

review of Makers of the Microchip: A Documentary History of Fairchild Semiconductor, by Christophe Lécuyer and David C. Brock

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Review by: Cyrus C. M. Mody

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environmental hormone disruptors—namely, that epistemological differences in data interpretation have hindered government efforts to regulate the chemical and pharmaceutical industries, because neither experimental studies in laboratory animals nor epidemiological correlations in humans have been able to provide direct evidence, or a “smoking gun,” to link reproductive failure undeniably to chemical exposure. Langston argues that industry has been successful in staving off federal regulation by using the uncertainty inherent in scientific risk assessment to lobby for liberal interpretations of data on toxicity and safety.

Toxic Bodies begins its historical account in the early twentieth century, with the establishment of the use of chemical pesticides in agriculture. This background sets the stage for the appearance of DES in 1938 and its approval by the Food and Drug Administration (FDA) in 1941, in spite of scientists’ concerns about the carcinogenicity of exogenous estrogens. In a series of well-written and well-informed chapters, Langston presents the chronicle of the use of DES by menopausal women (to treat symptoms such as hot flashes), by pregnant women (in an effort to prevent miscarriage), as implants in poultry (to fatten birds more quickly, so they consumed less grain for feed before being slaughtered), and as additives to cattle feed (also to promote animal growth) from 1941 until 1972, when the FDA issued a warning against its use by pregnant women (DES was linked to a rare form of vaginal cancer in the daughters of women who had taken the drug) and called for its removal from cattle feed (because of persistently high estrogen residues found in meat). In each of these cases, Langston shows how the absence of evidence to prove that DES was unsafe was turned around and used as evidence to judge it to be safe. The last third of the book looks at the more recent history of endocrine disruption. Langston follows the specific examples of the use of steroids in beef and bisphenol A in plastics—both of which have estrogenic effects that can lead to reproductive problems in animals and humans—to demonstrate how risk assessment was manipulated by lobbyists who employed technological elites to interpret data, thus replicating the format of the debates over DES earlier in the century.

Langston argues that important lessons must be learned from the DES story. First, the parallels between DES and other endocrine disruptors lay bare the importance of acknowledging the significance of animal experiments for human health, the porosity of boundaries between the natural and the synthetic, the risks of low

levels of exposure to chemicals, and the influence of the environment on the developing fetus. Second, and more generally, DES reveals the danger of using scientific uncertainty to justify regulatory inaction. Industry-sponsored research was designed to communicate controversy and contributed to the failure of the FDA to regulate the use of DES appropriately. Finally, progress must not be allowed to trump precaution; enthusiasm for medical and agricultural application of technologies must be tempered by regulations to protect public health and the environment. Langston wields history as a tool for advocacy, and she encourages fellow scholars to provide counternarratives to those told by powerful industries. *Toxic Bodies* is an inspiring call to action for historians, but it should also be read by scientists, policy makers, and anyone interested in the precarious state of health and the environment.

ELIZABETH SIEGEL WATKINS

Christophe Lécuyer; David C. Brock. *Makers of the Microchip: A Documentary History of Fairchild Semiconductor.* Foreword by **Jay Last.** xi + 368 pp., illus., bibl., index. Cambridge, Mass./London: MIT Press, 2010. \$23, £17.95 (cloth).

In autumn 1957, eight young employees of Shockley Semiconductor, irritated by William Shockley’s maddening personality and poor management, quit together to market their group expertise in transistor manufacturing. Through a New York investment bank, Hayden Stone, they contacted a Long Island conglomerate, Fairchild Camera and Instrument, which bankrolled them to found a California subsidiary, Fairchild Semiconductor. Within a few years Fairchild led its industry, thanks to innovations such as the planar transistor and integrated circuit. In the 1960s Fairchild employees (including its founders) replicated the secession from Shockley and formed a dazzling array of spin-off companies. These “Fairchildren” form the backbone of today’s microelectronics and venture capital industries and play important roles in sectors such as biotech, computer hardware and software, e-commerce, and entertainment.

That story has been told before, notably in Christophe Lécuyer’s *Making Silicon Valley* (MIT, 2006), Ross Bassett’s *To the Digital Age* (Hopkins, 2002), and Michael Riordan and Lillian Hoddeson’s *Crystal Fire* (Norton, 1997). Because the Fairchildren helped create so many corners of the modern world, many historians (not just of science and technology) need re-

sources relating to this remarkable company. Moreover, because of its colorful and world-changing characters, the Fairchild story lends itself to classroom discussion of many issues: corporate strategy, the relationship of research and development in high tech, regional industrial specialization, the economic role of universities, high-tech migration, the emergence of Asian Tiger economies, the intertwining of counterculture and innovation, and more.

To aid historical research and pedagogy, Lécuyer and David Brock have assembled some notable primary sources from Fairchild Semiconductor's early years, with accompanying essays. The central source in this "documentary history" is a notebook in which one of Fairchild's founders, Jay Last, recorded points from staff meetings. Together, facsimiles from pages of the notebook, Lécuyer and Brock's interpretive essays, and Last's foreword walk readers through both the mundane and the momentous steps in establishing a successful high-tech manufacturing enterprise.

Lécuyer and Brock's essays are light on overt theory, though (as they note) the selection of documents makes an argument in itself. Their main analytic contribution is to highlight three "logics" governing Fairchild's early corporate strategy: silicon logic, user logic, and competitive logic. In choosing to stick with silicon, Fairchild operated under both the constraints and the possibilities that came to be associated with that material. The choice of silicon co-evolved with the Fairchild founders' decision to target both military customers (requiring reliability and speed) and consumer markets (requiring low price). The choice of markets co-evolved, in turn, with Fairchild's need to surpass (and cherry-pick from) competing firms. The complex interlocking of those three logics is revealed nicely in the selected documents.

Other aspects of Fairchild, however, are left mysterious. For instance, the authors describe Fairchild's founders as wanting to give themselves maximum "speed and flexibility" in making decisions about new products and manufacturing processes (p. 16). They also, however, describe the Fairchild leadership as selecting "the best and most promising techniques for the long run" (p. 19; emphasis in original). Those strategies aren't mutually exclusive, but they are in tension. Yet Lécuyer and Brock don't examine that tension, even though it informs one of the book's critical episodes: Jean Hoerni's many months' delay between conceiving the planar transistor and persuading Fairchild's other founders to adopt his idea.

Here, and in a few other places, readers are

left to connect the dots (correctly or otherwise) with little help from the authors or from Last's difficult-to-decipher notes. That might be a failing if *Makers of the Microchip* were a traditional monograph, arguing with other monographs about Fairchild's early innovations and corporate strategy. But for a documentary history such gaps work well in eliciting readers' active engagement with a compelling set of primary sources.

CYRUS C. M. MODY

Philip Mirowski. *Science-Mart: Privatizing American Science*. 454 pp., figs., tables, bibl., index. Cambridge, Mass./London: Harvard University Press, 2010. \$39.95.

This book aspires to be nothing less than the *Das Kapital* of today's neoliberal political economy of science. It will probably be another generation before we can tell whether Philip Mirowski has succeeded, but certainly the two books (if we treat Marx's three volumes as one book) share many features: a central provocative thesis that is banged home in countless ways, with both theoretical and empirical arguments, and in a style that is never far from satirizing that of which it speaks. Whereas science studies often achieves comic effect by demonstrating that science is neither quite as good nor quite as bad as people think, Mirowski repays the compliment by showing that scientists, politicians, businesspeople, and, indeed, science studies scholars do not differ as much from each other as they might like to think. They are all "always already" neoliberal.

That the post-Cold War political economy of science is neoliberal is hardly news. However, Mirowski places the stress on the "neo": neoliberalism is liberalism mugged by history. Classical liberals dreamt of a time when free individuals could realize their potential once unshackled from the bonds of tradition. In practice, however, these dreams resulted in the French Revolution, the failed revolutions of 1848, and ultimately the Russian Revolution. The movement now called neoliberalism gained momentum in reaction to these events, starting with the Ultramontanist political theorist Joseph de Maistre and culminating in the Austrian school of economics, whose twentieth-century leaders Ludwig Mises and Friedrich Hayek helped to found the Mont Pelerin Society, where the doctrines discussed in this book were forged.

Unlike classical liberals, neoliberals actually distrust human judgment that ventures beyond the normal precincts of life from which markets