

Phage

William C. Summers

Phage Therapy: Past, Present and Future Stephen T. Abedon,Pilar García,Peter Mullany,Rustam Aminov,2017-09-05 Historically, the first observation of a transmissible lytic agent that is specifically active against a bacterium (*Bacillus anthracis*) was by a Russian microbiologist Nikolay Gamaleya in 1898. At that time, however, it was too early to make a connection to another discovery made by Dmitri Ivanovsky in 1892 and Martinus Beijerinck in 1898 on a non-bacterial pathogen infecting tobacco plants. Thus the viral world was discovered in two of the three domains of life, and our current understanding is that viruses represent the most abundant biological entities on the planet. The potential of bacteriophages for infection treatment have been recognized after the discoveries by Frederick Twort and Felix d’Hérelle in 1915 and 1917. Subsequent phage therapy developments, however, have been overshadowed by the remarkable success of antibiotics in infection control and treatment, and phage therapy research and development persisted mostly in the former Soviet Union countries, Russia and Georgia, as well as in France and Poland. The dramatic rise of antibiotic resistance and especially of multi-drug resistance among human and animal bacterial pathogens, however, challenged the position of antibiotics as a single most important pillar for infection control and treatment. Thus there is a renewed interest in phage therapy as a possible additive/alternative therapy, especially for the infections that resist routine antibiotic treatment. The basis for the revival of phage therapy is affected by a number of issues that need to be resolved before it can enter the arena, which is traditionally reserved for antibiotics. Probably the most important is the regulatory issue: How should phage therapy be regulated? Similarly to drugs? Then the co-evolving nature of phage-bacterial host relationship will be a major hurdle for the production of consistent phage formulae. Or should we resort to the phage products such as lysins and the corresponding engineered versions in order to have accurate and consistent delivery doses? We still have very limited knowledge about the pharmacodynamics of phage therapy. More data, obtained in animal models, are necessary to evaluate the phage therapy efficiency compared, for example, to antibiotics. Another aspect is the safety of phage therapy. How do phages interact with the immune system and to what costs, or benefits? What are the risks, in the course of phage therapy, of transduction of undesirable properties such as virulence or antibiotic resistance genes? How frequent is the development of bacterial host resistance during phage therapy? Understanding these and many other aspects of phage therapy, basic and applied, is the main subject of this Topic.

The Good Virus: The Amazing Story and Forgotten Promise of the Phage Tom Ireland,2023-08-15 How a mysterious, super-powerful—yet long-neglected—microbe rules our world and can rescue our health in the age of antibiotic resistance. At every moment, within our bodies and all around us, trillions of microscopic combatants are waging a war that shapes our health and life on Earth. Countless times per second, viruses known as phages attack and destroy bacteria while leaving all other life forms, including us, unscathed. Vastly outnumbering the viruses that do us harm, phages power ecosystems, drive evolutionary innovation, and harbor a remarkable capacity to heal life-threatening infections when conventional antibiotics fail. Yet most of us have never heard of them, thinking of viruses only as enemies to be feared. The Good Virus prompts us to reconsider, and to discover, how these viruses could save countless lives if we can learn to harness their extraordinary abilities. Taking us inside the ongoing quest to use phages’ powers for good, Tom Ireland introduces us to the brilliant, often eccentric, scientists who have fought to realize phages’ potential in the face of doubt and political intrigue. We meet the renegade French-Canadian scientist who discovered phages and pioneered their use as medicine over a century ago, leading them to be hailed as the world’s first genuine antibiotic years before penicillin. We learn why, in some pockets of the former Soviet Union, drinking a vial of phages remains as common as taking an over-the-counter drug. We follow the intrepid scientists and doctors now racing to make “phage therapy” work worldwide as the threat of antibiotic-resistant bacteria grows ever more urgent—even as other researchers uncover how phages bolster our everyday immunity, help generate the oxygen we breathe, and furnish the origins for breakthrough technologies like CRISPR. Unveiling the hidden rulers of the microbial world and celebrating the surprising power of viruses to heal, not harm, The Good Virus forever changes how we see nature’s most maligned life forms.

Phage and the Origins of Molecular Biology John Cairns,Gunther Siegmund Stent,James D. Watson,2007 First published in 1966 as a 60th birthday tribute to Max Delbrück, this influential work is republished as The Centennial Edition. The book was hailed as [introducing] into the literature of science, for the first time, a self-conscious historical element in which the participants in scientific discovery engage in writing their own chronicle (Journal of History of Biology).

The Bacteriophages . Stephen T. Abedon,2006 This book describes the fundamental biology and applications of the bacteriophages, viruses that infect bacteria. It provides a current guide to each major phage family, highlights interesting topics, and provides a description of the kinds of phages that are associated with the major classes of eubacteria and archaea.

Bacteriophages David R. Harper,Stephen T. Abedon,Benjamin H. Burrowes,Malcolm L. McConville,2021-01-30 This first major reference work dedicated to the manifold industrial and medical applications of bacteriophages provides both theoretical and practical insights into the emerging field of bacteriophage biotechnology. The book introduces to bacteriophage biology, ecology and history and reviews the latest technologies and tools in bacteriophage detection, strain optimization and nanotechnology. Usage of bacteriophages in food safety, agriculture, and different therapeutic areas is discussed in detail. This book serves as essential guide for researchers in applied microbiology, biotechnology and medicine coming from both academia and industry.

Bacteriophage Applications - Historical Perspective and Future Potential Jessica Nicastro,Shirley Wong,Zahra Khazaei,Peggy Lam,Jonathan Blay,Roderick A. Slavcev,2016-10-04 This book explores key applications of phage biotechnology and reviews recent advances in phage display technologies. The applications covered were selected on the basis of their significance and representativeness in the field. The small size and enormous diversity of bacteriophages make them ideal candidates for numerous applications across many industries. Since the discovery of phages and the advent of phage display systems, considerable attention has been focused on the development of novel therapeutic and industrial applications. Recent studies combine the genomic flexibility of phages with phage display systems in order to generate modified phages for targeted delivery.

Phage Therapy: A Practical Approach Andrzej Górski,Ryszard Międzybrodzki,Jan Borysowski,2019-10-25 This book gives a detailed yet clear insight into the current state of the art of the therapeutic application of bacteriophages in different conditions. The authors bring in their practical expertise within their respective fields of expertise and provide an excellent overview of the potential and actual use of phage therapy. Topics like economic feasibility compared to traditional antibiotics and also regulatory issues are discussed in far detail. This new volume is therefore a valuable resource for individuals engaged in the medical application of novel phage therapies.

The Bacteriophages Richard Calendar,2012-12-06 It has been 10 years since Plenum included a series of reviews on bacteriophages, in Comprehensive Virology. Chapters in that series contained physical-genetic maps but very little DNA sequence information. Now the complete DNA sequence is known for some phages, and the sequences for others will soon follow. During the past 10 years two phages have come into common use as reagents: A phage for cloning single copies of genes, and M13 for cloning and DNA sequencing by the dideoxy termination method. Also during that period the use of alternative sigma factors by RNA polymerase has become established for SP01 and T4. This seems to be a widely used mechanism in bacteria, since it has been implicated in sporulation, heat shock response, and regulation of nitrogen metabolism. The control of transcription by the binding of A phage CII protein to the -35 region of the promoter is a recent finding, and it is not known how widespread this mechanism may be. This rapid progress made me eager to solicit a new series of reviews. These contributions are of two types. Each of the first type deals with an issue that is exemplified by many kinds of phages; chapters of this type should be useful in teaching advanced courses. Chapters of the second type provide comprehensive pictures of individual phage families and should provide valuable information for use in planning experiments.

The Forgotten Cure Anna Kuchment,2011-12-10 Before the arrival of penicillin in the 1940s, phage therapy was one of the few weapons doctors had against bacterial infections. It saved the life of Hollywood legend

Tom Mix before being abandoned by Western science. Now, researchers and physicians are rediscovering the treatment, which pits phage viruses against their natural bacterial hosts, as a potential weapon against antibiotic-resistant infections. The Forgotten Cure traces the story of phages from Paris, where they were discovered in 1917; to Tbilisi, Georgia, where one of phage therapy's earliest proponents died at the hands of Stalin; to the Nobel podium, where prominent scientists have been recognized for breakthroughs stemming from phage research. Today, a crop of biotech startups and dedicated physicians is racing to win regulatory approval for phage therapy before superbugs exhaust the last drug in the medical arsenal. Will they clear the hurdles in time?

Biocommunication of Phages Guenther Witzany,2020-06-29 This is the first book to systemize all levels of communicative behavior of phages. Phages represent the most diverse inhabitants on this planet. Until today they are completely underestimated in their number, skills and competences and still remain the dark matter of biology. Phages have serious effects on global energy and nutrient cycles. Phages actively compete for host. They can distinguish between 'self' and 'non-self' (complement same, preclude others). They process and evaluate available information and then modify their behaviour accordingly. These diverse competences show us that this capacity to evaluate information is possible owing to communication processes within phages (intra-organismic), between the same, related and different phage species (interorganismic), and between phages and non-phage organisms (transorganismic). This is crucial in coordinating infection strategies (lytic vs. lysogenic) and recombination in phage genomes. In 22 chapters, expert contributors review current research into the varying forms of phage biocommunication and Phagetherapy. Biocommunication of Phages aims to assess the current state of research, to orient further investigations on how phages communicate with each other to coordinate their behavioral patterns, and to inspire further investigation of the role of non-phage viruses (non-lytic, non-prokaryotic) in these highly dynamic interactional networks.

Bacteriophages Elizabeth Kutter,Alexander Sulakvelidze,2004-12-28 In response to the emergence of pathogenic bacteria that cannot be treated with current antibiotics, many researchers are revisiting the use of bacteriophages, or phages, to fight multidrug-resistant bacteria. Bacteriophages: Biology and Applications provides unparalleled, comprehensive information on bacteriophages and their applications, such as

Phage Therapy - Part A ,2023-10-01 Phage Therapy - Part A, Volume 200 is an informative text on phage and their use for treatment in bacterial infections. The book highlights a number of aspects of the phage in a way that can help students, researchers, clinicians, entrepreneurs and stakeholders perform their research with great interest. Chapters in this new release cover An introduction to bacteriophage and their therapeutic applications, Isolation, screening and characterization of phage, Synthetic phage and their application in phage therapy, Phage engineering for development of diagnostic tools, Phage design and directed evolution to evolve phage for therapy, and more. Additional sections cover Host-phage interactions and modelling for therapy, Phage and phage cocktails formulations, Phage for treatment of Escherichia coli infection, Phage for treatment of Klebsiella pneumoniae infection, Phage for treatment of Salmonella spp infection, Phage for treatment of Staphylococcus aureus infection, and Phages for treatment of Acinetobacter baumannii infection. Includes discussions on phage isolation, screening and characterization Covers synthetic phage, phage for diagnostic, directed evolution and host interaction Presents the latest on phage for treatment of bacterial infections

Phage Therapy - Part B ,2023-11-01 Phage Therapy - Part B, Volume 201 covers bacteriophage and their isolation, screening, synthetic phage, diagnostics, directed evolution, host interaction, and more. The book's aim is to highlight a number of aspects of phage in a way that can help students, researchers, clinicians, entrepreneurs and stakeholders perform research. Sections cover Phages for the treatment of Pseudomonas aeruginosa infection, Phage for the treatment of Vibrio cholerae infection, Phages for the treatment of Mycobacterium species, Phage therapy for gut microbiome, Phages as delivery vehicles, Phage display, Unlocking the potential of Phages: Innovative Approaches to harnessing Bacteriophages as Diagnostic Tools for Human Diseases, and more. Other sections explore Phage display and human disease detection, Bacteriophage as Cargo and its application in nanomedicine, Phage for drug delivery vehicles, Genome editing for phage design and uses for therapeutic applications, Phage for cancer therapy, and Phage for regenerative medicine and cosmetics. Includes sections on phage isolation, screening and characterization Covers synthetic phage, phage for diagnostic, directed evolution, and host interaction Explores Phage for the treatment of bacterial infections

Bacteriophage Ecology Stephen T. Abedon,2008-05-01 Bacteriophages, or phages, are viruses that infect bacteria and are believed to be the most abundant and genetically diverse organisms on Earth. As such, their ecology is vast both in quantitative and qualitative terms. Their abundance makes an understanding of phage ecology increasingly relevant to bacterial ecosystem ecology, bacterial genomics and bacterial pathology. Abedon provides the first text on phage ecology for almost 20 years. Written by leading experts, synthesizing the three key approaches to studying phage ecology, namely studying them in natural environments (in situ), experimentally in the lab, or theoretically using mathematical or computer models. With strong emphasis on microbial population biology and distilling cutting-edge research into basic principles, this book will complement other currently available volumes. It will therefore serve as an essential resource for graduate students and researchers, particularly those with an interest in phage ecology and evolutionary biology.

Advances in Phage Therapy: Present Challenges and Future Perspectives Andrzej Gorski,Petar Knezevic,Naomi Sulinger Hoyle,Shigenobu Matsuzaki,2021-08-02 This Research Topic is dedicated to Prof. Elisabeth Kutter on the occasion of her 80th birthday. Dr. Kutter's career as a phage scientist has extended nearly 60 years. She has been a pioneer as a woman in science. She started to work with phage at the University of Rochester, New York working with Dr. Wiberg on radioisotopes making excellent progress in the field – progress which was even cited in Luria's 1969 Nobel Prize talk. Betty first encountered phage therapy during a visit to Georgia in 1990 which was part of a longer stay in the former Soviet Union under a US-USSR research exchange program. Dr. Kutter was one of the first Americans to advocate for phage therapy in the post antibiotic era. Betty started hosting the Evergreen International Phage meetings in Olympia, Washington, from 1975 onward, which helped to develop a strong phage community with participation increasing over the years to 350 at the 23 rd biannual last year. Betty continues to be an active member in the phage community, sharing her experience and working with all of us toward her ultimate goal of making phage therapy available worldwide thus reducing the burden caused by antibiotic resistant bacterial infections.

Phage Display Tim Clackson,Henry B. Lowman,2004 Phage display has become established as a powerful protein engineering method for identifying polypeptides with novel properties, and altering the properties of existing ones. Although the technique is widely used in biological research and drug discovery, it remains technically challenging, and new applications and procedures continue to evolve. Phage Display - A Practical Approach is an up-to-date, comprehensive and integrated experimental guide to the technique, useful for novice and expert alike. The book aims to enable researchers to design and undertake all aspects of a phage display project, from designing an experimental strategy and constructing a library to performing selections and analyzing the results. An introductory chapter provides an overview of phage biology and phage display, including guidelines for planning a successful phage display experiment. Individual chapters provide protocols for constructing libraries using oligonucleotide-directed mutagenesis or DNA recombination, performing binding selections, and analyzing the binding activities of selected phage clones. Separate chapters then cover common applications, including selection of ligands from peptide libraries, generation of phage antibody libraries and isolation and optimization of antibodies, selection of DNA binding proteins, and expression cloning using cDNA display. Further chapters describe alternative selection strategies, such as selection using immune sera, selection based on enzymatic activity or protein stability, and selection in vivo. Protocols and chapters are extensively cross-referenced, allowing readers to move beyond the specific examples given to customize the procedures to their own protein or selection system of interest. Written by experts in the field, Phage Display - A Practical Approach provides a comprehensive guide to the design and execution of phage display projects, for all those using the technique in basic research and drug discovery.

Life in Our Phage World Forest Rohwer,Merry Youle,Heather Maughan,2014-12-01 We share the Earth with more than 10,000,000,000,000,000,000,000,000,000 phages. Everywhere they thrive, from well-fed

guts to near-boiling acidic springs, from cryoconite holes to endolithic fissures. They travel from one microbial host to the next as virions, their genetic weapons packaged inside a protective protein shell. If you could lay all of these nanoscopic phage virions side-by-side, the line-up would stretch over 42 million light years. Through their daily shenanigans they kill or collaborate with their microbial hosts to spur microbial evolution and maintain ecosystem functioning. We have learned much about them since their discovery by Frederick Twort a century ago. They also taught us that DNA, not protein, is the hereditary material, unraveled the triplet genetic code, and offered their enzymes as indispensable tools for the molecular biology revolution. More contributions will be forthcoming since the vast majority of phages await discovery. Phage genomes harbor the world's largest cache of unexplored genetic diversity, and we now have the equipment needed to go prospecting. Although there are field guides to birds, insects, wild flowers, even Bacteria, there was no such handbook to guide the phage explorer. Forest Rohwer decided to correct this oversight, for novice and expert alike, and thus was born *Life in Our Phage World*. A diverse collection of 30 phages are featured. Each phage is characterized by its distinctive traits, including details about its genome, habitat, lifestyle, global range, and close relatives. The beauty of its intricate virion is captured in a pen-and-ink portrait by artist Benjamin Darby. Each phage also stars in a carefully researched action story relating how that phage encounters, exploits, kills, or otherwise manipulates its host. These behaviors are imaginatively illustrated by fine artist Leah L. Pantea. Eight researchers that work closely with phages also relate their experiences as inhabitants of the phage world. Rohwer has years of first-hand experience with the phage multitudes in ecosystems ranging from coral reefs to the human lung to arctic waters. He pioneered the key metagenomic methods now widely used to catalog and characterize Earth's microbial and viral life. Despite research advances, most people, many scientists included, remain unaware of the ongoing drama in our phage world. In anticipation of 2015, the centennial of phage discovery, Forest assembled a cadre of writers, artists, scientists, and a cartographer and set them to work. The result? This alluring field guide—a feast for the imagination and a celebration of phage diversity.

The American Phage Group William C. Summers,2023-01-10 A fascinating historical account of the American Phage Group and how its new research framework became the foundation for molecular biology This book is the first critical and analytical study of the American Phage Group—a small group of scientists who gathered around Max Delbrück, Salvador Luria, and Alfred Hershey between 1940 and 1960—and how this novel research program became the foundation of the field of molecular biology. These three young, charismatic, and iconoclastic scientists were convinced of the importance of bacterial viruses (bacteriophages) to the study of the gene and of heredity in general. Based on substantial archival research, numerous participant interviews collected over the past thirty years, and an intimate knowledge of the relevant scientific literature in the field, William C. Summers has written a fascinating new history of the American Phage Group. Rather than a linear narrative of progress by past heroes, this book emphasizes the diversity and historical contingencies in the group’s development.

Phage Mu Neville Symonds,1987

Gram-positive phages: From isolation to application Jennifer Mahony,Douwe van Sinderen,2015-05-15 Phage biology is one of the most significant and fundamental aspects of biological research and is often used as a platform for model studies relating to more complex biological entities. For this reason, phage biology has enjoyed focused attention and significant advances have been made in the areas of phage genomics, transcriptomics and the development and characterisation of phage-resistance mechanisms. In recent years, considerable research has been performed to increase our understanding of the interactions of these phages with their hosts using genomic, biochemical and structural approaches. Such multidisciplinary approaches are core to developing a full understanding of the processes that govern phage infection, information that may be harnessed to develop anti-phage strategies that may be applied in food fermentations or applied in a positive sense in phage therapy applications. The co-evolutionary processes of these phages and their hosts have also been a considerable focus of research in recent years. Such data has promoted a deeper understanding of the means by which these phages attach to and infect their hosts and permitted the development of effective anti-phage strategies. Furthermore, the presence and activity of host-encoded phage-resistance systems that operate at various stages of the phage cycle and the potential for the application of such systems consolidates the value of research in this area. Conversely, phages and their components have been applied as therapeutic agents against a number of pathogens including, among others, *Clostridium difficile*, *Lactococcus garviae*, *Mycobacterium* spp., *Listeria* spp. and the possibilities and limitations of these systems will be explored in this topic. Additionally, phage therapeutic approaches have been applied to the prevention of development of food spoilage organisms in the brewing and beverage sectors and exhonorate the positive applications of phages in the industrial setting. This research topic is aimed to address the most current issues as well as the most recent advances in the research of phages infecting Gram-positive bacteria covering areas such as phages in food fermentations, their impact in industry, phage ecology, genomics, evolution, structural analysis, phage-host interactions and the application of phages and components thereof as therapeutic agents against human and animal pathogens.

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