Book Reviews

Pioneer Laboratories

Willis R. Whitney, General Electric, and the Origins of U.S. Industrial Research. GEORGE WISE. Columbia University Press, New York, 1985. xii, 375 pp., illus. $29.

The Making of American Industrial Research. Science and Business at GE and Bell, 1876–1926. LEONARD S. REICH. Cambridge University Press, New York, 1985. xvi, 309 pp., illus. $24.95. Studies in Economic History and Policy: The United States in the Twentieth Century.

Wise and Reich have written two books that provide refreshing and complementary perspectives on the origin and early development of industrial research in the United States. The one is an examination of the emergence of industrial research as seen through the career of the first director of the General Electric Research Laboratory, who did more than perhaps any other individual to define and disseminate the concept of industrial research. The other, an exceptional synthesis of technological and business history, is a comparative analysis of the research laboratories at GE and AT&T. Both authors deal effectively with how the laboratories and their managers responded to long-term changes both within and outside the parent corporations.

Willis Whitney was born in Jamestown, New York, in 1868. He graduated in physical chemistry from the Massachusetts Institute of Technology in 1890, earned a doctorate from the University of Leipzig in 1896, and then taught at MIT until he was recruited to head the GE Research Laboratory in 1900. To provide a context for this enterprise Wise devotes a chapter to reviewing early efforts to link science and industry both in the United States and in Europe. At GE Whitney attempted to incorporate some features of a university science environment into the laboratory by holding regular colloquia for the staff and permitting principal members such as Irving Langmuir to publish research findings that lacked immediate commercial value or were protected by patent applications. A national economic crisis that began in 1907 threatened the viability of the laboratory and stimulated Whitney to make significant changes that included devoting more of his energies to research management and less to his own research. He took advantage of a successful effort to produce ductile tungsten at the laboratory to direct research into areas other than lamp improvement, such as electronics and radio. Whitney employed a highly personalized approach to research management by informal and daily tours of the laboratory. He generally controlled the direction of major research efforts through negotiation with his principal associates.

One of Wise's more interesting insights is his classification of styles of management as "exothermic" or "endothermic." He finds that Whitney exemplified the exothermic style in that he sought to energize and inspire others instead of absorbing energy from them to apply to his own investigations. Wise argues that the exothermic style worked well in the early years at the laboratory but became outdated by the 1920's, when endothermic management as exemplified by such men as William D. Coolidge, Whitney's successor as director, became the norm. Wise also believes that Whitney became too conservative during the later years of his tenure and failed to provide leadership into promising areas of research. Whitney's conviction that industrial research would provide GE with insurance against economic disruption proved incorrect with the advent of the Great Depression. His health deteriorated along with the economy, and he stepped down as head of the laboratory in 1932. The same year Irving Langmuir became the first industrial research scientist to receive a Nobel prize.

Reich at the beginning of his book characterizes industrial research as being conducted in laboratories that are separated from production facilities and kept "somewhat insulated from immediate demands yet responsive to long-term company needs" (p. 3). This definition effectively excludes all 19th-century as well as many 20th-century facilities from being considered true industrial research laboratories. Reich does, however, give a careful review of 19th-century developments in science and industry that set the stage for the creation of the two laboratory centers considered in detail in the remainder of the book. Reich devotes three chapters to the early history of GE and to the Research Laboratory, telling a story that agrees generally with that of Wise but places greater emphasis on the role of patents and how the laboratory's activities related to developments elsewhere.

Reich then turns to the early history of the Bell Company and the changes that resulted in the formation of its Research Branch in 1911. Especially provocative is his interpretation of the major reorganization in 1907, when control of the firm passed from Bostonian to New York financiers, the latter led by J. P. Morgan. It was the new management brought in at that time, including Theodore Vail and John Carty, that decided to organize and support the new Research Branch. Reich contrasts the interest and support of top management for the laboratory at Bell with the situation at GE, where the Research Laboratory tended to receive benign neglect from the top.

In a chapter on the research process at AT&T, Reich introduces a sophisticated model of research and development that includes scientific theory, invention, technological theory, and design methodology. He finds that it is almost impossible to distinguish between scientific and technological activity within the industrial research laboratory. He also concludes that distinctions between pure science and applied science are not very useful, at least in historical analysis of such laboratories as those treated in this study. Reich stresses the importance of technological theories that are formulated for the analysis of devices to the understanding of the research process. He points out that these theories could rarely be patented but could be converted into design methodologies and used to cope with complex technical systems. Also a technological theory frequently would stimulate numerous inventions that were patentable. Reich illustrates the usefulness of the concept of technological theory by a careful examination of early vacuum-tube amplifier research conducted at the Bell Research Branch during the period from 1912 to 1920.

In his final chapter, Reich discusses the impact of industrial research in the United States and includes data on the dramatic growth in the number of laboratories and industrial researchers since the 1920's. He finds that the influence of the GE and Bell laboratories was quite important even if later laboratories seldom if ever followed the same pattern. He concludes that "successful industrial research involves every part of a company's organization and that research has to be tailored to corporate structure and needs" (p. 257). Although neither Reich nor Wise claims that these two well-known laboratories necessarily provide an ideal model for an industrial research laboratory, they have furnished excellent models for historical case studies of other such institutions.

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The Disposal of Nuclear Waste

Geology and Radwaste. A. G. MILNES. Academic Press, Orlando, FL, 1985. xvi, 328 pp., illus. $60; paper, $39.95. Academic Press Geology Series.

Milnes describes this book as "a personal digest of the enormous volume of literature which has appeared on the subject of geology and radioactive wastes in recent years."