In this section, I provide articles on recent developments and new technology used in microbiology and related fields. I also post articles that may help you bring new information or techniques into your laboratory or classroom via case studies or lab exercises. I hope you find this information useful, and I encourage you to send suggestions, questions, or comments to me at herzogja@herkimer.edu. I look forward to hearing from you!

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Research Articles


(Review of current knowledge base regarding the genetic basis of infectious disease as well as disease resistance.)


(Analysis of carbon stores within microbial populations located in colder regions of the world and their potential to impact global climate change.)


(A review of the ecological, ecological, and economic implications of fungal pigmentation production.)


(Elucidation of key players in the process of biofilm formation by this medically important pathogen.)


(A two-fold program designed to enhance public understanding of an emerging infectious disease while creating ecological maps of a critical biological vector.)


(Laboratory evaluation of biochemical-based testing methods for clinically relevant yeast strains.)

Pedagogy


(A peer-led method to reduce attrition rates in introductory level courses for new science majors.)


(One Health initiatives are leading to effective curriculum changes in both secondary and higher education.)


(Use of microbiology-based virtual patients to enhance mastery of microbiological principles as well as critical thinking skills related to epidemiological patient case scenarios.)


(An engaging look at effective methods for utilizing the field of astrobiology to address multiple Next Generation Science Standards or to enliven nonmajors college-level biology courses.)

BOOKS

OpenStax: Microbiology Provides a Cost-Effective and Accessible Resource for Undergraduate Microbiology Students

DOI: http://dx.doi.org/10.1128/jmbe.v17i2.1104

Review of: OpenStax: Microbiology. Nina Parker, Mark Schneegurt, and Anh-Hue Tu; (2016). OpenStax and ASM. 1100 pages. (Note: At time of journal printing, this book was not yet published. Certain publication details may change slightly.)

As a Microbiology instructor in a rural, underserved area, I am perpetually searching for instruction materials that will fill my students’ academic needs while also addressing their financial limitations. After trying several open-source, internet-based textbooks, I have found that there is a fine balance between reducing costs and ensuring the students...
will use the materials. For example, while in more urban areas students are more comfortable with e-readers, many of my current students are uncomfortable with this format. In order to be certain that all of my students find the textbook and course materials accessible, it has become necessary to choose a publisher that offers a variety of cost effective options from which the students may choose. In my experience, the most effective resource has been the OpenStax line of textbooks (openstaxcollege.org).

Having adopted OpenStax: Biology for the past year for my General Biology courses, I was pleased to hear that the American Society for Microbiology was collaborating with the team from OpenStax College to create OpenStax: Microbiology. OpenStax offers web-based, PDF, and hardcover textbook options from which the students and instructors may choose, providing students with the option to purchase the textbook if they are more comfortable with traditional formats or to follow along online if they are unable to afford the book. In addition, the standard instructor resources such as test banks, PowerPoint slides, and sample syllabus language are provided. With regard to the general format, the only challenge I have run into is the lack of consistency in page numbers and chapter language across the platforms. For example, online, the dropdown menu uses the units rather than the chapters as the hard copy text does, which can lead to some confusion. I have adjusted my syllabus to use both the unit and page number formats to ameliorate this problem.

More specifically, OpenStax: Microbiology starts with the typical review of general biology concepts such as cellular anatomy, DNA, and microscopy. Next are individual chapters that give an overview of prokaryotes and eukaryotes, followed by viruses and prions. These chapters are followed by the systems approach, including biochemistry, metabolism, and growth, then the control of microorganisms. Finally, the book concludes with sections on pathogenicity, immunology, and infection.

Altogether, the book addresses each of the concepts in an introductory Microbiology college course syllabus. Although the progression of the chapters is outlined in a logical fashion, the chapters can be assigned out of order without diminishing the conceptual understanding. For example, I prefer to assign chapters on biochemistry and metabolism earlier than the given sequence because these concepts are crucial to understanding for my course’s laboratory curriculum. Having reviewed the format of the book, I feel that assigning these chapters out of sequence would not lead to confusing non sequiturs, contrary to what I have seen in some texts. Importantly, this text is easy to read. The concepts flow in a logical pattern and are introduced thoroughly but without delving into unnecessary depth. The authors were able to resist the temptation to overdo it when it came to their area of expertise, and the result is an elegant discussion that is simple without being over-simplified.

To summarize, I am looking forward to adopting OpenStax: Microbiology for my undergraduate Microbiology course. The format is cost effective and flexible to suit student needs. Although this can require more organization from the instructor, an experienced educator will have no difficulty developing a course around this resource.

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Pandemics—A Scientific Guide for Use in Varied Classes
DOI: http://dx.doi.org/10.1128/jmbe.v17i2.1046


Would you like to be invited on a scientific journey to learn about pandemics with Peter C. Doherty, the co-recipient of the 1996 Nobel Prize in Physiology or Medicine? If you replied “yes,” you will enjoy this book. Doherty developed a comprehensive, well-written, easy-to-understand informational guide about historical pandemics. His book contains an introduction, 12 topic chapters, a conclusion chapter, a functional index, a list of abbreviations, and a list of numerous resources for further investigation by the reader (e.g., books, articles, and websites).

Doherty sets the stage for his discussions about pandemics as follows: “pandemics can cause panics, and the sense of imminent danger may be more universally contagious than any virus or bacterium. A lethal virus spreading rapidly and inexorably is, to most of us, a truly terrifying thought, so much so that it pushes other nightmare scenarios that generally hover at the edges of our consciousness (terminal cancer, leukemia, incipient dementia, stroke, quadriplegia, cardiomyopathy, and so on) into deep background.” Doherty not only describes pandemics and provides guidelines for appropriate actions in case a threat emerges, he also puts pandemics into perspective with regard to individual and community life.

In the first chapter, Doherty discusses some key aspects of infection and immunity. He provides answers to numerous questions such as: What is the difference between a virus and a bacterium? Why is it important to distinguish viruses from bacteria when discussing pandemics? Are colds and flu caused by hundreds of viruses? Would you describe mAbs [monoclonal antibodies] as drugs or vaccines? I found this chapter to be written such that students of every level can understand and enjoy it. In Chapter 2, he provides the reader with definitions of basic terms such as “pandemic” and “epidemic,” as well as technical terms such as “zoonoses” and “epizootic.” He also discusses whether or not all pandemics involve infection and whether plants play a role in pandemics. This chapter is helpful for beginners and advanced students.
This book is adapted from a much longer book, Spill-over, where Quammen examined the leaps of pathogens from animal reservoirs to human hosts. Quammen’s writing addresses the chief concerns of epidemiologists and modern microbe hunters in a world where zoonoses are becoming increasingly common and describes the facts surrounding the Ebola epidemic without hyperbole or sensationalism. Richard Preston's The Hot Zone gave the public a misleading impression when his book described Ebola victims’ cadavers: “After death, the cadaver suddenly deteriorates: the internal organs... have already begun to dissolve, and a sort of shock-related meltdown occurs.” Quammen counters that it is his “duty to advise that you need not take these descriptions quite literally” (p. 47). This is merely one example of the way in which Quammen separates fact from fiction, delivering an objective, empathetic look at the horrifying devastation that the Ebola virus leaves in its wake.

Whether he is describing the tedium of a fruitless search for gorillas (the first victims to fall to the virus) or the forced quarantine of a scientist due to possible exposure to Ebola virus through a needle stick, Quammen paints a vivid portrait of the human side of the epidemic. The tale of Ebola is told both from the victims’ perspective and that of the scientists and public health investigators tasked with tracking down an elusive microbial enemy. Like Carl Zimmer and others who write for a target audience of non-scientists, Quammen’s vivid prose is accessible and he clearly defines and explains scientific concepts to reach a wide array of readers. A sketch map of Africa is provided in the introduction to mark the sites described later in the text, but the book is devoid of any of the ghastly images we have come to associate with this epidemic. Based on his narrative, readers do not need pictures to appreciate the impact of the virus. Students of epidemiology, virology, and general microbiology will appreciate the clarity and depth given to this topic in such a brief but deeply engaging volume. Instructors will undoubtedly turn to anecdotes from Quammen’s book to enhance their presentations on Ebola, and may assign selected chapters for homework readings, or even the entire book as a larger assignment. The material is covered at a level that can be understood by students in introductory microbiology courses for both majors and nonmajors. While Quammen states in the introduction that this book is just a “partial view of the history and science of Ebola, and a somewhat personal one” (p. 2), it provides a valuable resource for both science educators and the general public to understand the context of the Ebola epidemic and why it is crucial to appreciate that the “problem of the Ebola virus is both acute and chronic” (p. 111). Although the book obviously could not examine all of the dynamics of the 2014–2015 epidemic as it continues to unfold in real time, its value lies in sharing lessons learned from the past and providing a critical look at the complex variables faced by public health officials dealing with Ebola outbreaks.

In my opinion, Doherty’s book is a fascinating read about a topic that has been given much attention recently. His scientific discussions contribute to our understanding of infectious diseases of international concern. The question-and-answer format and the in-depth discussions of numerous infectious diseases make this publication an excellent textbook for students of infectious diseases on any education level in fields such as biology, microbiology, epidemiology, and immunology. I believe this book is also quite useful for in-depth discussions about pandemics during infectious disease topics seminars.

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Ebola Virus’ Zoonotic Roots and Horrific Path
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In Ebola: The Natural and Human History of a Deadly Virus, David Quammen expertly dissects the complex, terrifying narrative of the 2014 Ebola outbreaks in West Africa and the Democratic Republic of the Congo, putting them in a historical perspective and carefully delineating what scientists do and do not know about the Ebola virus, its suspected reservoir, and its paths of transmission. The book briefly discusses what is known about the related family of Marburg viruses as well. This slim paperback reads somewhat like a travel adventure/detective story, but it is packed with extensively-researched scientific information that the reader can pursue further through the bibliography.
Idaho forests. Organic, locally sourced food is becoming an important industry in the state, where morel mushrooms sell for up to $20 per pound (p. 44). Idaho consumers are increasingly demanding organic food that is locally sourced and supports area farmers, and these prized fungi are highly valued by restaurants and consumers.

Idaho is known for its potatoes, but it turns out that the dairy industry exceeds the potato industry as Idaho's primary cash cow. While the dairy industry brings in approximately $2.4 billion per year (p. 71), the odoriferous output of the state's 2.3 million cows (1) presents more than just a smelly nuisance to residents downwind of dairy farms. Enter more Idaho microbes, as entrepreneurs like Jay Kesting employ anaerobic digesters to convert the nearly 40,000 tons of manure per year (p. 74) into a reported 3.2 megawatts of electricity (p. 77). But it is not just the energy produced by these anaerobic digesters that benefits the state, homeowners downwind of the dairy farms no longer have to tolerate “the smell of money” (p. 71). Steubner continues his microscopic analysis of the state of Idaho as he investigates the burgeoning craft beer industry, relates his all-too-personal experience with Giardia as a hiker and camper in the Idaho mountains, documents the scourge of blister root fungus in Idahoan forests, reports on the bioremediation of oil and gas leaks at a gas station south of Nampa, and further explores the influence of bacteria, fungi, and algae on the state.

Idaho Microbes is accessible to all levels of readers with its copious and spectacular images, casual writing style and easy-to-read descriptions of microbial processes. Although at times the prose is somewhat lacking, Idaho Microbes is an excellent resource for K–12 teachers, introductory biology and microbiology instructors, microbe enthusiasts, and denizens of the Pacific Northwest.

REFERENCES


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Beautiful Images and Practical Examples Found in Idaho Microbes
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As a former resident of the Pacific Northwest, I was delighted to review Steve Steubner’s book, entitled Idaho Microbes: How Tiny Single-Celled Organisms Can Harm, or Save, our World. Not unlike the authors of The Human Microbiome Project (2), Steubner aims to explore the microbiome of an entire state and its impact on business, agriculture, and the daily lives of its citizens. Simultaneously an introductory microbiology textbook, Idaho tourist guide, and coffee table book, Idaho Microbes exposes the complexities of the microbial world to the layman and microbiology student alike with visually stunning imagery. In each chapter, Steubner not only discusses the microbes and macrobes of Idaho, but also gives readers a short lesson in introductory microbiology, explaining the physiology and life cycles of the microbes profiled in each chapter.

Steubner takes readers on a tour of the state of Idaho through the lens of a microscope, exploring the bacteria, protozoa, and fungi native to the Gem State and the scientists and citizens who study and work with them. The first chapter profiles Bill Bourland, a citizen scientist in Boise who hunts ciliates with a turkey baster. A former vascular and thoracic surgeon, Bourland has contributed significantly to the study of Puytoraciella dibroyophrys, a ciliate he discovered in a puddle in a park near the Boise river that was formerly only found in African rainforests. Next, we follow Chris Florence, chief fungus forager for Sweet Valley Family Farms, as he hunts for elusive edible mushrooms in the Idaho forests. Organic, locally sourced food is becoming an important industry in the state, where morel mushrooms sell for up to $20 per pound (p. 44). Idaho consumers are increasingly demanding organic food that is locally sourced and supports area farmers, and these prized fungi are highly valued by restaurants and consumers.

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