prove that the tools of Kuhnian analysis, in particular the idea of a revolution, may be applied usefully to produce history of the sort that goes beyond description in the logical presentation of ideas, to reveal what is at the heart of the process of discovery. Crowe's second essay, which is last in the collection, ends with an appropriate summary: "A revolution is underway in the historiography of mathematics, a revolution that is enabling a discipline that dates back to Eudemus to attain new and unprecedented levels of insight and interest."

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AEC and Critics

Containing the Atom. Nuclear Regulation in a Changing Environment, 1963–1971. J. SAMUEL WALKER. University of California Press, Berkeley, 1992. xiv, 533 pp., illus. $50.

"Demonstrators protest against Monticello nuclear plant at headquarters of Northern States Power in Minneapolis, 1971." [From *Containing the Atom*; © 1971 *Star Tribune*, Minneapolis–St. Paul]

In the 1970s nuclear reactors became one of the most controversial technologies in history, as enormous opposition movements developed around the globe. The conflict has differed from earlier controversies over new technologies, one difference being that other such technologies have usually been opposed—as was the case with the machine-smashing that occurred in the 19th century—as a threat to jobs, whereas nuclear energy was widely defended as creating them. A small library of books and articles has been generated in attempts to understand the battle, and the field of risk analysis was developed largely to explain antinuclear sentiments. It is crucial to understand this conflict, since it raises important issues of the role of experts in democratic countries.

"An ecologist at Oak Ridge National Laboratory uses a radiation-detecting instrument to measure radioactivity in the body of a live fish." [From *Containing the Atom*; National Archives]

In *Containing the Atom* J. Samuel Walker offers a wealth of raw materials for understanding the roots in the 1960s of the controversy that blossomed fully in the 1970s. Intended as a history of the Atomic Energy Commission from 1963 to 1971 (the period of Glenn Seaborg's reign as chairman), this beautifully written account provides more details concerning the civilian development of nuclear power in the United States during that period than any other work ever has—or perhaps ever will. As the official historian of the Nuclear Regulatory Commission, the AEC's successor, Walker had unprecedented access to internal memos and documents (as the 75 pages of notes demonstrate), a concern with covering all aspects of nuclear regulation, and the time to check his facts carefully. Because every aspect of nuclear development raised regulatory issues, his book approximates a general history of American nuclear energy rather than merely a history of the Atomic Energy Commission.

Walker organizes his book around a series of issues that regulators faced as they tried to balance their conflicting roles as promoters of the new technology and protectors of public health and safety. Despite the polite tone of the account, the evidence Walker presents is damning. Time after time, the promotional concerns won out, owing in some cases to the entreaties of the nuclear industry, in others to the coercion of Congress's powerful Joint Committee on Atomic Energy, and in others yet to the preferences of regulators themselves. I was struck by the number of controversies in this period, the golden age for American nuclear energy, the height of "the great bandwagon market" for reactors in the United States. Most of Walker's substantive chapters deal with debates and controversies: over proposals to put nuclear reactors in cities or near earthquake faults, over reactor safety and the odds for major accidents, over radiation standards and the effects of low doses of radiation. In many cases, the AEC and the nuclear industry treated nuclear critics brutally but learned from them in adopting new standards.

During the period from 1963 to 1971 nuclear fission seemed to achieve commercial success, with almost 80 reactors ordered from 1966 to 1968—representing almost half of all electrical generating capacity ordered in those three years. Virtually all the reactors ordered in this period were vastly larger than any then in operation. Only the contagious enthusiasm of nuclear energy's promoters, and some loss-leading plants sold by Westinghouse and General Electric, could persuade utilities to buy a technology about which so little (including its costs) was known. So the AEC was extremely successful in its promotional role. Unfortunately, expert understanding of nuclear plant operations and safety was not

Vignettes: Book Promotion

[Oliver] Lodge was an early convert to Maxwell's electromagnetic theory. He bought a copy of the *Treatise [on Electricity and Magnetism]* after hearing it praised at the 1873 meeting of the British Association [for the Advancement of Science]; the bookseller, he said, grumbled that it was "a product of the over-educated."

—*Bruce J. Hunt*, in *The Maxwellians* (Cornell University Press)

In Philadelphia almost everybody reads "The Voice of the Dolphins," five stories of political and social satire by Leo Szilard. (In second printing Simon & Schuster; paperback $1) on sale in the Harvard Coop. If you do not buy it to-day you will forget it.

—Advertising copy written by Szilard, as quoted by William Lanouette in *Genius in the Shadows: A Biography of Leo Szilard, the Man Behind the Bomb* (Scribner)

keeping pace, a lag that contributed to the financial disaster of the 1970s as utilities had to "backfit" safety features.

Containing the Atom, although smoothly written, is hardly casual reading. But anyone who has followed one or more of the issues in the debate over nuclear energy will find chapters of interest here, as most of the abiding questions were first asked in the 1960s. What is striking is how few had been resolved, and how much the technology and its regulation were still evolving, in 1971. Anyone interested in the interplay of democracy, technology, and expertise will be stimulated by these stories.

One of the book's lessons is that skeptics have an important role to play in the development of risky technologies. Civilian nuclear reactors, in an age when fossil-fuel prices and energy costs were falling, lacked the urgency of the wartime Manhattan Project, but they were nonetheless promoted with an impatient enthusiasm that dismissed opponents as ill-informed or malevolent (communists, for instance, or agents of the coal industry). The AEC tended to dismiss not only protestors (who in the 1960s were often less informed than those of the '70s) but journalists who pointed out the lack of evidence for nuclear energy's safety and cheapness (*Science*, for one, published some skeptical reportage) and unconvinced scientists (including many who worked within the AEC's vast empire). In too many instances the skeptics proved right.

In the absence of solid evidence about the effects of a technology, one can only base predictions on one's intuitions about how the world works: about the rapidity of technological development, about the competence of experts, about the ability of private corporations to balance profits and public safety, about the willingness of government regulators to oversee those corporations. Walker tells the story of people who, albeit with frequent exceptions, had an unquestioning faith in technology, experts, electric utilities, and government regulators. Other voices, of those who lacked that faith, were systematically excluded. But it is also the story of the skeptics' persistence, so that by 1971, whether right or wrong, they could no longer be ignored. There can be no simple explanation for the emotional controversy over nuclear energy, but Walker has provided much valuable raw material for building a complex one.

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Books Received

An Agenda of Science for Environment and Development into the 21st Century. J. C. I. Dooge *et al.*, Eds. Cambridge University Press, New York, 1992. viii, 331 pp., illus. $69.95; paper, $34.95. Based on a conference, Vienna, Nov. 1991.

Alcohol Abuse Treatment. Ronald R. Watson, Ed. Humana, Totowa, NJ, 1992. xii, 327 pp., illus. $59.50. Drug and Alcohol Abuse Reviews, vol. 3.

Chemical Sensitivity. A Guide to Coping with Hypersensitivity Syndrome, Sick Building Syndrome and Other Environmental Illnesses. Bonnye L. Matthews. McFarland, Jefferson, NC, 1992. xvi, 275 pp., illus. $29.95.

The Chemistry of Heterocyclic Compounds. Vol. 48, Pyrroles. Part 2, The Synthesis, Reactivity, and Physical Properties of Substituted Pyrroles. R. Alan Jones, Ed. Wiley, New York, 1992. xvi, 628 pp., illus. $225.

The Development of Mathematics. E. T. Bell. 2nd ed. Dover, New York, 1992. xiv, 637 pp. Paper, $3.95. Dover Books Explaining Science. Reprint, 1945 ed.

Differential Manifolds. Antoni A. Kosinski. Academic Press, San Diego, CA, 1993. xvi, 248 pp., illus. $59.95. Pure and Applied Mathematics, vol. 138.

Elegant Technology. Economic Prosperity from an Environmental Blueprint. Jonathan A. Larson. Riverdale, Westwood, MA, 1992. xii, 271 pp., illus. Paper, $19.95.

Emerging Infections. Microbial Threats to Health in the United States. Joshua Lederberg, Robert E. Shope, and Stanley C. Oaks, Jr., Eds. National Academy Press, Washington, DC, 1992. xiv, 294 pp., illus. Paper, $34.95.

Fracture Mechanics of Ceramics. Vol. 10, Fracture Fundamentals, High-Temperature Deformation, Damage, and Design. R. C. Bradt *et al.*, Eds. Plenum, New York, 1992. xii, 655 pp., illus. $129.50. From a symposium, Nagoya, Japan; July 1991.

Global Biogeochemical Cycles. Samuel S. Butcher *et al.*, Eds. Academic Press, San Diego, CA, 1992. xvi, 377 pp., illus. Paper, $24.95. International Geophysics Series, vol. 50.

God and the Astronomers. Robert Jastrow. 2nd ed. Norton, New York, 1992. 149 pp., illus. $18.95.

Human Evolution. Alan Bilsborough. Blackie Academic (Chapman and Hall), Glasgow, U.K., 1992. x, 258 pp., illus. $75.50; paper, $34. Tertiary Level Biology.

Illustrating C. ANSI/ISO Version. Donald Alcock. Cambridge University Press, New York, 1992. x, 214 pp., illus. Spiral bound, $19.95.

In Our Own Image. Building an Artificial Person. Maureen Caudill. Oxford University Press, New York, 1992. x, 242 pp., illus. $23.

Life Histories of North American Woodpeckers. Arthur Cleveland Bent. Indiana University Press, Bloomington, 1992. xvi, 263 pp., illus., + plates. $29.95.

Likelihood. A. W. F. Edwards. Johns Hopkins University Press, Baltimore, MD, 1992. xx, 275 pp., illus. Paper, $15. Corrected reprint, 1984 ed.

Mathematics of Classical and Quantum Physics. Frederick W. Byron, Jr. and Robert W. Fuller. Dover, New York, 1992. 2 volumes bound as one. x, 661 pp., illus. Paper, $16.95. Addison-Wesley Series in Advanced Physics. Revised reprint, 1969 ed. (Vol. 1) and 1970 ed. (Vol. 2).

Meanings and Uses of Material Culture. Barbara J. Little and Paul A. Shackel, Eds. Society for Historical Archaeology, Tucson, AZ, 1992. iv, 133 pp., illus. Paper, $12.50. Based on a meeting, Toronto, 1987. Also published in *Historical Archaeology*, vol. 26, no. 3 (1992).

Natural Selection. Domains, Levels, and Challenges. George C. Williams. Oxford University Press, New York, 1992. x, 208 pp., illus. $55; paper, $24.95. Oxford Series in Ecology and Evolution, 4.

New Symmetry Principles in Quantum Field Theory. J. Frohlich *et al.*, Eds. Plenum, New York, 1992. viii, 529 pp., illus. $129.50. NATO Advanced Science Institutes Series B, vol. 295. From an institute, Cargese, France, July 1991.

Organ Transplantation. Long-term Results. Leendert C. Paul and Kim Solez, Eds. Dekker, New York, 1992. xii, 416 pp., illus. $145.

Organic Coatings. Science and Technology. Vol. 1, Film Formation, Components, and Appearance. Zeno W. Wicks, Jr., Frank N. Jones, and S. Peter Pappas. Wiley, New York, 1992. xxiv, 343 pp., illus. $85. SPE Monographs.

Pancreatic Islet Cell Regeneration and Growth. Aaron I. Vinik, Ed. Plenum, New York, 1992. x, 187 pp., illus. $69.50. Advances in Experimental Medicine and Biology, vol. 321. From a conference, Norfolk, VA, June 1991.

Parallel Computation Systems for Robotics. Algorithms and Architectures. A. Fijany and A. Bejczy, Eds. World Scientific, River Edge, NJ, 1992. x, 247 pp., illus. $70. World Scientific Series in Robotics and Automated Systems, vol. 2.

Reading the Book of Nature. An Introduction to the Philosophy of Science. Peter Kosso. Cambridge University Press, New York, 1992. viii, 198 pp., illus. $34.95; paper, $10.95.

Science as Writing. David Locke. Yale University Press, New Haven, CT, 1992. xii, 237 pp. $27.50.

Science Funding. Politics and Porkbarrel. Joseph P. Martino. Transaction Publishers, New Brunswick, NJ, 1992. xiv, 392 pp., illus. $32.95.

Total Engineering Quality Management. Ronald J. Cottman. Dekker, New York, 1993. xiv, 134 pp., illus. $45. Quality and Reliability, 37.