Book Reviews

Themes in Victorian Science

Science in Culture. The Early Victorian Period. SUSAN FAYE CANNON. Dawson, Folkstone, Kent, England, and Science History Publications (Neale Watson), New York, 1978. xii, 296 pp. $17.95.

Today we all stand uneasily aware of the complexity of culture, the subtlety of science, and the intricacy of their interweavings. The actual relations between science and culture remain opaque, recalcitrant, and hard to decipher. If present experience puzzles us, recourse to the historical record offers one avenue to enlightenment. Susan Faye Cannon's book is correspondingly welcome. In nine deft chapters she ranges over subjects as varied and important as "The invention of physics" and "Science as norm of truth." At each turn she displays superb historical instincts, a gift for the vivid phrase and the telling instance, and a gleeful delight in demolishing what John Kenneth Galbraith has called the standard wisdom. Indeed, Cannon bids fair to become the Galbraith of the history of science—sometimes maddening, often irritating, and frequently elusive on critical issues, but boldly novel and disconcertingly correct on many things and always eminently readable.

Cannon begins by pointing out that to certain early Victorians science and religion belonged together as two faces of a single truth. A "Cambridge network" of poets, dons, and divines made this intellectual unity their special property: to them physical astronomy was the paradigm of science, science was the earthly standard of God's truth, and members of the network were specially blessed in their appreciation of that reality. The lines of argument and of social connection ran from such London savants as Francis Beaufort (at the Admiralty), G. B. Airy (Astronomer Royal), and Charles Babbage (computer-extraordinary and absentee Lucasian professor of mathematics at Cambridge) to cathedral dignitaries like George Peacock (dean of Ely and less absent Lowndean professor of mathematics) and Adam Sedgwick (prebendary of Norwich and very present Woodwardian professor of geology). The common terminus lay in Trinity College Cambridge. There William Whewell ("science was his forte, and omniscience his foible") and others of the network toiled to refashion education, morals, and much else to accommodate the new vision. There too on occasion came the poet William Wordsworth to join the Master of Trinity (his brother Christopher) in a benign scrutiny of this world amaking. Science-as-religious-truth was intimately related not only to poetry but also to power—a fact nicely signaled in the marriage of a daughter of the network's scientist-hero John Herschel to a son of a prime minister. In matters more cerebral the Cambridge network also sought integration and synthesis: an "intellectual totality" was their aim. Ironically, their greatest triumph and their deepest mortification were of a piece: they prepared the ground in which were to be rooted the integrating yet dividing syntheses of James Clerk Maxwell and Charles Darwin.

To her important idea of the centrality of a Cambridge network committed to the unity of science and religion, Cannon joins a second major theme, that of "Humboldtian science":

> The great new thing in professional science in the first half of the 19th century was Humboldtian science, the accurate, measured study of widespread but interconnected real phenomena in order to find a definite law and a dynamical cause. Compared to this, the study of nature in the laboratory or the perfection of differential equations was old-fashioned, was simple science concerned with easy variables. Insofar as you find scientists studying geographical distribution, terrestrial magnetism, meteorology, hydrology, ocean currents, the structures of mountain-chains and the orientation of strata, solar radiation; insofar as they are playing around with charts, maps, and graphs, hygrometers, dip needles, barometers, maximum and minimum thermometers; insofar as they spend much of their time tinkering with instruments and worrying about error . . . they are eagerly participating in the latest wave of international scientific activity [p. 105].

This Humboldtian activity was "the major concern of professional science for some forty years or so" (p. 77). As if this bold hypothesis were not enough, the book is peppered with further provoking assertions, such as that physics "was invented by the French around the years 1810–1830" (p. 115) or that Napoleon "was a 'cause' of the *Origin of Species*" (p. 285).

Unlike Galbraith, Cannon supposes a considerable familiarity with her subject on the part of her readers. Minor figures are abruptly introduced. Much knowledge of the sciences is innocently assumed. And the historical writings of Thomas Carlyle are taken for granted. The reader who can take all this in stride will find much of profit. Thus Cannon offers a fascinating discussion of the various stages through which the articulation of a historical problem proceeds in the work of succeeding generations of scholars. This discussion is focused on the idea of the "professionalization" of science. Simpleminded beliefs are ruthlessly exposed. The shortcomings of presentist sociological explanation are laid bare. The complexity of historical truth—and of science in culture—is richly displayed. The discussion lifts our understanding to a new level and should affect all future work.

The lessons learned are applied in two chapters on a central episode in early Victorian intellectual life, one that was full-brimmed with implications for science as an element of culture, namely the founding of the British Association for the Advancement of Science. Cannon rightly labels it "a nice subject for some historians to use in displaying their notions of expertise" (p. 167). The forms of, and the weaknesses in, available accounts are displayed. And a start is made in developing new explanations. Those explanations depend almost entirely on Cannon's close reading of the voluminous manuscripts of John Herschel. Because Herschel was a key figure in English science, and because Cannon possesses a well-honed historical sensibility, her explanations are novel, important, and—as far as they go—convincing. However, in observing that "there is nothing like knowing unpublished material which the other fellow hasn't seen" (p. 174) she unknowingly points toward a weakness of her own study. For she makes little use of the manuscripts of those dozens of other actors who crowded the stage of early Victorian culture and who helped define and shape the science she studies. Her work is therefore more often fruitful in demolishing old myths than in fashioning fresh truths that will stand the test of time.

A study as richly discursive as this one leaves many things lightly sketched.

"Humboldtian science" comes close to explaining everything—and nothing. The varieties of science in London, then the commanding city of the Western world, deserve a fuller treatment. The uses and abuses of scientific knowledge in cities like Edinburgh, Glasgow, Dublin, and Manchester are not developed. On occasion Cannon's work threatens to become an entertaining rollick, as when she offers admirable rules of historical evidence but goes on to admit that "I have violated these rules often in this book, but here I have provided a standard whereby the reader can judge whether to believe what I say or only to become interested in it" (p. 173).

Because early Victorian Britain was a seedbed of our modern science, it deserves the historian's attention. We must hope that this bold, iconoclastic survey will encourage other scholars to undertake new analyses of the scientific institutions, ideologies, politics, and personalities of that era. A more disciplined technique than appears here will be needed to separate out, characterize, and display the rich variety of elements that constitute science in culture. The challenge to the historian is to develop that technique without sacrificing the interest or intelligence so vividly displayed in Cannon's idiosyncratic account.

ARNOLD THACKRAY
Department of History and Sociology of Science, University of Pennsylvania, Philadelphia 19104

Chemistry in Britain

Chemists by Profession. The Origins and Rise of the Royal Institute of Chemistry. COLIN A. RUSSELL with Noel G. Coley and Gerrylynn K. Roberts. Open University Press, Milton Keynes, England, 1977 (U.S. distributor, Humanities Press, Atlantic Highlands, N.J.). x, 342 pp. + plates. $21.50.

Authors of commissioned institutional histories, even when trained historians, frequently are subject to subtle or overt pressures to illuminate an institution's best profile, to avoid discussion of controversial matters of policy and personality, to emphasize their subject's significance, and to refrain from pursuing topics or themes that might displace the institution itself from center stage. *Chemists by Profession*, a history commissioned to celebrate the Royal Institute of Chemistry's centenary in 1977, avoids most of these pitfalls.

Commencing with a valuable account of the growth of chemistry as a science in Britain, Russell, Coley, and Roberts proceed to examine the factors that contributed to the formation of a body of professional British chemists during the 19th century: the increasing importance of chemical analysis to municipal authorities and a variety of private firms, the expansion of British chemical industries, and the growth in the number and variety of educational institutions at which chemistry was taught. Several societies arose in response to the needs, interests, and ambitions of Britain's chemists. The Chemical Society of London, the Society for Analytical Chemistry, and the Society of Chemical Industry were all products of the Victorian era.

From its inception in 1877, the Institute of Chemistry was unique among these organizations. Its primary aims were to promote the economic and social standing of its members and to ensure that practicing analytical and consulting chemists possessed training suitable for their tasks. The promotion of chemistry as a profession was the Institute's central goal, not the advancement of chemistry as a branch of knowledge. Following its establishment, the Institute gradually evolved a system of examinations and qualifications for membership which, its leaders hoped, would serve as standards for practicing chemists. At a time when an array of colleges, universities, technical schools, mechanics' institutes, and hospitals were training chemists, this would have been no small accomplishment. The ambition, however, was never fully realized. A Royal Charter granted the Institute in 1885 conferred legal authority to award certificates of competence, but failed to give the Institute a monopoly on qualifying chemists for practice.

During the 20th century the Institute slowly expanded the scope of its activities. Although it has continued to administer examinations, during the years since World War I the Institute's leaders have given greater attention to surveys of remuneration, the development of a national appointments register, and lobbying efforts within government councils in behalf of chemists' professional interests in matters of legislation and national policy.

Russell and his collaborators provide a thorough account of the circumstances that led to the organization of the Royal Institute and a detailed discussion of subsequent changes in its structure and function. They are at their best in analyzing the Institute's qualifications as products of the conflicting interests of academic chemists, who provided much of the Institute's leadership, and practicing chemists, who constituted a majority of its members. They also succeed in demonstrating how an organization that embraced both employers and employees in its membership was forced to walk a fine line between acting as a trade union and acting as a professional society, especially during the years after World War I when British society became increasingly polarized between management and labor organizations.

As their title suggests, the authors of *Chemists by Profession* sought to do more than chronicle the Royal Institute of Chemistry's development. They also aimed to trace the evolution of chemistry as a profession in Britain. According to their criteria, a profession consists of a group sharing intellectual qualifications, standards of remuneration, a sense of corporate identity, and an awareness of social responsibility. Its accredited representatives should constitute a recognized source of authority in society. Russell and his associates see the Royal Institute's history as a vehicle for studying the formation of this professional group. Indeed, they claim that the story of the development of chemistry as a profession in Britain is largely the history of the Institute.

In this claim they are not entirely convincing. Certainly the Institute's foundation and continued existence should be read as an expression of chemists' professional yearnings, but has a profession defined according to the authors' criteria ever taken form in Britain? Despite recent efforts toward unification, the Royal Institute remains one among several organizations seeking to speak for chemists. Although it alone enjoys the right to certify practical chemists as being competent, many chemists who fall short of the Institute's standards continue to practice, and many others who possess the qualifications necessary for membership have not joined. The authors tell us that as late as 1971 only 60 percent of the chemists qualified to enroll had done so. Moreover, the same tensions among academic chemists, independent consultants, employees of industry, and managers that the authors use so effectively in analyzing the glacial development of Institute policies also speak tellingly for the enduring strength of particularist sentiments within the Institute's membership. Current attempts to unify chemists' organizations in Britain, the subject of the last chapter of this book, offer dim promise of resolving these conflicts.