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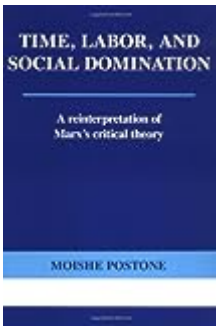

Louis Galambos, Jane E. Sewell. *Networks of Innovation: Vaccine Development at Merck, Sharp & Dohme, and Mulford, 1895-1995.* New York: Cambridge University Press, 1995. xi + 273 pp. $39.95 (cloth), ISBN 978-0-521-56540-0.

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This book was initially commissioned as a private document to be used internally by Merck Corporation. Sensing a broader appeal and more general significance, Galambos and Sewell subsequently received permission to publish an expanded history. *Networks of Innovation* presents the thesis that vaccine producers, and other R&D driven enterprises, require the capability to interact with the broader scientific community in order to obtain ideas and to recruit requisite personnel. Also, they must be able to interact with government to anticipate, and to possibly help shape, regulatory and legal climates, as well as to profit from marketing and funding opportunities. The use of the word "innovation" in the title suggests a Schumpetarian perspective, and indeed the authors make the case that to gain necessary access to networks, a firm needs a very rare person or entity at the helm; one that combines entrepreneurial talent with scientific eminence.

Health care in the United States is a trillion dollar industry. However, in terms of dollar sales, prescription drugs are a small part of that industry, amounting to about 87 billion dollars in 1997, and vaccines and related biologicals constitute a small fraction of the sales, and a smaller fraction of the profits of the prescription drug industry. Galambos relates that Merck is the leading producer of vaccines in the United States and that in 1989 its sales of $360 million came to 21 percent of the world total. In that year, Merck had at least two blockbuster drugs–Vasotec for treating hypertension, and Mevacor for lowering blood cholesterol levels–each of which produced sales exceeding, and profits vastly exceeding, that of the vaccine division. It would have been unusual for a business historian with the accomplishments and reputation of Galambos to write a company history. That he chose to write, along with medical historian Sewell, a history a single division of a company is intriguing.

The book outlines the development of the capability to produce vaccines and related biologicals at one firm, Merck, and at its relevant antecedent firms. In the 1890s, H. K. Mulford, a relatively new, and not particularly large, pharmaceutical company became the first U.S. firm to commercially produce diphtheria antitoxin. Early in this century, Mulford attained a leadership position in the production of vaccines and serums, and despite becoming a strikingly less innovative firm after World War I, remained a leader in the marketplace. In 1929, Sharp & Dohme, with marketing skills but possessing only a standard catalogue of traditional medications, recognized that the pharmaceutical industry was becoming research driven and that it had to restructure to survive. The purchase in 1929 of Mulford and its biological laboratories constituted a key element in that restructuring. In 1953,

Merck acquired Sharpe & Dohme through merger. It was the complementarity of traditional strengths–Merck upstream in research and manufacture of fine chemicals and Sharpe & Dohme downstream in dosage delivery and distribution–that provided synergy. The biological laboratories came with the deal, but were hardly central to it. Merck reinvigorated the laboratories and, after making significant contributions to the development of flu and polio vaccines, played a leading role in developing vaccines against measles, mumps, rubella, pneumonia, meningitis, and hepatitis.

These accomplishments would be notable even if spread out over the hundred years that the laboratories have been in existence, but Galambos and Sewell emphasize that they occurred during four relatively brief waves of innovation. The first wave began when Mulford entered the business. The other three at Merck each followed a critical decision whether to fish or cut bait; whether to invest in a fundamentally different technology, or phase out vaccine production. In investigating the decision process at Mulford, the authors tapped corporate archival records and also utilized secondary sources to illuminate why Mulford, rather than some other firm, became the commercial leader in producing biologicals. With Merck, the authors not only had access to rich archival materials, but were able to interview key players. The breadth of secondary materials utilized remains impressive, involving the medical literature as well as that of business and economics, but the story focuses more narrowly on Merck with little attention to the situation elsewhere.

When sticking to the central thesis, this is a most impressive work. It contains a brilliant portrait of Maurice Hilleman, the pivotal figure in vaccine development at Merck. It provides clear insight into the choices open to Merck at critical junctures, and it shows why certain paths were taken and alternatives forsworn. The critical centrality of access to networks is clearly demonstrated, as is the personal as opposed to institutional basis of that access.

However, when Galambos and Sewell assess the failure or success of a corporate policy, or berate the wisdom of a government regulation, one would have hoped for a broader comparative basis for their assertions. For instance, Sharpe & Dohme devoted few resources to its biological laboratories and developed little in the way of new vaccines, although it continued to sell the line established by Mulford. Galambos and Sewell view this as a failure, but absent knowing the alternatives, or at least how other firms responded to the environment, how can one assume that the policy was anything other than rational? Particularly striking with regard to ignoring comparative work is the absence of reference to *Taking Your Medicine: Drug Regulation in the United States* (1980), in which Peter Temin provides broad industry perspective to such issues as the relationship between corporations and research scientists, the temporal flow of research opportunities, and the rationale behind government regulation.

Poor prospects for profit from vaccine research has led many firms, including Lilly and Pfizer, to abandon the business. Patents are hard to come by, and the risks from law suits loom large. Most of the product is purchased by governments and international agencies who exercise monopsony power. Most of the profit comes from the small part of the U.S. market, and the smaller part of the European market in private hands. Huge quantities of vaccine are consumed in less developed countries, but, in a business where price and average cost can be orders of magnitude higher than marginal cost, that external market yields a markedly lower price. Merck stays in the business in part because exiting would produce bad publicity.

Measured by sales, and even more by profits, abandonment of the vaccine business would have no perceptible impact on the size of the health care industry or even pharmaceuticals. Look again at the list of vaccines developed just by Merck–the contribution to world health status is far from trivial and is clearly out of proportion to the volume of sales. Galambos suggests that what is good for Merck is good for everyone. Make patents easier to obtain, lawsuits harder to pursue, and above all, maximize the share of vaccine distributed through for-profit channels. Given the potential social rewards from new vaccines, that suggestion may well be better than the status quo. However, greater rewards for innovation combined with extremely broad product distribution, a combination requiring greater, not lesser, government involvement, might be better yet.

This book deserves a broad audience. It is superb at showing the requisites for successful vaccine innovation. It provides outside observers rare insight into decision-making processes at a leading pharmaceutical firm. Its views on public policy may be more open to question, but do deal with important issues.

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