium vivum fluidum" to the recognition that they are composed primarily of nucleic acids and proteins and are the smallest biological units known to possess the inherent characteristics of life. In this short time, an impressive amount of knowledge, systematized and formulated to establish verifiable general laws, has been accumulated with the result that virology is now an independent discipline. The universality of viruses, shown to be associated with the diseases of plants, animals, insects, and bacteria, has attracted the interest and stimulated the imagination of individuals representing many branches of science. Because virology proffers a common ground for fundamental investigations of biological processes, its wide appeal for the scientific community has been a propitious circumstance. The knowledge and methodology of the many specialized fields that comprise the physical, chemical, and biological sciences have been applied and integrated into virus research and, undoubtedly, this has been a contributing factor to its accelerated and dramatic growth in recent times.

In common with most sciences, virology, from its inception and in its subsequent development into a full-fledged science, did not proceed along a straightforward course. It was beset by a generous share of ideological discord, technical obstacles, and the dominating influence of certain factions. Virology was precipitated by necessity (consequences of virus disease on human life, livestock, and plant produce) and given impetus by fortuitous discoveries and perspicacious experimenters, sometimes hampered by existing bacteriological concepts and methodology, and, for many decades, demarcated into divisions (plant, animal, insect, and bacterial) in accord with the major host systems that were attacked by the infectious agents. For a considerable period, each major division developed independently; each had its own special technology, terminology, and conceptions of virus disease. The remarkable technological feats, highlighted by the crystallization of viruses which provided material in a high state of purity for biochemical studies and the discovery that viruses are nucleoproteins which contain either deoxyribonucleic or ribonucleic acids as

their genetic determinants, emphasized certain fundamental properties common to all viruses. The interchange of ideas and complementation of techniques that ensued gradually, infused a unified approach to virus research. The basic problems that were common to one group of viruses were germane then to the comprehension of all viruses. This outlook has been increasingly apparent in recent years.

Although virology is still concerned with the understanding, control, and alleviation of virus diseases, as it was throughout its history, it is equally concerned with exploring the fundamental processes of life. The profound revelations that have been disclosed within the past decade on the mechanisms of virus replication at the molecular level have contributed immensely to this latter viewpoint. Nucleic acids of viruses have been shown to carry the code or information to guide the biological processes and functions of the host cell for the complete replication of the infectious particle. Furthermore, in the process, the viral genetic material may redirect existing metabolic functions of the cell resulting in the alteration of cell morphology and behavior, and in the formation of new enzymes and biochemical products. Even more revealing is the knowledge that fragments of viral nucleic acid may be carried within the cell genome for generations without detection until the fragments are provoked into activity by some stimulus and then produce an overt sign to disclose their presence. The manifestations of viral infections may be regarded then as the consequence of viral nucleic acid present in the cell's hereditary apparatus.

In effect, viruses have assumed a novel and fundamental role in biological and biochemical research. They offer a form of genetic material amenable to quantitative titration and genetic analyses and, as such, are excellent models for examining the biochemical anatomy and functions of cells and for probing the mechanisms of heredity. Viral nucleic acids provide a means for studying and characterizing the reactions intrinsic to the biosynthesis of proteins and nucleic acids. The provocative demonstrations within the past two years of the synthesis of viral capsid proteins of plant, bacterial, and animal viruses in cellfree systems containing *E. coli* ribosomes, amino acids, and the specific viral RNA may be a foretoken of the eventual *in vitro* formation of complete virus particles. In broader perspectives, evidence may be accrued eventually to formulate reasonable hypotheses on the origin of viruses. Because of their intimate association with the biological processes of life, viruses may offer clues on the biochemical beginning and evolution of life on earth.

In the light of all these penetrating discoveries and their deep implications, one is confronted with excogitating a definition for the remarkable entities termed "viruses." The older and descriptive definitions based on size, pathogenicity, and obligate parasitism seem inadequate. Viruses have been envisioned now as transmitters or vehicles of information-bearing

genetic material or, stated in more general terms, as "bits of infectious heredity in search of a chromosome." The recent definition of viruses expressed by S. E. Luria seems an appropriate reflection of our present knowledge "to consider viruses as genetically specific cell constituents containing coded DNA (deoxyribonucleic acid) or RNA (ribonucleic acid) which can, as one of their genetic functions, determine their own incorporation into specific vehicles for transmission to other cells."

In the preceding paragraphs, a cursory account has been given of the evolution of our present understanding of the nature of viruses, the current trends prevailing in virus research, and the vital role destined for viruses in biological research. Various facets of these areas are considered in greater detail by this collection of papers on virology.

Selected Papers on Virology

AN INQUIRY into THE CAUSES AND EFFECTS of THE VARIOLAE VACCINAE, A DISEASE discovered in some of the western counties of England, particularly GLOUCESTERSHIRE, and known by the name of THE COW POX.

BY EDWARD JENNER, M.D. F.R.S. & c.

——— quid nobis certius ipsis
sensibus esse potest, quo vera ac falsa notemus.
Lucretius.

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