Methods in Molecular Biology

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Since the publication of the First Edition of *Bacteriophages: Methods and Protocols* in 2009, the field of bacterial virus research has evolved extensively. This can be readily observed from the fact that this latest volume contains all new chapters addressing newly emerging themes and methodologies.

One of the first key trends is the successful and broad-scale introduction of phage-based teaching innovation tools within the field of phage biology and beyond. Most notable in this regard is the “phage hunting program” from the University of Pittsburgh, headed by Dr. Graham Hatfull and the Science Education alliance (SEA). This program has exposed university and high school students across the United States to the scientific method and the joy of bacteriophage discovery.

Phage research is undergoing a clear shift from the microbiological and genomic to the postgenomic era. New phage genome sequences and metavirome analyses are flooding public databases and are revealing new insights into the field of ecology, all supported by new bioinformatics approaches and tools. This type of research has now also reshaped bacterial virus taxonomy from the morphology-driven classification (originally introduced by Professor Hans-Wolfgang Ackermann) to an integrated genome-driven taxonomy, which has gradually been implemented in the last decade. Affordable high-throughput sequencing is now also opening the door to systematic transcriptome analysis using RNaseq, introducing new standard towards experimental validation of gene predictions, genome organization, and the importance of ncRNAs.

This postgenomic era is driven by curiosity of the vast numbers of unknown gene products encoded by phage, also termed the “viral dark matter.” The functional elucidation of the function of these proteins using new state-of-the-art approaches is rekindling research questions which have driven the “Golden Age” of phage research and have led to key advances in biotechnology between the 1950s and 1970s. One may argue that a new generation of researchers is currently emerging which may hopefully lead us into a “Second Golden Age” of phage research. Indeed, the discovery and impact of the CRISPR/cas system and its derived biotechnological techniques is yet again a driving force impacting entire research fields. The CRISPR/cas genome editing tools are just a single example of the impact of phage research on synthetic biology. The advances in our ability to engineer phage in various bacterial hosts provide a scaffold for new and innovative antibacterial design strategies.

Indeed, the last decade has also resulted in the re-evaluation of phage and phage-derived strategies to combat multidrug resistant human pathogens and approaches for the food and agriculture industry. Companies driven/supported by academic research have emerged and develop phage-based antimicrobials (phage therapy, endolysins, ArtiLysins™), the first of which have now entered the market in agriculture and food industry and for human applications (diagnostics, ongoing clinical trials).
All of these developments in phage research have been supported by initiatives from within the research society to organize and broaden its scope. The establishment of the “International Society for Viruses of Microbes” has expanded the community, made it more tightknit, and is coming together through social media initiatives (e.g., PhageBook, “A smaller flea” blog). We hope this edition of *Bacteriophages: Methods and Protocols* will like the previous volumes assist both the established and novice phage scientist.

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