good deal of it. Now that the dust of the recent election season has settled, one can only hope that our new president will find the time to actually read this valuable work.

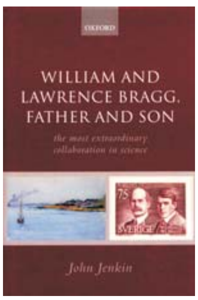
William and Lawrence Bragg, Father and Son

The Most Extraordinary Collaboration in Science

John Jenkin
Oxford U. Press, New York, 2008. $85.00 (458 pp.). ISBN 978-0-19-923520-9

John Jenkin's *William and Lawrence Bragg, Father and Son: The Most Extraordinary Collaboration in Science* is a valuable and thoughtful book, notable for its thoroughness, especially with respect to its coverage of William Henry Bragg (1862–1942), the father. It gives scrupulous attention to evidence and deals carefully with controversial issues in the lives of its subjects. It also draws more extensively from a wide array of research sources than have previous individual biographies of the Braggs.

Jenkin is a scholar emeritus in the philosophy program at La Trobe University in Melbourne, Australia. His book is a culmination of more than 25 years of research on the lives and work of the two physicists and is clearly a labor of love, especially of love for his homeland of southern Australia and pride in the accomplishments of an English transplant, William, and a native son, Lawrence (1890–1971). Yet the author's great affection for his subjects does not bias his careful storytelling of their lives and contributions. The Braggs were two of the most important and influential physicists of the 20th century, though perhaps underappreciated today. William was a major contributor to early studies of radioactivity and became a leader in the study of the properties of x rays; his son was a founder of the science of crystallography. Together and individually, they made monumental contributions to the foundations of modern condensed-matter physics by developing methods to study crystal structure, the basis of many of the properties of solids. Each in his own way, almost up to the time of death, greatly influenced British science.



My own introduction to physics research was when I studied x-ray diffraction at high pressure as an undergraduate. Early in my education, I became familiar with Bragg's law and the techniques of x-ray diffraction and x-ray spectroscopy that the Braggs either developed or influenced significantly. But like many physicists, even historians of physics, I was unclear which Bragg was responsible for the law; I only figured it out after I began a more serious study of the history of physics. Jenkin's book clearly assembles the evidence that Lawrence developed the law independently of his father, but it also shows how the two men's joint discussions of the relevant physics were important to the respective contributions of both. Moreover, the evidence marshaled in the book should lay to rest any lingering questions among scientists about whether Lawrence really deserved the Nobel Prize, which he shared with his father in 1915. At age 25, he was, and still is, the youngest ever to win the award in physics. The independent contributions of the son clearly deserved that recognition along with the distinguished, important work of the father.

William and Lawrence Bragg, Father and Son is an unusual scientific biography in treating two related physicists in depth; however, the treatment is not equal. William Bragg's life and science are given more attention than Lawrence's, and the reader comes to know William more fully than his son. In his previous extensive work in the history of physics, Jenkin has written more about William, so the imbalance is understandable. Nevertheless, coverage of the most salient aspects of Lawrence's life and work is as thorough and careful as the study of William's; thus the disparity does not seriously undermine the value of Jenkin's lengthy exposition.

The book would have benefited from a bibliography: All the references are in footnotes, which can be distracting to the reader and difficult to keep track of. The author adds editorial comments, fortunately infrequently, explicating for readers the meanings of events or some of the responses of his subjects. I find that the comments detract from the narrative rather than clarify it. Yet such concerns do not lessen my admiration for the excellent work of the author in the difficult task of producing a joint biography of the two Braggs.

I highly recommend Jenkin's biography to all readers interested in the history of 20th-century physics and to those interested in the history of condensed-matter physics or crystallography. The text clearly explains the science under consideration without being highly technical. Although the book is not a quick read because of its thoroughness and its sometimes slow-paced prose, it superbly rewards one's attention.

William Evenson
Utah Valley University
Orem

Energy in Nature and Society

General Energetics of Complex Systems

Vaclav Smil
MIT Press, Cambridge, MA, 2008. $75.00, $32.00 paper (480 pp.). ISBN 978-0-262-19565-2, ISBN 978-0-262-69356-1 paper

Vaclav Smil's *Energy in Nature and Society: General Energetics of Complex Systems* reads like an encyclopedic narrative on energy. With its myriad of facts and figures, it complements the more conceptual approach of *Sustainable Energy: Choosing Among Options* (MIT Press, 2005), by Jefferson Tester and colleagues; the somewhat more mathematically detailed *Advanced Energy Systems* (Taylor & Francis, 1998), edited by Nikolai Khartchenko; and the still useful *Renewable Energy Resources*, by John Twidell and Tony Weir, now in its second edition (Taylor & Francis, 2005). Still, Smil's book is a must-have for anyone who has an adequate high-school math and science background and has a serious, broad interest in energy systems.

A taste of the style and scope of the book can be found in the variety of questions the author presents: What is the earliest date man is known to have controlled fire? Answer: 900 000 years ago. How much volcanic material was ejected in the formation of the Toba caldera in Sumatra 75 000 years ago? Answer: 2500 km^3, over a thousandfold more than from Mount St. Helens in 1980. And how many people were left alive on Earth afterward? Answer: less than 10 000. What are the maximum numbers of people per square kilometer supportable by foraging, pastoralism, slash-and-burn agriculture, pre-industrial permanent cropping, and contemporary agriculture? Answer: 1, 3, fewer than 100, 1000, and 2000, respectively. What are chernozems, whose loss by 1900 accounted for about a quarter of the 1100 billion metric tons of carbon in preagricultural phytomass? Answer: