challenge yourself and your students. Allow students and yourself time for exploration and analyses. Set your expectations high, both for your students and for yourself. Third, learn from your mistakes and take these missteps in stride. Next, there is a balance between stimulation and growth; too much stimulation does not allow adequate time for reflection. Critical thinking and creativity are not separate skills but are part of the whole learning experience. Finally, be a committed educator – be the teacher who says "I am all in," and live up to that promise. A great teacher learns his or her limits and capabilities after taking that pledge. Yes, teaching can make us fearful, but we grow – professionally, personally, or spiritually – if we face that fear with great confidence.

I urge you to read *Soul of a Teacher* and share it with your fellow educators. It is an uplifting, soul-searching, and heroic tale that will inspire readers to be – or become – great teachers and lifelong travelers.

Elizabeth Cowles
Eastern Connecticut State University
Willimantic, CT 06226
cowlese@easternct.edu

HUMAN ANATOMY & PHYSIOLOGY

Diagnosis for Classroom Success: Making Anatomy and Physiology Come Alive, Teacher and Student Editions. By Nicole H. Maller. 2013. NSTA Press. (ISBN 978-1936959525 and ISBN 978-1936959501). 244 pp. and 96 pp. Paperbacks. $28.95 and $14.95.

This book contains very clear, well-constructed and pertinent case studies. The exercises are approachable by the reader and provide valuable opportunities to review the contents. I believe this manual can be easily followed in the classroom and will help the instructor engage the students. It is precise but not too long, which will make it easy to manipulate in the classroom.

My criticisms of the book are at two levels: organization and content/questions/answers. Both deal with the pedagogical approach. First, the organization of the book is cumbersome. The teacher edition should be split into two parts. The first part would be dedicated to the aspects of instruction. The second part would focus on the answers to the student edition's questions. This would ease the instructor's tasks during class and furthermore eliminate the redundancy of a "Teacher guide" in each chapter.

The author, being a teacher, should have paid closer attention to the pertinence and the form of the questions, as well as their answers. Here are some examples:

- Page 37: "What is fertilization?" The answer should begin "Fertilization is…", not "Fertilization occurs when…." And "Where does the female egg travel upon fertilization?" Better to refer to the blastocyst than the egg.
- Page 75: "What is the difference between simple carbohydrates and complex carbohydrates?" Nutritionists do not use these concepts anymore.
- Page 83:."How do arteries differ from veins?" The question needs precision: is it about structure or function or both?
- Page 112: "Why is hCG found only in pregnant women?" Answer: "hCG is produced in the placenta." The answer should be that "hCG is produced first by the components of the fertilized egg. The placenta intervenes later.
- Page 113: "What is the difference between type 1 and type 2 diabetes?" The answer does not give the right response; it states where and when they occur instead of the physiological differences.
- Page 84: "What happens to the hemoglobin protein on a red blood cell if someone has sickle cell anemia?" Nothing is going to happen. It happened already. The mutated DNA is the cause of sickle cell anemia, not the other way around.

Other suggestions for improving the book include using the word *function* instead of *job* in many cases (page 119: "What is the job of the small intestine?") and improving the quality of some diagrams (for example, pp. 188 and 120).

Mohamad Lakrim
Kingsborough Community College
City University of New York
mlakrim@kbcc.cuny.edu

HISTORY OF BIOLOGY

Outsider Scientists: Routes to Innovation in Biology. Edited by Oren Harman and Michael R. Dietrich. 2013. University of Chicago Press. (ISBN-13: 978-022607840X). 374 pp. Paperback. $35.00.

"No one likes an outsider. They know it all, haven't paid their dues, and often think little of the rules everyone else has been required to play by…." With these words in the preface, the editors set the stage for an interesting group of essays about contributions to the field of biology by those who were not trained in the field of biology in which they had an impact. The titles of the sections demonstrate the variety of fields from which these contributors arose. Areas outside biology include physical sciences, mathematics, human sciences, and computer science. One section is devoted to those who were trained in one specialty of biology but made contributions in other fields of biology.

In the introduction, the editors describe biology as being the "middle ground between the physical and exact sciences, on one hand, and the social sciences and humanities on the other." The essays in the book demonstrate how that statement can be true. The introduction also provides much food for thought. There is an expectation that the reader will come away with new thinking about biology and how it is studied; why outsiders are so important to the progress made in biology; and the process of innovation. The editors help the reader visualize biology by characterizing biology as a duck-billed platypus, an aquatic mammal with some bird-like characteristics, a chimera. Throughout the introduction, reference is made to chimera-like characteristics of the science of biology.

How has biology benefited from this cross-pollination of various fields of study? Who are these "outsiders"? Gregor Mendel, Louis Pasteur, Felix d'Herelle, and Samuel Butler did not begin their work in science through the study of biology. Erwin Schrodinger, Linus Pauling, and Walter Goad from the physical sciences used their expertise to develop molecular biology. The contributions of mathematicians R. A. Fisher, Robert MacArthur, and Nicholas Rashevesky provided statistical approaches and mathematical modeling to move biology understanding forward. Linguist Noam Chomsky, writer Elaine Morgan, and philosopher David Hull demonstrate that there are various ways to approach understanding biology. Biologists whose initial work was in a different field who made significant contributions in other fields of biology include Ilya Metchnikoff, who moved from evolutionist to immunologist, and Francois Jacob, who moved from bacteria to mouse embryos to develop the idea of model systems. The use of informatics in biology was developed through the work of John von Neumann and Norbert Wiener, George Price, and Drew Endy.

Each chapter includes a black-and-white photograph of the individual described in the essay. The authors of each chapter portray the personality of the individual and how that

personality allowed the move from "outsider" to contributor in the field of biology. For many of these "outsiders," their personalities not only allowed them to make inroads, but also restricted their contributions. Reading about these scientists from this perspective shines an interesting light on the work of scientists. Sharing some of these stories with your students can help them see how life's experiences can help them understand the process of biology study. One example is Walter Goad, a physicist working at the Los Alamos National Laboratory. Goad developed an interest in applying his numerical and statistical skills to biological problems. Using these skills to build mathematical models for biological systems, Goad was a key person in developing GenBank, the National Institutes of Health collection of all DNA sequences publicly available today.

A major disappointment is the lack of female examples. Of the 19 individuals described in the essays, only one was a woman, a feminist writer. Her contribution is significant in that she was one of the first authors to point out that anthropological theories reflected a male bias. However, the author of this chapter points out that Elaine Morgan's work was not accepted as scientific until it was "stripped of her sharp feminist wit and dissociated from Morgan herself and repackaged as legitimate science."

Although the chapters are similar in structure, some are more difficult to read because of the nature of the information that is being conveyed. Some chapters contain more jargon specific to the field, and those not acquainted with the language of the field will have difficulty.

Despite these shortcomings, the book offers the image that biology has evolved by various pressures exerted by "outsiders" and the challenges they met along the way. The book also demonstrates that the chimera that is biology continues to evolve through connections built by individuals with diverse professional backgrounds.

Pat Waller
NABT President 2007
wallerfp@enter.net

MICROBES & MICROORGANISMS

The Amoeba in the Room: Lives of the Microbes. By Nicholas P. Money. 2014. Oxford University Press. (ISBN 978-0199941315). 220 pp. Hardcover. $24.95.

Nicolas Money opens *The Amoeba in the Room* by peering into the "Eden" of his garden pond in Ohio during the cold month of December. However, he quickly dives in deeper, exploring the history of his pond, and the land it occupies, through millions of years of biological and geological history. *The Amoeba* makes it clear that the diverse roles of microbes are central to Money's understanding of biology, enhanced by his appreciation for the beauty and wonder of adaptations represented by the microbial world. Money presents an overview of microbes, a history of early microscopy, microbes of a variety of ecosystems (soil, freshwater, ocean, and air), humans as microbial ecosystems, and the extremophiles of "Vulcan's Forge and Dante's Hell" (hot springs, thermal vents, and frozen arctic biomes). Money ends with a reflection on the imbalance of our focus on species diversity, which places far too great an emphasis on easily perceptible macrobiology.

As the book progresses, readers meet many wonders of microbial life: diatoms and bacteriophages, airborne fungal spores, human gut microbe communities, and the incredible extremophiles, inhabiting the deepest oceans, the coldest ices, and the most lifeless looking rock. Money presents each microbe with interest and excitement – he writes with the same sensibility as 18th-century biologist Baker, whose works he describes as having "an evident sense of excitement, something absent from papers in today's scientific journals." This vast scope and assortment is both the book's strength and its downfall. Every example is interesting and ecologically significant, but a thorough explanation of each would require a deeper explanatory discussion than the author presents in this relatively slim volume. This necessitates Money's use of terminology without definition, requiring his reader to have a basic biological background. Thus, despite its many strengths, *The Amoeba* does not seem to focus clearly on the needs of a specific audience: too specific for the very basic lay reader, and not sufficiently in-depth for the more advanced science enthusiast.

Most pertinent to biology teachers as readers are Money's repeated calls to open our eyes to the roles of microbes in biology, evolution, and the understanding of life on Earth. Throughout *The Amoeba*, he emphasizes the vast diversity of microbes and microbial roles. As Money concludes in his opening chapter: "The truth of life looks nothing like the traditional tree where almost everything is an animal, and vastly more numerous oddities are squashed at the base under an icon that looks like an amoeba or a hairy bacterium. To teach a course on biological diversity lasting the standard three-month American semester and spend more than one class on the animals is to encourage an absurd caricature of life. The way that we teach biology is no more sensible than evaluating all of English Literature by reading nothing but a Harry Potter book." Money pleads for teachers of biology to present microbes and microbiology with excitement and passion:

> The point of the customary microscopy class at the beginning of a biology lab course is not – and should never have been – to learn the use of the microscope. It is an entrée to the student's inquiry into the nature of life. The act of putting a drop of fluid on a microscope slide and viewing it at up to 1000 times its actual size can be an awe-inspiring experience, no less a thrill than looking at the night sky with a telescope or binoculars.

Cate Hibbitt
Lincoln School
Providence, RI 02906
chibbitt@lincolnschool.org

ELIZABETH COWLES teaches freshman-level biology, biochemistry, and entomology at Eastern Connecticut State University. She has taught at the undergraduate and graduate college levels for over 20 years. Her interests include insect toxicology, protein characterization, and astrobiology. Cowles holds degrees in biology and biochemistry from Cornell University and Michigan State University. Her address is Department of Biology, ECSU, 83 Windham St., Willimantic, CT 06226; e-mail: cowlese@easternct.edu.