Another Lucasian Professor

The Mathematical Work of Charles Babbage. J. M. DUBBEY. Cambridge University Press, New York, 1978. viii, 236 pp. $26.50.

One spring afternoon in 1828 the bells of St. Mary's, Cambridge, rang out for the election of a new occupant of England's most prestigious chair of mathematics—the Lucasian professorship, once held by Isaac Newton himself. But the man so honored, who was in Italy at the time (he learned the news from a Rome newspaper), hadn't even asked to be considered, and his immediate reaction was to decline the post. His friends talked him out of this. In the event he held the chair for ten years, during which time he never lived in Cambridge and never gave a lecture (although he did participate in examining). This strange scholar was Charles Babbage, whose name is familiar today as the pioneer of computer logic and technology.

When younger (he was born in 1791), Babbage had helped brew up a storm over the out-of-dateness of the mathematical sciences in English universities by contrast with what was happening in Europe. (In illustration: it wasn't until the 1830's that Laplace's tremendous *Mécanique Céleste* was available in English. Then two translations appeared—one by Bowditch the navigator, who was an American, and the other by Somerville the aristocrat, who was a woman and therefore nonacademic by definition.) So it seems odd, to say the least, that when presented with this golden opportunity to revitalize the teaching of mathematics Babbage should pass it up. The main reason was that his zeal had flagged; he had become wholly absorbed in his calculating machines, the construction of mathematical tables, and allied topics. His work in these areas has been discussed in many places in recent times. But Babbage the pure mathematician has not been properly examined, and this book makes good that omission.

Dubbey points out that Babbage's original work in mathematics "began in 1813, continued at a prolific rate, producing three books, two unpublished books, three papers of considerable length, fourteen other papers, two long encyclopedia articles, and then came to an abrupt end in 1821." The unpublished books are "The History of the Origins and Progress of the Calculus of Functions," belonging now to the Museum of the History of Science at Oxford, and "The Philosophy of Analysis," now in the British Museum. The author has consulted both these manuscripts.

In a fresh and illuminating appraisal Dubbey persuades us that Babbage's potential as a creative mathematician was greater than had been realized and that his treatment of the calculus of functions was novel and forward-looking. What he lacked in rigor was compensated by his ingenuity. Especially notable is his concern with the all-important matter of notation. This was a leitmotiv in all his work, going back to his earliest attacks on the English sanctification of Newton's defective symbolism in the differential calculus.

Here we have what is required reading for anyone seriously interested in the progenitor of the computer age. A pity, though, that the volume, which is small and quite ordinary (physically speaking), is so expensive.

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A Provincial Scientific Community

Science in Victorian Manchester. Enterprise and Expertise. ROBERT H. KARGON. Johns Hopkins University Press, Baltimore, 1978. xiv, 284 pp. $16.

The most abiding historical image of Manchester has undoubtedly been as the shock-city of the first British industrial revolution: it symbolized the harsh problems of urban industrial society. At the same time, however, its energy and wealth made it a place where science could be pursued and patronized with a success unequaled in other parvenu provincial manufacturing towns. Its renowned heroes, such as Dalton and Joule, remain secure in the scientific pantheon. At the institutional level, too, it was the setting for notable innovations: the Literary and Philosophical Society (founded in 1781) is Britain's oldest surviving provincial scientific society, and Owens College (founded in 1851) rapidly became the prototype British provincial science-based university. Science in Victorian Manchester is therefore an important and enticing theme.

As Kargon's bibliography confirms, the multiplicity of sources facing the Victorian urban historian is daunting. Rather than be overwhelmed by his data, Kargon has shrewdly chosen to portray the evolution of Mancunian science using various typologies concerning scientists and science. He organizes his material around five kinds of scientist: the gentleman who pursued science as leisured polite learning; the devotee dedicated to a scientific career on which he was not dependent financially; the civic who practiced science for money under a utilitarian banner that proclaimed both public good and private profit; the academic who served Manchester's industrial and commercial needs; and the university scientist committed to international success by way of research. In a related way Kargon uses the two conceptions of science as enterprise and as expertise. By these he means the views that scientific knowledge, indeed scientists, can be produced like goods and that science, being the supreme form of human knowledge, is fruitfully applicable to social and other problems.

These typologies enable Kargon to interweave deft accounts of scientific institutions and of scientific careers. He resurrects societies, like the Manchester Geological, that are usually dwarfed by the "Lit and Phil" and gives welcome attention to individuals, such as Binney and Leigh, who are normally condemned to lurk in the shadow of their contemporary Joule. In thus depicting Manchester's changing scientific community, Kargon rather surprisingly does not try to buttress his general case by exploiting prosopographical techniques: he relies mainly on shrewd qualitative portraiture. One wonders, too, how Mancunian activities in statistics and phrenology fit into his synoptic survey: after all, the Manchester Statistical Society (founded in 1833) was the first in Britain devoted to that subject, which in its numerical aspects fell under the rubric of science. Sometimes the stress on typology leads to an unbalanced account: though it is indisputable that in the 1860's Owens College, led by Roscoe and Balfour Stewart, displaced the "Lit and Phil" as Manchester's leading center of scientific activity, Kargon virtually ignores the latter after 1870. That same stress on typology, progressively interpreted, explains the startling gaffe of representing Manchester in 1840 as a scientific backwater.

These are, however, not disabling faults in a work that generally succeeds in giving a reliable and perceptive account of a scientific community. Without in any way displacing the important work of Thackray on Mancunian science in its cultural context, Kargon's book-length account lifts the study of that science to a new level. In his penetrating

analysis of civic science and scientists he even transforms social history of science into urban history. Despite occasional signs of hasty revision, this book is therefore essential reading for those interested in science in its urban locale while it also reveals how by 1906 Schuster could justly affirm to Rutherford that "Manchester is not at all a bad place."

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Science für das Volk

Scientific Materialism in Nineteenth Century Germany. FREDERICK GREGORY. Reidel, Boston, 1977. xxiv, 280 pp., illus. Cloth, $28; paper, $13.50. Studies in the History of Science, vol. 1.

Historians of science normally take little interest in the German Revolution of 1848. It was a straightforward political episode in which middle-class liberals riding a wave of popular social discontent tried to wrest a share of power from Germany's entrenched aristocracy. The movement failed—some say it was talked to death by lawyers and professors—and authoritarian governments cracked down. For the next decade, politically minded liberals were left with little to do, but many of them apparently chose to spend their time reading about science. During the 1850's, a number of popular science journals were founded, and several writers made national reputations by expounding scientific ideas before a general audience. The tone of this literature, skeptical and irreverent toward established belief, was often materialistic in a philosophical sense. However, the authors were not philosophers, and they had little interest in philosophy for its own sake; they were scientists or scientifically trained men who hoped to forge their special knowledge into an ideological weapon against the status quo. Ludwig Büchner, the most popular of these writers, explained the matter simply: "The public is demoralized by the recent defeat of national and liberal aspirations and is turning its preference to the powerfully unfolding researches of natural science, in which it sees a new kind of opposition against the triumphant Reaction."

This scientific materialism of the 1850's, typically German in its origins and motivation, has attracted little attention from American scholars. Now, however, Frederick Gregory has produced a thorough study of the intellectual leaders of the movement, detailing their lives and careers and analyzing the significance of their ideas. His *Scientific Materialism in Nineteenth Century Germany* focuses first on Ludwig Feuerbach, the philosopher whose assault on Hegel's idealism set the stage for the materialists. Gregory then concentrates on three men, Karl Vogt, Jacob Moleschott, and Ludwig Büchner, the most prolific and most characteristic representatives of the materialist school. He indicates some of the variety possible in materialist thinking by describing the atypical views of Heinrich Czolbe. Finally, he discusses at length the implications of this German materialism for philosophy, biology, and social thought. Throughout the book, Gregory is sensitive to the political background of his subjects' thinking, and he offers a wealth of personal detail about each of them. The emphasis, though, is on polemical argument, the ideology that the German materialists fashioned out of the science of their day.

The doctrines worked out by Vogt, Büchner, and Moleschott assumed the form of a naive realism that regarded the things of this world to be very largely what they seem to be. The materialists bridled at Kant's notion that the ultimate constituents of the world might remain in principle unknowable; for them, there existed no *Ding an sich*, no category of being that was inaccessible to empirical investigation. One had only to experiment and observe, and all truth would eventually be perceived. Confident in this faith, the materialists brought the average German reader a world picture of mechanistic determinism in which rigorous laws of cause and effect governed all things from the motions of atoms to the thoughts of men. In doing so, they paid special attention to the biological sciences. All the materialists had studied medicine and were engaged in either medical practice or biological research. Those were years in which German physiologists were making rapid progress in relating life phenomena to physical and chemical processes. The materialists naturally made much of these developments. For them, physiological research proved that all human activities could ultimately be explained in terms of physical causation, a position summed up in Karl Vogt's blunt assertion that the brain produces thought much as the kidneys produce urine. Most practicing physiologists were far more cautious, preferring to restrict their comments to known mechanisms and declining to speculate about the ultimate basis of life and thought. Still, in spite of their crudity—or perhaps because of it—the materialists contributed much to the widespread enthusiasm for science that existed in mid-19th-century Germany.

When measured against their ideological goals, the accomplishments of the materialists seem more uncertain. Vogt, Büchner, and Moleschott were concerned not merely to popularize science but to harness it to an ideological purpose, the cause of radical liberalism and democracy in Germany. Here they faced the objections of philosophical critics who wondered how any moral purpose could truly be derived from the materialistic determinism they espoused. Even more concretely, they were challenged by the Prussian Army physician Heinrich Czolbe, who proceeded with a rigor that matched their own to derive a conservative, authoritarian message from his view of science. Gregory also observes that German socialists have paid more attention to scientific materialism than liberals have. He might further have noted the materialistic influence on technocratic *nur-Wissenschaftler*, who have indiscriminately served successive German regimes, unconcerned about the political uses made of their scientific work. In practice, then, scientific materialism has been turned to many ends that would have appalled Vogt, Büchner, and Moleschott. The ease with which science can be reconciled with diverse ideological positions suggests a notable weakness in the thought of the materialists and underlines the perennial value of alert philosophical criticism—precisely the kind of criticism Gregory offers in this book.

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Miescher and Successors

A Century of DNA. A History of the Discovery of the Structure and Function of the Genetic Substance. FRANKLIN H. PORTUGAL and JACK S. COHEN. MIT Press, Cambridge, Mass., 1978. xiv, 384 pp., illus. $17.50.

The authors of *A Century of DNA* set themselves the ambitious task of tracing the long history of investigations surrounding "the greatest discovery in biology in this century." They have followed the development of knowledge of the chemistry of DNA from the initial discoveries by Friedrich Miescher in 1869 to Watson and Crick's famous achievement establishing a three-dimensional structure that provided also a compelling