Book Reviews

Dimensions of a Scientist

Lavoisier and the Chemistry of Life. An Exploration of Scientific Creativity. FREDERIC LAWRENCE HOLMES. University of Wisconsin Press, Madison, 1985. xxiv, 565 pp., illus. $39.50. Wisconsin Publications in the History of Science and Medicine, No. 4.

This book examines Lavoisier's investigations into respiration, fermentation, and plant and animal chemistry from 1773 until 1792. The restricted topic and period and the painstaking examination of manuscript sources might suggest that here is a book for the specialist in the history of science; and indeed such specialists will learn a good deal from Holmes's account. But the work's subtitle indicates another dimension that invites a much wider readership, for Holmes has succeeded admirably in exploring and revealing how Lavoisier worked, how he made his discoveries, even how he thought about his problems. Given the magnitude of Lavoisier's achievement, this confronts us with scientific creativity in action. The author has written a work of fine historical scholarship and is careful to eschew unsupported generalizations, but he does raise the question whether similar attributes may not "recur in different combinations in different individuals" (p. 502). Those interested in scientific creativity, in the interface between the history and the philosophy of science, in the history of chemistry, or in the history of physiology will find this a work of major significance.

Holmes has concentrated upon Lavoisier's investigations, rather than upon the development of his ideas in isolation from the laboratory or upon the social matrix in which those ideas were developed, because he sees this as the best way to understand Lavoisier's problems and their resolution. His principal sources are Lavoisier's manuscript notebooks, supplemented by informal notes, memoranda, and drafts; he has made sensitive and exemplary use of these materials, using Lavoisier's revisions and corrections as indications of the growth of his ideas.

Lavoisier is recognized as the dominant figure in the chemical revolution of the late 18th century, a revolution based upon the analysis of water, a new understanding of the nature of combustion, and the development of a new system of elements. The revolution was most visible for its successes in inorganic chemistry, and Lavoisier's contributions to organic chemistry are generally thought of as a later phase of his work, of lesser distinction, and interrupted before fruition by his execution during the Terror. One of Holmes's achievements in this book is to force a revision of that picture. Lavoisier is revealed as a founder of physiological chemistry whose study of the physiological process of respiration was an integral part of his investigative program from the early 1770's, organic and inorganic chemistry being interdependent and part of a methodological whole. In particular, respiration and combustion shed light upon one another; inorganic thermochemistry and the heat balance of physiological processes came under the same purview; and the chemistry of gases and the analysis of water were both crucial to and illuminated by Lavoisier's researches in organic chemistry.

Lavoisier was the master of quantitative analysis and was guided by the principle of the balance sheet. "Mastery" and "guidance" are key words here, for Lavoisier was in control of his data, wise in adjusting them when the balance sheet was imperfect and also in judging when an approximate result sufficed to carry the investigation forward and when real precision was essential. One of the most fascinating aspects of this book is the way in which Holmes explores Lavoisier's mastery and manipulation of quantitative data. It is crucial to recognize that such imaginative and intuitive manipulation of data was constructive rather than fraudulent, was often overt, and has characterized the work of some of the greatest scientists.

Also striking is the revelation of what everyone knows but often forgets, the distance between the actual course of an investigation and the logical, tidy way in which it is reported in the published paper that follows. Lavoisier often presented his ideas as if he had known precisely where he was going. There is indeed, as Holmes shows, a remarkable long-term coherence to his multiform research program. But Holmes also reveals the gradual, piecemeal exploration of conceptual regions, with clarity emerging here and there while contradictions and confusions persist elsewhere. The length of the process, covering years, is stressed, and Holmes argues that in the case of Lavoisier the idea of a passage rather than a Gestalt switch provides a helpful metaphor for the process.

The revelations Holmes provides concerning the subtlety and fluidity of Lavoisier's reasoning in the course of an investigation, Lavoisier's success in bringing quantitative methods to a qualitative science, the benefits of crossing fields in science, the significance of imaginative innovations in instrumentation, and many more matters not only contribute vitally to an understanding of Lavoisier's work but also raise wider questions about the nature of scientific creativity.

This is an important and penetrating study and will repay careful reading by scientists, historians of science, and philosophers.

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Influences on Einstein

The Young Einstein. The Advent of Relativity. LEWIS PYENSON. Hilger, Bristol, 1985 (U.S. distributor, International Publishers Service, Accord, Mass.). xiv, 255 pp. + plates. $28.

No single set of historical events has attracted more attention from historians of modern physics than Einstein's creation of the theories of relativity. Indeed, perhaps only Newton's route to his *Principia* and Darwin's to his *Origin of Species* have attracted as much attention within the history of modern science. From late 1919, when Einstein first came onto the world stage, there has been an unceasing number of articles and books, both popular and academic, about his life and work. It is no easy task to say something fresh about Einstein and the coming of relativity.

Lewis Pyenson's approach to this well-tended subject explicitly eschews historical discussion of such technical matters as simultaneity or the purported role of the Michelson-Morley experiment. Nor does Pyenson seek to offer a complete, definitive biography of the young Einstein. Instead, he concentrates on three themes: the nature of Einstein's education and the socioeconomic condition of the young Einstein's life, non-Einsteinian attempts to resolve problems