

German science and technology. Completing his dissertation in 1872 at the age of 22, Braun spent the next 40 years teaching, establishing or heading physics institutes in various German universities, conducting experiments in areas as seemingly disparate as acoustics and thermodynamics and publishing countless scholarly papers. His colleagues included such luminaries as Herman von Helmholtz, Heinrich Hertz and Wilhelm Conrad Röntgen. Although his scientific contributions were highly significant and seminal, he is probably most frequently remembered as the man who shared the Nobel prize with Guglielmo Marconi in 1909 for their contributions to wireless telegraphy. His work on radio transmitting and receiving and his invention of the cathode-ray oscilloscope in 1897 were major advances that helped lay the technical foundations for broadcasting voice, and later, images. Even an abbreviated list of his accomplishments gives the impression of a highly energetic, versatile and creative man who both contributed to and benefitted from the German scientific renaissance of the late nineteenth and early twentieth centuries. The story of his life would seem to provide an excellent vehicle for exploring physicists' roles in the contemporary transformations in science, technology and university training. The scientist and the historian would like to know more about such an extraordinary figure. What drove him, what discouraged him, and what were the dynamics of the scientific circle of which he was part? Can a study of his life and work help us better understand the social and intellectual origins of twentieth-century electronics?

Unfortunately, *Ferdinand Braun: A Life of the Nobel Prizewinner and Inventor of the Cathode-Ray Oscilloscope* by Friedrich Kurylo and Charles Susskind leaves these questions unanswered and the reader highly unsatisfied. Kurylo, a German journalist, wrote the book in 1965; Susskind, who teaches engineering at the University of California at Berkeley, has translated, edited and revised it for the English-speaking audience. The book is reportorial, duly recounting births, deaths, promotions and experiments, and it adheres to a strictly chronological organization. Its uneven style gives little indication of whom the authors are addressing. The opening chapters on Braun's boyhood and schooling have a Horatio Alger tone and read as if designed for adolescents. Yet when describing Braun's experimental work, the authors launch into scientific and technical accounts accessible only to more sophisticated readers. While these descriptions are sophisticated, they are not elegant. Discussions of

Braun's theories and experiments are flat; the authors fail to breathe life into his ideas and breakthroughs. Their consistent use of the passive voice and weak phrasing leads, repeatedly, to confusion. Their hackneyed prose—"deep in his heart" or "said Braun with a twinkle"—trivializes the man's motivations and character. Aside from these irritating flourishes, the authors give us no textured or persuasive portrait of Braun. We get no sense of passion, drive, triumph, or remorse. Cataloguing when and where Braun worked and what he accomplished does tell us what he did; but it cannot tell us how or why.

The overriding problem with the book is the lack of interpretation and analysis. The reader searches in vain for the moment when the authors stand back from their material and assess Braun's decisions, concepts and role in larger historical and scientific trends. We learn little, except for information of an anecdotal nature, about the complex interrelationships between universities, industry and the German government that ultimately gave birth to Telefunken, a company based on Braun's patents and Marconi's major competitor. But the most disappointing aspect of this biography is how little we learn about Braun. A more provocative and sensitive biography remains to be written.

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The Social Context of Innovation: Bureaucrats, Families, and Heroes in the Early Industrial Revolution, as Foreseen in Bacon's New Atlantis

Anthony F. C. Wallace

175 pp. Princeton U. P., Princeton, N. J., 1982. \$15.00

Historians of science with a sociological bent point to Francis Bacon's *New Atlantis* as the inspirational document that led to the foundation of the Royal Society of London and the Académie des Sciences in Paris and that, indirectly at least, helped to create modern science. Anthony Wallace, professor of anthropology at the University of Pennsylvania, applies this perspective to early industrial innovation in this book based on his 1981 Stafford Little Lectures at Princeton. The result is a lively, readable little book with important insights into the institutional contexts that nourish technological innovation.

In the first essay, Wallace compares Bacon's *inginary*, or engine houses, in the House of Salomon to the Royal Office of Ordnance and naval dock-

yards, which were the nursery for the development of the steam engine during the 17th century. In the second, he analyzes the family structure of the ruling house of Bensalem in the *New Atlantis*, a part of this treatise that is now almost universally overlooked, probably because it is so tedious, and relates it to the extended families—Crowleys, Crawshays, and Darbys—that, through the 18th and early 19th centuries, dominated the British iron industry and developed the use of coke in making iron. The features of these institutions that favored innovation were, first, continuity over several generations; second, redundant resources; and third, a belief that the support of innovation from internal funds produces greater profit.

Deep-shaft coal mining in 19th-century Pennsylvania provides a counterexample. Wallace examines the hero theme in Schuylkill County against the background of Bacon's galleries of inventors in Salomon's House. He describes some investors in mines who wanted to become industrial and economic heroes, to have statues erected to them, and who gambled on striking it rich. They ignored existing techniques for ventilating deep shafts and invested nothing in research into mine safety or even in safety practices that were well established. They failed spectacularly and with enormous loss of life as mines exploded and burned.

Wallace argues his case persuasively and well. His writing, while overburdened with parenthetical remarks, is refreshingly free of sociological jargon. Aptly illustrated, this book will be a valuable resource for historians of technology and an entertaining introduction to the field for general readers.

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book notes

Crystallography in North America

D. McLachlan Jr., J. Glusker, eds. 479 pp. American Crystallographic Association, New York, 1983 (dist. by Polycrystal Book Service, Western Spring, Ill.) \$50.00

With contributions by many of the most celebrated participants, this history of crystallography contains scores of brief articles written for it. Here are histories of crystallographic labs, in many cases by their one-time directors, sketches of past presidents of ACA, accounts of organizations, congresses and critical meetings. The second half of the volume concerns technical achievements. Crystal scientists outline the evolution of methods and apparatus, discoveries of the internal properties of materials. A final section covers the application of crystallogra-