



stars, on the one hand, and for beetles on the other, for the simple reason that there are nearly 300,000 species of beetle known, and perhaps more, as compared with somewhat less than 9,000 species of birds and a little over 10,000 species of mammals. Beetles are actually more numerous than the species of any other insect order. That kind of thing is characteristic of nature." Some have rephrased this to "The creator has an inordinate fondness for beetles."

*The Book of Beetles* celebrates this inordinate fondness in picturesque style. The images are focus-stacked, giving them extraordinary depth of field and great detail. There are (to date) about 387,000 species of beetles, or 25% of all known animal species. The book highlights 600 species, covering nearly all of the 211 families.

The first few chapters provide a general introduction to beetle biology and culture. Topics include morphology (distinguishing characteristics), classification, diversity, behavior, and conservation. A chapter is devoted to beetles in human society – for example, the use of sacred scarabs in ancient Egyptian civilizations.

The remainder of the book is devoted to the beetles themselves, grouped by the four suborders. Each page has two images: a life-sized picture and one that is magnified to show intricate detail. The only exceptions are the largest beetles, for which one image is sufficient. The family, subfamily, global distribution (map with colored areas), habitats, feeding habits, and notes are at the top of each page. The species and common names accompany the pictures, along with more details, including size ranges, close relatives, and distinguishing

characteristics. There is a glossary, a classification guide, and an extensive resource list.

*The Book of Beetles* is a perfect gift for a budding entomologist and for anyone who appreciates these jewels of nature. It is easy to see why Charles Darwin and Alfred Russel Wallace were intrigued (some would say obsessed) with this fascinating order. The members of the Connecticut Entomological Society gave it two thumbs up, especially for the exquisite photographs and well-crafted references.



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## LIFE'S ENGINES

How Microbes Made Earth Habitable



PAUL G. FALKOWSKI

### MICROBES

**Life's Engines: How Microbes Made Earth Habitable.** By Paul G. Falkowski. 2015. Princeton University Press. (ISBN 978-0-691-15537-1). 203 pp. Cloth. \$24.95.

Not a microbial biologist, I approached this book with a bit of trepidation, imagining lengthy discussions of biochemistry. Instead, I was immediately engaged by Falkowski's conversational, fluid writing ("Let us take a look 'under the hood' to see how some of the machinery that makes these invisible creatures work"; p. 46), personal anecdotes ("It took me a few years to understand how this transition in the chemistry of the Black Sea . . ."; p. 83), and interesting choice of topics. The author easily distills volumes of relevant

history down to the salient points to set the scene for the biology he relates. As such, the book is focused as much on the history of science, including the processes of invention of various scientific tools as well as famous people, as it is on advocacy of the long-needed recognition of the importance of microbes in our world. For instance, the story of evolution as it emerged in the 19th century, of Darwin's trajectory of thoughts on evolution by natural selection, is composed of only 10 pages, yet I didn't feel that any of the information that was important to Falkowski's story was missing. The author steps through some of this history to demonstrate his claim that "Microbes were missed because of our observational biases . . . [and yet] they played an outsized role in making this planet function" (p. 22). He effectively shows the progress that has been made in the field. He also highlights many of the unknowns – the still-to-be-done work, including current unsolved controversies within science.

By Chapter 4, the biochemistry comes in, with clear but not overly simplified diagrams, and Falkowski's writing remains understandable. Describing the formation of ATP, he explains, "As the shaft physically turns, it mechanically moves the larger proteins (the deck of the merry-go-round) which bind ADP and phosphate" (p. 59). Discussions of rising oxygen levels in the early atmosphere, RuBisCO, horizontal gene transmission, symbiosis and microbial communities, evolution of multicellularity, opsins, petroleum, the Haber-Bosch reaction, synthetic biology, and extraterrestrial explorations make you feel as if your biology courses are coming alive in a conversation with a master storyteller. Each chapter ends with a logical transition that leads to the next large topic, so you feel as if the entire book is one continuous, interwoven concept. At the end are a few extra readings suggested for each chapter and an extensive index. "In sum, the oversight of microbes, in both the literal and figurative senses, distorted our worldview of evolution for more than a century, and including microbes in our understanding of evolution is still a work in progress" (p. 12). *Life's Engines*, easily accessible to the lay reader but engaging for the scientist as well, will go a long way to boost that work in progress.



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