viewers' moral psychology would have been welcome. RWU film producers knew that film could not only inform but also influence viewers emotionally; yet they claimed to be producing purely scientific, educational material. This, of course, enhanced the professional image of collaborating doctors and scientists. But there was an additional function: these films drew on the authority of science to blunt viewers' critical and moral sensibilities. Who could argue with raw data? Paradoxically, the exclusion of overt ideological content is precisely what gave these films their potential to shape people's thinking. In the end, education and propaganda were not so incompatible after all.

BRONWYN MCFARLAND-ICKE

Barry Parker. *Einstein: The Passions of a Scientist*. 297 pp., illus., bibl., index. Amherst, Mass.: Prometheus Books, 2003. $28 (cloth).

Barry Parker claims that his book is not a biography but, rather, a "detailed look" at Albert Einstein's "obsessions and passions," a study that describes how Einstein's development as a scientist was related to his life outside of physics. While Parker accomplishes this goal to a degree, his book, nevertheless, is best described as a short biography that narrates Einstein's life in fifteen compact chapters. His account is not based on original work but relies on relatively recent scholarship, especially the *Collected Papers of Albert Einstein* (Princeton, 1987) and the biographies by Albrecht Fölsing (Viking, 1993) and Denis Brian (Wiley, 1996). It features many photographs and drawings that are well integrated into the text and is suitable as an introduction for the general reader or undergraduate student.

Parker's book is a companion to his earlier volume *Einstein's Brainchild* (Prometheus, 2000), which concentrated on Einstein's scientific work, yet the new book may be read independently of the first one. It may come as no surprise that Parker's greatest strength is his clear discussions of Einstein's theories of relativity and contributions to quantum mechanics and the atomic theory. He deftly summarizes difficult ideas in a few sentences and mentions important theoretical and experimental developments so that the interested reader can follow up. While covering Einstein's scientific career, Parker relates Einstein's scientific accomplishments to a passion for unity in physical science. He also gives interesting discussions of Einstein's attitudes and opinions regarding the institutions that he worked for and the cities in which he lived.

Parker integrates a number of Einstein's lifelong preoccupations into the narrative. He does an excellent job of describing the young Einstein's ambivalent attitude toward his teachers, his general dislike of German military culture, and his pacifist beliefs. This strain of discussion is followed up well in certain later sections, such as the backlash against Einstein in Germany and his move to the United States. Because Parker covers the last twenty years of Einstein's life in as many pages, his discussions of Einstein's concerns about the atomic bomb and support for a Jewish state are relatively short.

The weakest aspect of Parker's book is his treatment of the "passions" of Einstein's personal life. He manages to avoid presenting Einstein as either a saint or a sinner, but his brief accounts of knotty psychological and personal issues leave the reader wanting more. For example, Einstein's distant or nonexistent relationships with his children (including a daughter born out of wedlock) remain an unexplained mystery throughout the book. Similarly, Parker's foreshortened accounts of Einstein's relations with "the women in his life" rarely give convincing motivations for either Einstein or his companions. Parker does a better job handling the controversy about the possible contribution of Einstein's first wife, Mileva Maric, to the special theory of relativity, arguing that Maric's weak mathematical abilities and waning interest in physics make it unlikely that she could have played a large part.

Parker uses the theme of "passion" to discuss Einstein's different preoccupations, but his efforts to link them together are minimal. This is reflected by the fact that he ignores his ostensible theme in the book's final pages and closes with a summary of Einstein's scientific accomplishments. However, despite these drawbacks, *Einstein: The Passions of a Scientist* is a good short biography that draws on recent scholarly work looking beyond Einstein's scientific accomplishments. It gives a portrait of a brilliant, complex, and sometimes unsettling person that is sure to hold the interest of the general reader.

GARY J. WEISEL

Vaclav Smil. *The Earth's Biosphere: Evolution, Dynamics, and Change*. viii + 346 pp., figs., tables, bibl., indexes. Cambridge, Mass.: MIT Press, 2002. $32.95 (cloth).

In this ambitious and complex book, Vaclav Smil surveys the evolution of the earth's bio-

sphere from its remote origins to its distant future. He begins with the work of the Russian geochemist Vladimir Vernadsky, who first developed the notion and in 1926 published *Biosfera,* in which he examined how "living matter" has shaped the earth's surface over the eons. In the West, the notion of the biosphere caught on only some forty years ago, as concern grew about the human impact on the environment.

In a chapter on the nature of "carbon-based life," Smil discusses the evolution of cells and outlines the nature and function of proteins, carbohydrates, lipids, RNA, and DNA. Some organisms, dubbed autotrophs, absorb carbon dioxide directly, whereas heterotrophs secure their carbon by eating them. Complex life is possible because our earth, born 4.55 billion years ago, circles a suitable star in an appropriate orbit. Until about 1.5 billion years ago, its major life forms were bacteria that thrived in an atmosphere rich in methane and carbon dioxide. They expelled oxygen, which finally accumulated in the atmosphere in sufficient quantity to drive them underground.

Some 544 million years ago, an explosion of new life forms created virtually all lineages known today. Some are energized by solar radiation; some trap chemical energy; others thrive in the complete absence of light and organic matter. Estimates of the number of earth's species and their rates of extinction vary widely. Calculations of such things as the numbers of invertebrates in soils, the density of vertebrates in water and on land, and the area of leaf surfaces vary erratically. The best current guess of the biosphere's phytomass is somewhere between 500 and 800 billion tons of carbon.

Catastrophes have helped to shape the biosphere. What with massive volcanoes that spewed out vast quantities of carbon dioxide and collisions with asteroids and comets, the planet's temperature has veered wildly. Every 100 million years or so, an object more than 10 kilometers in diameter crashes into the earth. One such probably led to the extinction of the dinosaurs.

Smil shows how the sun's radiation energizes the biosphere, powers photosynthesis, and induces air and water flow. Deep in the earth is an underlying hot mantle. The relatively new science of geotectonics examines how all these forces interact to reshape the earth's crust.

Organisms must adapt their structures, life strategies, and energy use to compensate for the consequences of being small or large. Smil discusses the nature of bioclimatic zones and the complex combinations of plant and animal life that coexist in various climatic regions. He shows that cooperation between diverse species plays as important a role in evolution as competition.

Finally, Smil discusses the impact of human activity on the biosphere. Our species has transformed up to 50 percent of the land surface of the planet. We have altered water balances and affected global nitrogen and sulfur cycles and the atmosphere. Today, the aggregate mass of machines exceeds that of humans, and they use up more of the world's carbon than we do. On an optimistic note, Smil speculates about directions in which intelligent life might evolve even after the earth ceases to be habitable.

The student of the biosphere must reintegrate branches of science that long ago diverged one from another. Smil draws on much recent literature for this account of our world's biochemistry, physics, geology, cosmology, and chemistry. *The Earth's Biosphere* is a hard read but worth the effort to introduce oneself to the rich and rapidly developing study of the biosphere and of biogeochemistry.

ELIZABETH HAIGH

Sean F. Johnston. *History of Light and Colour Measurements: Science in the Shadows*. xi + 281 pp., illus., figs., tables, bibl., index. Bristol: Institute of Physics Publishing, 2001. $75 (cloth).

This book examines the practice and culture of light measurement from the eighteenth to the late twentieth centuries. Emphasis is on the measurement of light intensity (photometry), but consideration is also given to specification of color (colorimetry) and measurement of nonvisible radiation, particularly ultraviolet and infrared (radiometry).

Sean F. Johnston argues that light measurement has historically been a "peripheral science," which he defines as having "a lack of 'ownership' of, and authority over, the subject by any one group of practitioners; a persistent straddling of disciplinary boundaries; absence of professionalization by practitioners of the subject; [and] a shifting interplay between technology, applied science and fundamental research that resists reconciliation into a coherent discipline" (p. 9). Johnston also argues that the development of photometry largely followed the identification of cultural needs rather than directly following technological advance.

The credibility of nineteenth-century photometry was generally low because of the imprecision of measurements. Physical scientists had