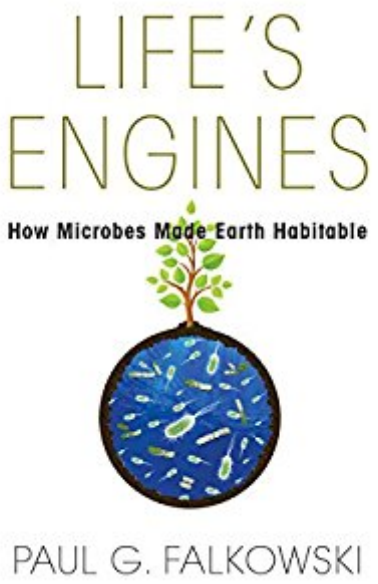
Life's Engines: How Microbes Made Earth Habitable



Synopsis

For almost four billion years, microbes had the primordial oceans all to themselves. The stewards of Earth, these organisms transformed the chemistry of our planet to make it habitable for plants, animals, and us. Life’s Engines takes listeners deep into the microscopic world to explore how these marvelous creatures made life on Earth possible - and how human life today would cease to exist without them. Paul Falkowski looks "under the hood" of microbes to find the engines of life, the actual working parts that do the biochemical heavy lifting for every living organism on Earth. With insight and humor, he explains how these miniature engines are built - and how they have been appropriated by and assembled like Lego sets within every creature that walks, swims, or flies. Falkowski shows how evolution works to maintain this core machinery of life, and how we and other animals are veritable conglomerations of microbes. A vibrantly entertaining audiobook about the microbes that support our very existence, Life’s Engines will inspire wonder about these elegantly complex nanomachines that have driven life since its origin. It also issues a timely warning about the dangers of tinkering with that machinery to make it more "efficient" at meeting the ever-growing demands of humans in the coming century.

Book Information

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Customer Reviews

Paul Falkowski is an eminent scientist who studies the impact of aquatic photosynthetic microbes on Earth’s geochemical cycles and climate. This book is intended for the general reader. Without using technical jargon, he explains how microbes shaped the early planet, from the "oxygen

revolution" as cyanobacteria supplied the first oxygen to the atmosphere and powered the first eukaryotes and multicellular life, to the role of microbes in interlocking and stabilizing the nitrogen, oxygen, sulfur, hydrogen, and carbon cycles. The perspective is fresh, even for a scientifically aware reader, from the depiction of life as a "marketplace of electrons" changing hands to the "core nanomachines" of life (evolutionarily conserved macromolecular assemblies) which are continually repurposed. His writing style is engaging and the black-and-white illustrations nice. My favorite might be his description of the photoacoustic effect as tiny molecular claps. I have a few reservations about the book. In an attempt to keep the book accessible, he avoids any discussion of quantum energy levels or thermodynamics. It’s hard to explain photosynthesis without those concepts. He doesn’t explain catalysis and refers consistently to "nanomachines" except where he slips and calls them enzymes, without explanation. Sometimes it’s better to give a full explanation which the reader might not entirely grasp than to quit early and be sure to mystify. For instance, there is a detailed diagram of reaction centers in photosynthesis, with photosystem I and II and photophosphorylation depicted; if you’re going to go that far you might as well explain why there are two photosystems and how they work together.

Falkowski and I both had an aquarium and radio kits as youthful hobbies. I didnâ ™t see any connection at all between the two. I guess thatâ ™s why Iâ ™m reading his book and heâ ™s not reading mine.There was a positive review in the NYRB, but with a warning that this was for the scientifically informed. Iâ ™m an interested layman and didnâ ™t find it difficult. Itâ ™s only 180 pages long, well spaced. The first 50 pages are a breeze, and though a good background, could have easily been condensed. They relate the history of the microscope and how our knowledge has depended upon our ability to visualize microbes. Then we get into the chapter on nanomachines. This is where the speed bumps appear. At this point I had to Google some basic concepts, you know, nucleic acid, sulfide/sulphate, and the like; but only a dozen times. And frankly Falkowski does such a good job laying out the story, itâ ™s really a matter of how deep the reader wants to go. Perhaps a glossary would have been helpful. The graphs and diagrams are also extremely well presented and helpful.If I had to pick one main topic itâ ™s the evolution of the nanomachines as the energy producing artifacts in all life on earth. And our old friend ATP plays a large part as well. This is a great overview of the discoveries of the last decades of the tine mechanics of life. Additionally, the subtext is the recognition - angelfish and whisker radios - that the system as a whole is like, no, IS, an incredibly large, complex, interconnected chemo-electrical system.The gene transfers between â œspeciesâ • of microbes are explained and, very interesting to me, as I had not

heard of it before, the notion of a concordium consisting of many microbial species.

This is perhaps the best of the "Science Essentials" series from Princeton UP. The writing is very good and the various graphics are insightful and get complex points across better than usual. The book is written for the intelligent layperson; the science is about college sophomore level, I would say. Some readers may find the content difficult, but Falkowski is very good at explaining complex concepts. I admit to not fully understanding how horizontal transfer of DNA among microbes works, and I wish he had used a better phrase than "microbial nanomachine."The first sections of the book are really a kind of history of how science came to understand evolution, and how the existence of and then the importance of microbial life came to be understood. He describes how oxygen evolved, so to speak, in the atmosphere. He essentially sees a process combining the total activities of life, geological processes, chemistry and other elements worked together to create the atmosphere, and not only create it but maintain it over a long span. His concept isn't quite Gaia, but does see life as a major actor in the planet's history.One thing I'd like to see more of is his discussion of viruses in the oceans. He says that in the upper ocean, there are several hundred million viruses per milliliter of water, outnumbering bacteria and other microbes ten to one. That indicates a major constituent that seems to be little studied.A fascinating aspect of the book is what he describes as microbial consortia, a sort of allied group that works together, and may number dozens of species that in effect communicate via chemical signals, in what he calls "quorum sensing." Can microbes have evolved as groups rather than indivuduals?

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