books

Examining the science and politics of Ben Franklin

The First Scientific American

Benjamin Franklin and the Pursuit of Genius

Joyce E. Chaplin
Basic Books, New York, 2006.
$27.50 (421 pp.).
ISBN 0-465-00955-7

Stealing God's Thunder

Benjamin Franklin's Lightning Rod and the Invention of America

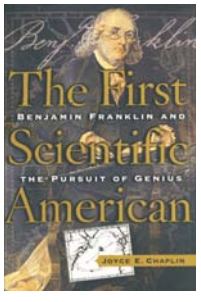
Philip Dray
Random House, New York, 2005.
$25.95 (279 pp.).
ISBN 1-4000-6032-X

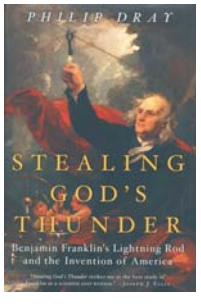
Reviewed by John L. Heilbron

"If your head is wax, don't walk in the sun." Neither Philip Dray, a Pulitzer-prize-winning freelance writer and author of *Stealing God's Thunder: Benjamin Franklin's Lightning Rod and the Invention of America*, nor Joyce Chaplin, author of *The First Scientific American: Benjamin Franklin and the Pursuit of Genius* and a professor of American Studies at Harvard University, heeded that apt warning from *Poor Richard's Almanack*. Both seem to have skipped elementary physics. The consequences are a few soft spots in Dray's book and frequent meltdowns in Chaplin's.

Although Dray draws almost all of his information from second-hand sources and embellishes stories to decorate his book for the current tricentennial of Franklin's birth, he has a good eye for the illustrative detail. He writes clearly and unaffectedly and, luckily, does not stick to the subject in his title. He touches on several other examples of Franklin's "science" besides his research on electricity and lightning: He covers the Pennsylvania fireplace (or Franklin stove), bifocals, the glass armonica, freshwater polyps, and mesmerism. Dray reports that the bifocals worked well, but not the fireplace; that the regenerating polyps, one of the wonders of the age, served as a political symbol in Franklin's 1754 cartoon urging colonial union; that the glass armonica, on which the very different hypnotists Franz Anton Mesmer and Wolfgang Amadeus Mozart became proficient, shared technology with the electrostatic generator; and that Franklin served as a member of the Paris Academy of Sciences committee that would debunk Mesmer's animal magnetism.

Sometimes, Dray's Franklin appears more modern and modest than he was. Yet the author's unassuming book can be read with moderate pleasure and hedged confidence as an introduction to the life and works of the man who, as his friend Anne-Robert Jacques Turgot quipped, "snatched lightning from the sky and the scepter from tyrants."





Chaplin's book is scholarly. Footnotes gathered by her and her research assistants identify many passages in Franklin's writings not usually considered in accounts of his science. The references may be more useful in other books than in hers. Her renditions of Franklin's science, apart from his writings on hydrography, are marred by errors that are compounded by presumption. She claims to paint a truer portrait of Franklin than any existing. She aims to rescue Franklin's life from the distortion of hagiographers and political historians. She will wrest his science from the "specialists" who have made it inaccessible to most readers. That is presumption. The author's errors in explaining "why we now misunderstand Franklin" (page 5) are too plentiful to survey here. A half dozen of her blunders in physics may be recorded to help evaluate what Walter Isaacson, another Franklin biographer and one of Chaplin's blurbists, judges to be a "brilliant and thoroughly researched account."

On page 125, Chaplin writes that "gravitation must create a shortening of the earth's axis;" on page 132, that "the only electrical fatality [was] when an ungrounded Georg Wilhelm Richmann unwittingly approached a charged Leyden jar" (an ungrounded lightning conductor, not a Leyden jar, electrocuted Richmann); on page 277, that the electrophore "defied Franklin's definitions of electricity as a fluid that slipped in and out of equilibrium;" on page 278, that the two kinds of electricity, "positive in the metal and negative in the [electrophore's] cake," were known to repel each other; on page 353, that "by the end of the 19th century, experimenters in quantum physics were stating that particles of matter did not have absolute mass." On page 354, she unravels the mysteries of relativity: $E=mc^2$ signifies that "the energy (E) needed to accelerate a mass (m) to the speed of light (c) would be infinite (an amount of energy divisible by the speed of light squared)."

It would be unfair to conclude that Chaplin's book gets nothing usefully right. Her coverage of Franklin's lifetime interest in marine affairs, navigation, the course and consequence of the Gulf Stream, and the meteorological cycle is informative and might have been more so if her publisher had not printed the 18th-century maps illegibly. Her accounts of the glass armonica and mesmerism are as good as Dray's. She correctly insists on the importance in Franklin's political economy of the physiocratic principle that a nation's strength is proportional to its population.

Nonetheless, Chaplin's history is almost as bad as her science: It is pretentious, fatuous, weak in evidence and argument, and lacking context. One example must suffice. By calling Franklin a scientist, she appears to establish that in the 18th century scientists and politicians collaborated. Further, according to Chaplin, professionalization broke that connection in the 19th century, and only in the 20th cen-

John L. Heilbron is a professor emeritus of history at the University of California, Berkeley. He is the author of *Electricity in the 17th and 18th Centuries: A Study of Early Modern Physics* (U. of California Press, 1979; Dover, 1999).

© 2006 American Institute of Physics, S-0031-9228-0609-240-4

tury did scientists regain political influence. Her account is nonsense. Franklin is a false starting point, and the history of European politics during the 19th century is strewn with men of letters and science.

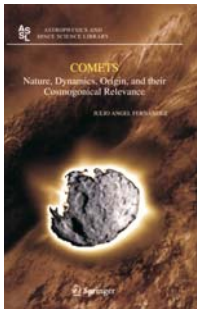
As a historian, I do not find it gratifying to admit to readers of PHYSICS TODAY that my colleague's attempt to make sense of their science has fallen so short. Two more of Chaplin's blurbists, Dudley Herschbach, a Nobel laureate in chemistry, and Lawrence Krauss, a distinguished physicist, judge *The First Scientific American* to be admirable in concept and execution. The book is full of "verve, insight and wit," according to Herschbach, and, according to Krauss, offers, a "fascinating . . . comprehensive exploration of [Franklin's] scientific side." Herschbach and Krauss's uninformed tolerance is misplaced. The cracks between the cultures of science and history should not be safe havens for work that would not survive in either.

Comets

Nature, Dynamics, Origin, and Their Cosmogonical Relevance

Julio Angel Fernández
Springer, Dordrecht, the Netherlands, 2005. $159.00 (383 pp.). ISBN 1-4020-3490-3

The study of comets is currently in a remarkable period. Progress is often stimulated by the appearance of bright comets such as Hyakutake in 1996 and Hale–Bopp in 1997, or by a space mission to examine comets. The *Stardust* mission encountered comet Wild 2 on



2 January 2004 and returned samples of cometary dust for laboratory analysis. On 4 July 2005 the *Deep Impact* mission to comet Tempel 1 performed the first experiment on a comet by delivering 19 gigajoules of kinetic energy to the surface of the comet's nucleus and recording the effects.

Against this backdrop of recent comet research, Julio A. Fernández's *Comets: Nature, Dynamics, Origin, and Their Cosmogonical Relevance* treats extensively a part of cometary physics that is not closely linked to single events but instead is based on Newtonian mechanics. Research based on Newtonian mechanics is not always considered at the cutting edge of science—but it certainly is for studies of asteroids and comets in the solar system. Understanding their long-term orbital histories requires approaches and techniques far beyond simple Keplerian orbits. Fernández, a professor of astronomy at the University of the Republic in Uruguay, is a leading authority in the field and has presented an excellent account up to January 2005. The text has references to published material through 2004 and to some papers in press in 2005.

One serious quibble concerns the title of the book versus the goals stated in the preface and the actual content. Despite what the subtitle suggests, the book contains about four times more discussion on dynamics than on nature. As a result, the text is not a suitable introduction to comets. For comprehensive coverage at the research level, readers can consult *Comets II* (U. Arizona Press, 2004), edited by Michel C. Festou, H. Uwe Keller, and Harold A. Weaver; at the tutorial level they can look at the second edition of *Introduction to Comets* (Cambridge U. Press, 2004), which I coauthored with Robert D. Chapman.

Nevertheless, Fernández's monograph is a lucid account of cometary dynamics and related topics that is an important contribution to the literature. His style combines a readable narrative with order-of-magnitude estimates and detailed mathematics where necessary. Among the topics discussed are the dynamics of long-period comets and the Oort cloud. The author explains how encounters with passing stars and giant molecular clouds, as well as galactic tides, influence comets in the Oort cloud and send some of them into the inner solar system. But getting into the inner region is not simple because Jupiter and Saturn act as gravitational barriers. In fact, the fate of most comets is ejection from the solar system. Advances in the understanding of orbits and dynamics have influenced the descriptions of them. Although such terms as short period and long period are still used, researchers also speak of "Jupiter-family" and "Halley-type" comets.

The need to pin down the source of the Jupiter-family comets naturally leads to a discussion of the belt of trans-Neptunian, icy objects. Fernández gives a nice, brief history of the confusion over the name of that belt—whether it should be called the Kuiper belt or the Edgeworth–Kuiper belt. The structure and evolution of the trans-Neptunian belt is fascinating. Many objects, called plutinos, and including Pluto, are in a stable mean-motion resonance with Neptune. The scattering of the icy planetesimals or cometesimals in the early solar system is responsible for the major outward migration of Neptune's orbit.

The formation of comets is a topic closely related to the formation of the solar system. The dynamics presented in the book take comets from their formation to their end states. The author also covers the dynamical issues related to the hypothesis that comets supplied Earth with water and the seeds of life. The need for an external source seems clear, but the relative contributions from comets and asteroids remain to be determined. Fernández's brief closing discussion of comet missions is somewhat out of date, a problem common to all recent comet treatises.

Comets provides an important and extremely readable summary of cometary dynamics and related topics. It is accessible to anyone with a basic knowledge of celestial mechanics and astronomy. Many scientists, including astronomers, can benefit from reading it. And despite the book's high price, they should buy a copy for themselves.

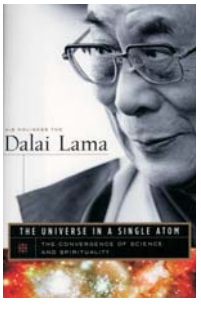
John C. Brandt
University of New Mexico
Albuquerque

The Universe in a Single Atom

The Convergence of Science and Spirituality

Dalai Lama
Morgan Road Books, New York, 2005. $24.95 (216 pp.). ISBN 0-7679-2066-X

Last November, amid some controversy, Tenzin Gyatso, Dalai Lama XIV, addressed more than 10 000 scientists at the Society for Neuroscience's annual meeting in Washington, DC. He spoke about recent developments in the "neuroscience of meditation" and the ethical implications of science. The Dalai Lama's talk was the most recent instance of his lifelong interest in science, a story engagingly told in his *The Universe in a Single Atom: The Convergence of Science and Spirituality*.



The Dalai Lama articulates the need for what he terms an "urgent engagement" between Buddhist philosophy