


ARCHAEABACTERIA

The Surprising Archaea. By John L. Howland. 2000. Oxford University Press (198 Madison Ave., NY 10016-4314). 204 pp. Hardback \$29.95.

 The discovery and identification of the Archaea in 1977 has to rank as one of the most stunning finds of the 20th century. We were able to put a person on the moon before we even knew of the existence of what is now acknowledged to be one of the three domains of life! And yet, considering their importance, very little information on the Archaea has been available to the general public. In writing this book, **The Surprising Archaea**, John L. Howland takes a giant first step in filling this gap by gathering basic information about Archaea from the journals and making it accessible to biology teachers and educated nonscientists. Howland is a professor at Bowdoin College in Maine and teaches a course on the origin of life. The extensive reading he has done on the Archaea for this course makes him eminently qualified to write this book. The book itself is interesting, readable, and full of amazing information that you will want to know and use in your classroom.

Howland describes three common Archaeal lifestyles: using sulfur at high temperature, often acid environments; living in concentrated salt solutions; and producing methane from carbon dioxide and hydrogen gas in high temperature, anaerobic environments. He describes how Archaeans were discovered, techniques for identifying and studying organisms that thrive at the boiling point of water, and the unusual metabolisms that enable them to live in these extreme environments. Howland points out that many Archaea also live under ordinary conditions, and that we are just beginning to discover these forms. Carl Woese's work on small subunit ribosomal RNA that was used to identify the three domains is described.

There is also an excellent description of Archaeal cell membranes, which are not the usual phospholipid bilayers found in Bacteria and Eukarya. Howland points out that the ether linkages and modifications of the fatty acids found in Archaeal membranes are adaptations that make the membranes more stable at high temperatures. Also included are explanations of some of the unusual energy metabolisms found in Archaeans, along with an excellent discussion of the deep-ocean hydrothermal vents where many Archaeans


are found and where life might have originated. I found particularly interesting his discussion of the symbiosis of ruminants and Archaeans. Methanogens, a kind of Archaea that requires anaerobic conditions and produces methane, live in the rumen of cattle and digest the cellulose in the grass for them. The methanogens then eat some of the digested cellulose, and the cows wind up eating these methanogens in the cud. This means that the Archaeans are actually protein producers for the cows!

This book is full of great information about the Archaea, well organized and well presented. There is a deep understanding of evolution throughout and many valuable insights into the important place of the Archaea in the biotic world are presented. I urge high school and college teachers to read it and use it in their teaching. It is a great way to welcome these important organisms into the 21st century.

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PHYSIOLOGICAL ADAPTATIONS

Life at the Extremes. By Frances Ashcroft. 2000. University of California Press (2000 Center St., Berkeley, CA 94704). 326 pp. Hardback \$24.99.

 **Life at the Extremes** offers readers an exciting opportunity to understand the science behind the responses of the human body to extreme environments by sharing the adventures of men and women who confronted extreme physical challenges. This combination of fascinating tales and scientific analyses makes the book an enjoyable read for both the science professional and the layperson. For science teachers, in particular, **Life at the Extremes** is an excellent tool for grabbing students' attention to enable them to grasp some complex concepts.

The book explores the physiological responses of the human body to extreme conditions, ranging from the thin air of Mt. Everest to the icy depths of the Mariana's Trench. For example, in her chapter "Life at the Top" Ashcroft relies on her own experiences as a mountain climber to offer insights into the challenges faced by those who have tackled the most demanding climbs on the planet. The special value of her storytelling lay in her absorbing descriptions which lead the reader to a clearer understanding of such subjects as partial pressure, acute mountain sickness, hemoglobin and acclima-

tization. In "Life in the Fast Lane," her accounts of famous runners throughout history serve as a departure point for understanding muscle contraction, fatigue and performance-enhancing drugs. "The Final Frontier" uses space flight as the context to help the reader understand gravity, human balance and space sickness.


Throughout the book, the author intersperses her narrative with more technical analyses of specific topics. In the chapter, "Life in the Hot Zone," for example, she describes places on the planet where sweating is critical to survival, but she discusses the physics of heat transfer in a separate, discrete section of the chapter. As a teacher, I find this arrangement to be most convenient since it allows me to point students to a specific resource for explaining a single topic.

The unifying theme of **Life at the Extremes** is the adaptation of organisms to multiple, difficult environments. Students of biology, chemistry and physics will all find something of interest for their own specialties in these tales of adaptation. Teachers of these subjects now have in this wonderful book a wealth of material to pique student interest in often abstruse topics by showing them how physiological reactions accompany adventurous challenges.

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INSECTA

Millions of Monarchs, Bunches of Beetles. By Gilbert Waldbauer. 2000. Harvard University Press (Cambridge, MA). 264 pp. Hardback \$24.95.

 Gilbert Waldbauer is a master at communicating the natural history of adaptive behavior of why certain groups of insects get together and what they get out of their associations. He looks at groups of insects such as ladybird beetles, monarch butterflies, locusts, mayflies, cicadas and others that are not organized into complex or tightly organized societies like the termites, wasps, ants and bees.

Waldbauer starts by discussing the basic needs of group living such as defense against enemies, coping with the weather, finding and subduing food, and meeting members of the opposite sex. He discusses how group defenses against predators such as coloration make them inedible and warn certain predatory species of their