Reviews and Resources

BOOKS

Bacteriophages: Biology and Applications

This new and excellent volume, together with Richard L. Calendar and Stephen T. Abedon (ed.) The Bacteriophages, edition 2, from Oxford University Press (ISBN no., 0195148309, published in December 2005 release date) may help to redress the loss of understanding of the role of phage studies in modern microbial science. It is difficult without current volumes to imagine how essential bacteriophage were in the invention of molecular biology as we know it, from the understanding that the gene consists of DNA to the discovery of messenger RNA and many essential aspects of the triplet genetic code. Thus, it is also surprisingly that Amazon.com does not list the classic books Bacteriophage T4 (1983) and The Molecular Biology of Bacteriophage T4 (1994), both co-edited by E. Kutter and published by ASM.

Here, the cast of authors has changed, while Dr. Kutter has remained (for over 30 years, it says) actively thinking phage and on the faculty of a small teaching college in the Northwest. Her new coeditor has a history and interest in the use of phage as medical therapeutics, a subject developed in Europe but mostly abandoned decades ago in North America.

The volume starts with an enjoyable history of phage by W. C. Summers, with the discovery of phage by Twort and De- Herelle (still less than 100 years ago), and then to the roles of phage in the development of molecular biology. Phage were famous in the time of Max Delbrück and colleagues as a black box where input and output analysis elucidated much of what became molecular genetics, without opening the box (i.e., cells) to see biochemically what was happening inside. More recently phage are more like a black hole, where much energy has been usefully spent without much understanding escaping to the larger molecular or microbial communities. The remaining chapters include updates on basic phage biology, genetics (and now genomics), as well as phage ecology and a range of more practical uses of phage in medicine and agriculture, including the new rebirth of phage therapy. These attempts to use bacteriophage to treat human disease will be for many a deja vu of Arrowsmith, the Pulitzer Prize-winning novel by Sinclair Lewis (1924), which introduced more than one generation to the romance of microbiology and of bacteriophage.

Allow us a closing plea for wide use of this welcome volume: the phage group no longer is large enough to maintain the major Cold Spring Harbor Laboratory presence, and the Annual Phage Meetings have expanded to include bacteria and moved to Madison, Wis. It is clear here that much novel and exciting science of phage has been done recently and that there is more that remains to be done.

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Proteomics Today: Protein Assessment and Biomarkers Using Mass Spectrometry, 2d Electrophoresis, and Microarray Technology

A number of books have been written on proteomics extolling its technology, applications, and perceived future. In general, most of these books are written with a prospective outlook. This particular book is unique in that the authors have taken a historical perspective in the development of proteomics. They named the book Proteomics Today. I believe the name stems from the authors’ perspective that the field existed before, but has gotten more impetus of lately due to advances in technology and discoveries of genomics, and has gotten a new name. The authors have done an excellent job of demonstrating with historical accounts the evolution of proteomics. The historical account of the field provides a nice learning experience and insights for anyone new as well as experienced scientists to this field of research.

Advances in proteomics are based on the developments of two areas of distinct technologies: protein separation and their identification. Thus, the book has been conveniently divided into two parts: Part I primarily deals with the development of technologies for protein identification, and Part II deals primarily with protein separation.

The mainstay of proteomics is mass spectrometry. It would not be an understatement to claim that the advances in mass spectrometry have made proteomics possible. The author of Part I, Dr. Hamdan, discusses in detail, in two chapters, the instrumentation and quantification of proteins by mass spectrometric methods. Further, in one chapter, he presents application of proteomics in cancer research. The remaining three chapters of the book, by Dr. Righetti, are focused on various protein separation techniques, such as isoelectric focusing, sodium dodecyl sulfate gels, and two-dimensional maps.

Both theoretical and practical aspects of the technology are treated well in the book. However, bioinformatics is an integral part of proteomics to make sense out of enormous data output from this high throughput technology. The very little discussion of this aspect of the field is a draw-
back of the book. Despite this limitation, this is an excellent book on proteomics as far as separation, detection, and quantification aspects of proteomics are concerned.

All the chapters are highly authoritative. The book is highly coherent, as it is written by only two authors as opposed to many books written by several authors and edited by one or more authors. Books written by only one or two authors have an edge, as they tend to be more comprehensive and better coordinated in contents.

I highly recommend this book for anyone planning to get involved in proteomics technology or for one who is already involved in proteomics but needs to brush up on the historical aspects of its origin. It provides an entertaining insight on the field of proteomics.

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Microorganisms in Soils: Roles in Genesis and Function


Microorganisms and soil processes are intimately connected but not well understood. This lack of knowledge is in part due to a reliance of traditional soil microbiologists and scientists on outdated scientific methods that are merely descriptive; able to elucidate or predict neither their complex and dynamic interactions nor the interior architecture of soils. In addition, the traditional boundaries of soil physics, soil chemistry, and soil microbiology have to be overcome for an integrated, meaningful approach (I. M. Young and J. W. Crawford, Science 304:1634–1637, 2004).

Recently, interest in these topics has increased as the importance of these processes for many global cycles has become apparent, and this area has become a scientific frontier in microbiology and biogeochemistry (A. Sugden, R. Stone, and C. Ash, Science 304:1613, 2004). It is in this context that a well-edited guide to this field comes in handy. This is the third and so far best volume of the Soil Biology series, edited by Francois Buscot and Ajit Varma. The 18 chapters are thematically well organized, most having a concluding paragraph. The figures and photographs are of good quality, with most chapters being informative and a pleasure to read.

The book is arranged into six thematic parts, with the first part defining soils and covering microbial diversity. Curiously, molecular techniques such as describing the microbial community using 16S-rDNA libraries or metagenomics are entirely missing. The second, very good, part looks at the role of microbes in soil genesis, mineralization, humification, and aggregation. Biogeochemical processes such as carbon and nitrogen cycling, as well as phosphorus mobilization and availability, are covered in the third part. The fourth part on biotic interactions focuses mainly on the mycorrhizosphere and contains an excellent review entitled “Mycorrhizosphere: Strategies and Functions.” In addition, food web structures and other interactions of microorganisms with the micro-, meso-, and macrofauna are discussed in the last chapter. The fifth part, which looks at the function of microbes in specific soil compartments, has a very nice chapter by Burkhard Büdel entitled “Microorganisms of Biological Crusts on Soil Surfaces,” which has an extensive survey of pro- and eukaryotes inhabiting various types of soil crust; however, I thought the subsection on bacteria in soil was not very up to date and should have included, e.g., F. Garcia-Pichel, S. L. Johnson, D. Youngkin, and J. Belnap, Microb. Ecol. 46:312–321, 2003. Finally, in the last part, some modern tools in soil microbial ecology are described. The theory and some relevant examples of isotopic techniques were given a good treatise in the last chapter, “Assessing Functions of Soil Microbes with Isotopic Measurements,” by Erik Hobbie. It is both the authors’ and my hope to see an increase in the use of this methodology in the future when looking at soil ecosystems.

Unfortunately, a chapter on the use of modern spectroscopic techniques such as Fourier-transform infrared (FTIR) spectroscopy and nuclear magnetic resonance (NMR) is missing. Although I thought that most chapters were well-researched and useful, some were disappointing. In “Microbial Diversity in Soils,” the phylogeny is outdated, and statements such as “Archaebacteria is a group of primitive prokaryotes” are just annoying. Primitive compared to what? Are then Halobacteria more primitive than Salinibacter? In addition, it should be pointed out that not all archaea are extremophiles, and most “extreme” environments are also occupied by eubacteria. Entirely missing in this chapter is a description of microbial diversity using 16S rDNA analysis. The chapter “Microorganisms in Toxic Metal Polluted Soils” often appears confused with a mere listing of facts. In my opinion, it has to be pointed out that there is no difference between plasmid and chromosomally encoded genes conferring metal resistance/tolerance. This error is unfortunately repeated in many reviews; however, genomic sequence analysis clearly shows that plasmid-encoded genes are also encoded on the chromosome of other microorganisms. Strangely, the chapter on “Transgenic Rhizospheres of Crop Plants: Their Impact on Indigenous Soil Fungi” appears to be more of a small paper than a review.

In contrast, I found, “Role of Microorganisms in Wear Down of Rocks and Minerals” by Anna Gorbunova and Wolfgang Krumbein to be quite interesting and thought-provoking. Connections between rock wearing, increasing hydrocarbon and CO2 concentrations, and active surface areas of soil and rock, as estimated by fractal calculations, are explored. Whether one agrees or disagrees with the authors is beside the point; the chapter is definitely entertaining, a quality often missing in scientific literature.

Overall, I can mostly recommend this book and hope it sets the standard for the Soil Biology series.

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Helicobacter pylori: Physiology and Genetics


This book is a well-prepared treatise about Helicobacter pylori, a gram-negative, spiral-shaped, microaerophilic bacterium that is now known to be a cause of gastritis, gastric and duodenal ulceration, and gastric cancer. Although reports of spiral bac-
taria in the stomach date back to the 1800s, Barry J. Marshall and J. Robin Warren were the first who successfully cultured these unusual microbes from a gastric biopsy in 1982. Their discovery initiated an almost unparalleled research activity over the past two decades, and this book summarizes and reviews the most significant knowledge about this important human pathogen. The editors have assembled a group of 95 scientists and clinicians from different scientific disciplines from around the globe who have prepared 46 chapters on various aspects of *H. pylori*, including morphology and culture, taxonomy, metabolism and physiology, genetics and molecular biology, epidemiology, pathogenesis, diagnosis and treatment, animal models, and the relationship between *H. pylori* and other *Helicobacter* species.

The book is divided into eight sections: In section I (Introduction), the authors review the history and significance of this microorganism as a pathogen, the epidemiology of infection, and the association of *H. pylori* with peptic ulcer disease. Section II (Bacteriology) is about the organism’s cultivation, taxonomy, morphology and ultrastructure, the cell envelope, lipopolysaccharides (LPS), and the vacuolating cytotoxin. The third section (Energy Metabolism and Synthetic Pathways) covers respiration, nitrogen and nucleotide metabolism, biosynthetic pathways, and strategies to evade the toxic effects of oxygen. In the fourth section (Physiology and Molecular Biology), the authors discuss the structure and regulation of *H. pylori’s* urease enzyme, the ion metabolism and transport mechanisms, the metabolite transport and protein export, as well as the organism’s motility via flagella and the chemotactic activity toward various compounds. The authors also review aspects of transformation, recombination, DNA repair, chromosomal and plasmid replication, cell division, restriction and modification systems, transcription, translation, and the regulation of urease including acid resistance.

The next section (Genetics) describes *H. pylori’s* genome, genetic exchange and gene regulation, mutagenesis, and the *cag* (cytotoxin-associated gene) pathogenicity island. This section also reviews aspects of population genetics, genomic diversity, and subtyping. The following two sections relate to *H. pylori’s* virulence and pathogenic potential. In section VI (Bacterial Virulence and Pathogenic Mechanisms), the authors review the organism’s adherence and colonization characteristics, and discuss aspects of autoimmunity, LPS Lewis antigens, and the development of preventive and therapeutic vaccines. Section VII (Pathogenesis in the Host, Diagnosis and Treatment) describes the pathology of *H. pylori* gastritis, peptic ulceration, and gastric cancer, and provides information about markers of infection, immune responses, and antibiotic susceptibilities and resistance development. The final section (Animal Models and Other *Helicobacter* Species) discusses various animal models used to study *H. pylori* infection and disease. Two quite interesting chapters provide information about enterohepatic *Helicobacter* species and about other known *Helicobacter* species and spiral organisms.

I found this book to be comprehensive, exceptionally well written, and sufficiently illustrated. I would highly recommend this book and believe that it is an important volume for microbiologists and infectious disease specialists. It is also a useful textbook for students and postgraduate scholars who have an interest in *H. pylori*. Barry Marshall and Robin Warren were just recently awarded the 2005 Nobel Prize in Physiology or Medicine for their discovery and successful culture of *H. pylori* and for their demonstration that gastritis and ulceration of the stomach or duodenum is the result of an infection of the stomach caused by this bacterium. It is worth mentioning that Nobel laureate Barry Marshall contributed a chapter to this book.

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