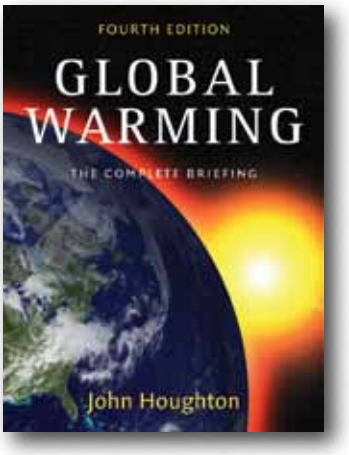
THE OFFICIAL MAGAZINE OF THE OCEANOGRAPHY SOCIETY

Oceanography

CITATION

Syvitski, J.P.M. 2009. Review of *Global Warming: The Complete Briefing (Fourth Edition)*, by J.T. Houghton. *Oceanography* 22(3):270–271, doi:10.5670/oceanog.2009.90.

Global Warming: The Complete Briefing (Fourth Edition)



By Sir John T. Houghton, Cambridge University Press, 2009, 438 pages, ISBN 978-0-521-70916-3, Softcover, $50 US

REVIEWED BY JAMES P.M. SYVITSKI

Most geoscientists today have the unenviable task of elucidating the reasons and consequences of global warming to the highly interested public. This task is a direct result of the nature and magnitude of the global warming problem, and is made difficult for conscientious scientists because the popular press often engineers debate between experts who truly understand the science of climate change and others whose negative discourse expresses beliefs or fears based on religion, politics, or commerce. This unprecedented connection to the public goes well beyond the scientific leaders of the related major research programs: the International Geosphere Biosphere Programme, the International Human Dimensions Programme, the World Climate Research Program, and Diversitas, which deals with the study of species diversity. Yet, few in the scientific community truly understand the nuances involved in crafting the findings of the Intergovernmental Panel on Climate Change (IPCC).

What makes the subject of global warming so fascinating is that it involves most aspects of human existence, and it also involves a full and thorough understanding of how our planet functions. The subject crosses all of the boundaries so artificially fenced off at universities—geology, oceanography, geography, ecology, biology, chemistry, atmospheric science, environmental science, hydrology, engineering, economics, health, business, and law. So, to write a text that is both scientifically sound and yet brushes aside disciplinary jargon is quite an accomplishment. Sir John Houghton appears up to the challenge with the fourth and much updated edition of his seminal text. He has the credibility and credentials to write such a text. He was the cochair of the IPCC scientific assessment working group and lead editor of the first three IPCC reports. He was a professor of atmospheric physics at the University of Oxford, former Chief Executive of the Met Office, and founder of its Hadley Centre. Interestingly, he is also a founding member of the International Society for Science and Religion. This association bears mention because his Chapter 8 ("Why should we be concerned?") includes quotes from the world's major religions and his personal views on them.

Substantively, the book is one on science. Chapters on global warming and climate change, greenhouse effect, greenhouse gases, paleoclimate, climate modeling, and climate change in the twenty-first century are all very well done. They provide a sense of the problem's complexity, along with our present understanding and the uncertainties associated with our predictive capacity. Another author may have chosen to provide a more balanced discussion of model estimates, and may have relied less on Hadley Centre products. However, Houghton does have intimate knowledge of Hadley products and makes use of this information. His presentation of forecast uncertainty is sophisticated enough to educate professors, yet simple enough to reach most smart undergraduates.

Beyond the physical sciences, other chapters cover the impacts of climate, uncertainties in humankind's action or inaction, and strategies for change, as well as the options in our energy future. The book ends with a chapter on the global village, which covers the social aspects of pollution, poverty, population, and stewardship.

Other competing textbooks focus more narrowly, usually on a single subject such as paleoclimatology. Compared to these texts, individual chapters in *Global Warming* may appear to lack depth. However, the advantage of *Global Warming* is in the secondary title, *The Complete Briefing*. This text combines all of the various IPCC products under one cover and adds a single, well-edited delivery mechanism. Each chapter leads with an outline, followed by bite-size sections, break-out text boxes, colorful and visually appealing figures, and chapter summaries, along

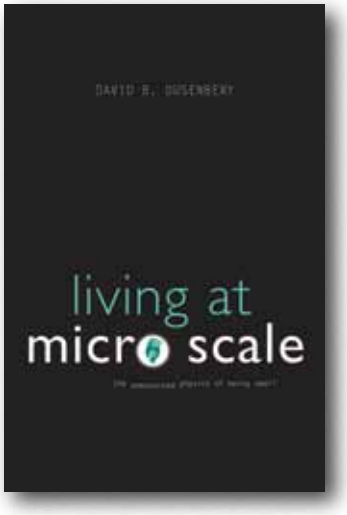
with follow-up questions, further readings, and insightful notes (references). The book ends with a glossary and an index. Other competing books have started to appear (see the 2008 *Oceanography* review [21:208–209] of W.J. Burroughs' *Climate Change*, 2nd edition). However, Houghton's *Global Warming: The Complete Briefing* sets the standard for these other competing texts.

James P.M. Syvitski *(james.syvitski@colorado.edu) is Professor and Executive Director, Community Surface Dynamics Modeling System, University of Colorado at Boulder, Boulder, CO, USA.*

Living at Micro Scale: The Unexpected Physics of Being Small

By David B. Dusenbery, Harvard University Press, 2009, 416 pages, ISBN: 978-0-674-03116-6, Hardcover, $49.95 US

REVIEWED BY GEORGE JACKSON



Planktonic organisms live in a world where viscosity, molecular diffusion, and thermal fluctuations dominate, a world outside the mainstream of ocean physics studies. The task of explaining the properties of this domain has fallen to talented biologists, such as Vogel (1981), Berg (1983), and Denny (1993), who provide intuitive understandings about it. Within the last year, two new books exploring the world of the small have arrived. The first, by Kiørboe (2008), has a strong emphasis on biological interactions, experimental tests, and oceanographic implications. The second, by David Dusenbery, published this year, emphasizes the physical nature of this realm.

Dusenbery is a sensory biologist, and his book *Sensory Ecology* (1992) was a classic synthesis of how sensory systems extract useful information from physical and chemical fluctuations to map out organisms' environments. It was noteworthy that he used insights from multiple disciplines to understand different organisms' worlds. The present book is similar in exhibiting his desire to synthesize, but here he tackles the world of the small.

The world of *Living at Micro Scale* is centered at 1 µm. It is a world where molecular diffusion is more important than advection in movement of material to and from cells, where shape is more important for providing stability than for reducing drag, and where size is a critical property in determining lifestyle. It is this realm that Dusenbery delineates with his use of simple formulae and scaling arguments from diffusion, viscous fluid flow, and information theories.

The author uses the first third of his book to provide background information, including formulae to be used later. The historical aspect here is particularly fascinating, as it reminds the reader of the importance of small-scale phenomena in the development of physics. In the second third of the book, Dusenbery explores the implications of this background material. The calculations shed light on movement of molecules to the microbe, both for nutrition and for information gathering; they show how size and shape constrain the ability of the microbe to move, either at random or in a directed way. In the last third of the book, the author discusses implications for how organisms interact, using size-based food webs and the fertilization of eggs by sperm as examples.

To appreciate *Living at Micro Scale*, it helps to have read Berg's short book *Random Walks in Biology* (1983), which explores bacterial motion and how it is affected by the small-scale chemical environment. Dusenbery's book is not so much a discussion about life in low Reynolds number environments as it is a fluid mechanic's interpretation of Berg's book. There is mention in *Living at Micro Scale* of more complex organisms and structures, but the emphasis is on microbes, what they can sense, how they move, and the costs and benefits of such movement. Dusenbery uses his extensive experience with sensory structures to consider how the small numbers of molecules available for an organism to sense affect its ability to choose. He also has the most extensive consideration of shape and its implications for diffusion,