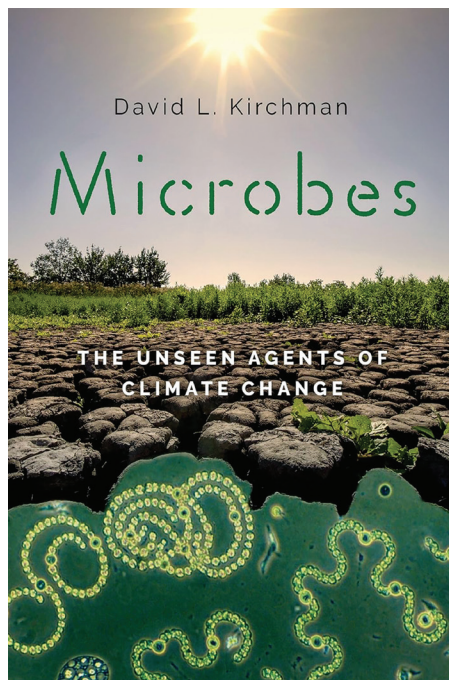


Microbes: The Unseen Agents of Climate Change. By David L. Kirchman. 2024. Oxford University Press Books. (ISBN 978-0197688564). Hardcover. 240 pp. \$34.95.



Microbes: The Unseen Agents of Climate Change clearly steps through the role of microbes in cycling Earth's nutrients, the disruptions due to climate change, and potential solutions. This book is a must read for anyone living in our dramatically changing world. The importance of microbial processes in climate change models has only recently been acknowledged, perhaps because we've been needing a book like this one to bridge the gap between microbial ecosystems and planetary change in an

approachable, concise way. Thank goodness it's here now!

David Kirchman's extensive knowledge of microbial ecology and physiology combined with his teaching prowess come together to create a powerful, concise reference text. An emeritus professor at University of Delaware, Kirchman's research focuses on microbial carbon cycling across the globe. *Microbes* eloquently summarizes his deep understanding of the history, present, and future of this field. In only 176 pages of this well-referenced book, Kirchman leads the reader through microbial physiology, biogeochemistry, and climate science in an engaging way for readers at a high school level and beyond. From van Leuwenhoek's discovery of "tiny animalcules" under his microscopes to Father Secchi's measurements of water turbidity with black and white "Secchi" discs, *Microbes* weaves the stories of scientific discovery throughout the ages into modern understandings. In intertwining these stories from different fields with the evolution of our understanding of the role of microbes over time, Kirchman teaches us not only about the science, but also the process of science.

Carbon dioxide, methane, nitrous oxide—which of these is the most damaging greenhouse gas? Where does it come from? How do cow farts, canned whip cream, and rock-eating microbes influence climate change? Kirchman steps through the different sources and sinks of carbon, sulfur, and nitrogen on land and in the ocean, then deftly connects Earth's planetary conditions throughout time with microbial processes to highlight future concerns, areas for research, and potential solutions. Kirchman presents the information in a clear, thoughtful way that makes these topics approachable.

I especially appreciated how he shows the interconnectedness and complexity of Earth's different ecosystems. For example, peat bogs can release large amounts of methane and nitrous oxide, while storing some carbon. What are the costs and benefits? Should the peatlands be drained to halt these two more damaging greenhouse gases? If adding iron to ocean waters can stimulate phytoplankton growth, providing a carbon sink over time, should we dump iron in the ocean? Kirchman thoughtfully walks the reader through the pros and cons of several different scenarios for mitigating climate change using microbes.

As a biologist who is passionate about our microbial world, I greatly appreciate well-written books with microbes as the central focus. *Microbes: The Unseen Agents of Climate Change* is certainly a new favorite of mine, but my appreciation goes well beyond simply good writing about microbes. It is the kind of book we've been needing for scientists, the public, and policymakers. I can see this book being required reading for biology, sustainability, and environmental engineering classes. I will be using this as the text for my next environmental microbiology course and will use it to restructure key lectures in my general microbiology course. However, I think it's also the kind of book that high school students could pick up to help them see a future for our world and inspire them to learn more about microbes—the invisible organisms that shape our Earth.



Anne M. Estes, PhD,
Associate Professor
Towson University
Baltimore, MD
aestes@towson.edu