PREFACE

The history of studies on prokaryotic viruses that was initiated with the independent discoveries of bacteriophages by Hankin, Twort and d'Herelle at the junction between XIX and XX centuries has its ups and downs. Intuitively, since they were killing bacteria, phages were used initially as antibacterial agents. However, they were not enough standardized, and too variable, which did not permit to design highly reproducible experiments. Thus, clinical use of phages was more of an art than science. Therefore, in 1940's, bacteriophages were quickly supplanted by antibiotics and other antibacterial drugs, which acquired an aura of "miracle" medicines.

Although phages became "visualized" only after the discovery of electron microscope, their representatives soon acquired an important status in several research laboratories all over the world, as sophisticated genetic and molecular biology tools and as model "organisms" to study molecular mechanisms that underlie basic biological processes. They remained as such for decades contributing to numerous groundbreaking discoveries and to the development of genetic and molecular biology methods that enabled a rapid progress in several fields in biology and medical sciences. The discovery of restriction enzymes and the development of phage display-based drug discovery methods are just some examples.

When one of us (W.S.) was exposed for the first time to the Biology at the high school level in Lwów, Poland, in late 1930s, the smallest unit of life was the cell. Under the microscope, he had seen and admired the bacterial, yeast or larger eukaryotic cells. Moreover, he was told that there existed also viruses, that are even smaller than cells and that attack cells. He learned that viruses lysing bacterial cells were called bacteriophages. He saw the first electron micrographs of them, obtained from prof. Ruska in Berlin, when visiting the Institute of Prof. Rudolf Weigl in Lwów, at about 1940. As a student of chemical engineering, he immediately became mesmerized by these creatures, because of both scientific and practical reasons: (1) they seemed to look like hexagonal microcrystals, while appearing to be on the borderline between the "lifeless" chemical molecules and smallest units of life, (2) they seemed to be be a good candidate to unravel the chemical essence of life, (3) they might permit him to undertake the first time a chemical enzymatic/cathalytic synthesis of life (4) they were killing bacteria and thus they could cure the diseases. This is why he elected to become microbiologist in late 1940s and later joined the phage group of CSHL.

When the second one of us (M. L.) attended a high school in Warsaw, viruses, phages among them, were now included in the program of Biology classes. Descriptions of deliberate experiments on phages – at that time still considered to be physical structures, dominated the lectures on Genetics at the Warsaw University, and spurred the fascination of many students with this viruses. This fascination transformed into a laboratory practice, in 1970s and 1980s, at the time when phages were commonly used as simple models to elucidate mechanisms of basic biological processes, and as tools to study and engineer bacterial genomes.

The second half of XX century could be seen as a golden era of bacteriophage research. However, the glitter of this era was predicted by some to decline and be over at 1990's, when they claimed that "all what was important was already discovered with prokaryotes" and that eukaryotic organisms would became the focus of attention. The development of cell culture-based techniques enabled a rapid progress in studies on eukaryotic cells and organisms. However, the discoveries of recent decades that pointed out the numerical dominance of viruses, especially phages, over all cellular organisms in most environments and enabled to get insight into the genomes of various phages and bacteria, revolutionized our understanding of the role of phages in the control of bacterial populations, in the adaptation of bacteria to new environmental niches, in the exchange of genetic information between them, and in the global circulation of matter. Thus, phages are now seen as key factors that shape our environment and again they attract the attention of more and more scientists. At the same time the emergence and spread of multiresistant bacterial pathogens revitalized the interest in the potential use of phages as antibacterial agents – an approach that was abandoned in Western countries with the introduction of antibiotics.

This book should reach the readers somewhat over a year after a crucial event – the first International Congress on Viruses of Microbes, at the Pasteur Institute in Paris. The congress attracted nearly a thousand participants, like no other phage-focused conference before, although the numerically smaller Phage Meetings initiated in CSHL have been held every year since 1950, as were other series of phage gathering including those in Olympia. WA and Salamanca, Spain.

No single book can reflect the full richness of phage world, with its estimated number of 10^{30} representatives. No book can cover in sufficient detail the topics of the First International Congress on Viruses of Microbes, which inspired us to initiate this undertaking. Thus, a reader will find here several topics that seem worth of more attention because of their novelty, importance or historical value. Most what we know about the prokaryotic viruses comes from bacteriophage studies. However, archeal viruses, whose only sparse representatives are known so far,

may be even more diversified than bacteriophages, as is described in a chapter of this book by Mart Krupovic and coauthors. Clearly, there is still plenty of room for new discoveries. A few additional examples are the recently discovered new virus representatives, virophages, that propagate at the expense of other viruses in the "viral factories" of the latter. Although not sensu-stricto prokaryotic viruses, virophages resemble to some extent bacteriophages and thus, a chapter that concerns virophages is included in this book.

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