BOOKS: HISTORY

Unraveling Complex Events

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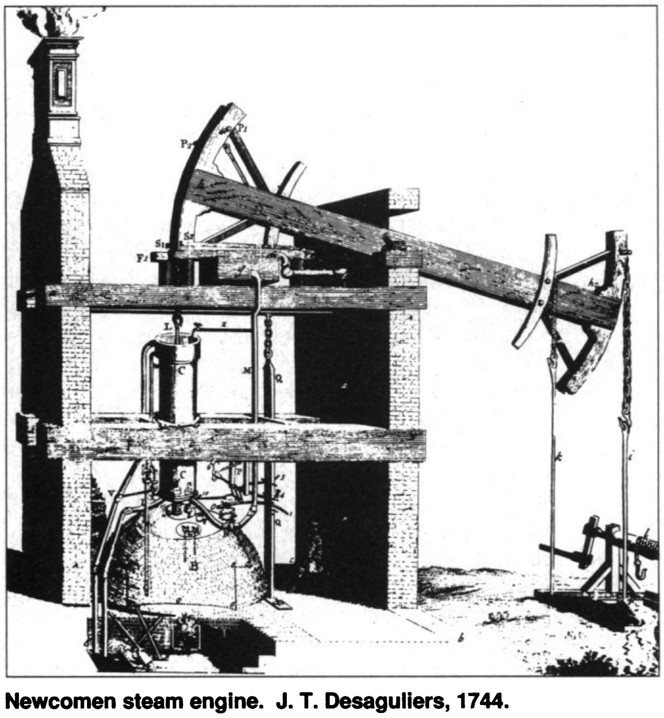
Physics in the Nineteenth Century. ROBERT D. PURRINGTON. Rutgers University Press, New Brunswick, NJ, 1997. xx, 251 pp. $55, ISBN 0-8135-2441-5; paper, $25, ISBN 0-8135-2442-3.

The 19th century presents considerable difficulty to anyone trying to write a coherent story of the development of physics. The epoch was very complex, with many simultaneous events, the connections among which are clear only in retrospect. In other centuries, the work of a few especially important physicists (Galileo and Newton in the 17th century, for example) must dominate any account—or the course of a major revolution (such as quantum and atomic structure in the 20th century) provides an obvious framework. There is no best path to follow physics in the 19th century from Lagrange to Einstein. How to describe the contributions of (and in what order?) Volta, Dalton, Fresnel, Faraday, Helmholtz, Clausius, Kelvin, Maxwell, and the other familiar names? It is a formidable task to offer a comprehensible explanation of what these individuals achieved, while also not forgetting to give due consideration to social, institutional, and philosophical factors, as well as to technological applications.

Few authors have attempted this synthesis; even fewer have succeeded as well as Robert Purrington. A professor of physics at Tulane University, he aspires to "regain for scientists some lost ground, namely the prerogative to explore the history and evolution of their discipline." In particular, he insists on discussing the "evolution," even the "progress," of physics, as well as the "connections between modern science and its forebears." These words, held at arm's length by scare-quotes, signal an approach that most historians now consider obsolete and stigmatize as Whiggish—seeing the past as progress toward the present. Instead, it is fashionable to treat earlier science in terms of the context of its own time and place, ignoring what it later became—and, indeed, almost abandoning the attempt to explain long-term historical change.

His adoption of the scientist's viewpoint does not mean that Purrington overlooks the enormous amount of research performed by historians of science on 19th-century physics. On the contrary, he displays an impressive command of this research. At the same time, however, he has also examined many of the original sources and does not always accept the interpretations of these sources made by professional historians. The result is a generally accurate account of theories and experiments (facts about the physical world), presented with frequent reminders that motives, influences, and historical trends (facts about the world of physicists) are often disputed and never completely known.



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Newcomen steam engine. J. T. Desaguliers, 1744.

Purrington organizes his book around three major topics—electromagnetism (subsuming optics and ether theories, which are treated minimally), energy (including heat and thermodynamics), and atomism (leading into kinetic theory and statistical mechanics)—following each through most of the century and then going back to pick up the next. A penultimate "Fin de Siècle" chapter briefly reviews the breakthroughs and discoveries that initiated the 20th-century revolution: black body radiation, spectroscopy, cathode and x-rays, radioactivity, quantum theory, and special relativity.

The short text (only 174 pages, followed by 63 pages of endnotes) sacrifices breadth for depth. Omitted or discussed superficially are mechanics, hydrodynamics, and mathematical methods. Most of the physics is treated qualitatively (but carefully), although thermodynamics is presented at a fairly technical level with the use of calculus. Discussion of the social and philosophical context is largely confined to an introductory chapter. No mention is made of the "social construction" doctrine, popular among some historians of science in the 1980s. (According to this doctrine, things like indeterminism, quarks, and gravity waves are not properties of the physical world that scientists simply discover; rather, they are established by a process of negotiation among scientists, with little or no input from the physical world.)

Challenging a view widely held by physicists and historians of science, the author endorses Thomas S. Kuhn's argument that Max Planck did not propose physical quantization of energy in 1900. Instead, Planck used quantization as a mathematical device to calculate combinatorial entropy (he even said that if the energy is not equal to an integer number of quanta, we take the closest integer). According to Kuhn and Purrington, the physical quantum theory began only with Einstein in 1905.

Given that Kuhn was widely regarded as the most influential historian of science in the last third of the 20th century, and that quantum theory was the most important discovery of the first third of the century, it seems odd that Kuhn's interpretation of the origin of quantum theory has been generally rejected or ignored. It appears that few readers have bothered to check the original sources on which Kuhn based his conclusion. Yet, if Kuhn is right, the erroneous belief that Planck introduced the quantum theory is a prime example of the Whig fallacy in historiography: judging a text on the basis of its similarity to the ideas now considered correct, rather than looking at its historical context—in this instance, the earlier writings of Ludwig Boltzmann and of Planck himself. Whether or not one agrees with Kuhn, the kind of understanding of 19th-century physics provided by Purrington is a prerequisite to joining this debate.

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