

Budget appropriations between the wars stimulated the development of new armaments and the building of the air force. In the 1930s Britain had the biggest arms-producing military-industrial complex in the world and became its largest exporter of arms. By the late 1930s its air force was highly developed, with a sophisticated array of aircraft, and it had acquired the jet engine. All this came from government and corporate laboratories and workshops. This process expanded during World War II and continued in its aftermath. This course did not alter until after Britain developed its own nuclear arsenal, rockets, jet fighters, and bombers. At the end of the 1950s the warfare state declined as Britain became dependent on the United States for its weaponry. Harold Wilson pinned the slow economic development of Britain on the lack of investment in R&D by previous Conservative governments. With his administration came the establishment of the short-lived Ministry of Technology.

Edgerton's exploration of the conventional historiography of Britain locates its origins in the needs of left-leaning intellectuals, including the historians A. J. P. Taylor, Peter Kennedy, Perry Anderson, and others who denied or ignored the British warfare state. Their image was of a welfare state, its armed services mired in conservative humbug and its pacifist governments unprepared for the coming onslaught. These assumptions were shared by scientist-commentators such as J. D. Bernal, Patrick Blackett, Henry Tizard, and C. P. Snow. Snow went further, making explicit the intellectual superiority of the sciences in his "Two Cultures" lecture of 1959. These scientists all contended that in World War II the R&D of imported academics was crucial. Britain in decline fitted the needs of these writers as well as those of various technocrats who argued there was not enough support for technological development and the military. The only intellectual with any insight into the state was E. P. Thompson. Edgerton also demonstrates that during World War II academics had little impact on the R&D efforts, the conduct of the war, or the development of weaponry. Power lay in the ministries, especially the Ministry of Supply, and hence was wielded by career civil servants and appointees from corporations. Academics overestimated the value of their own work and its efficacy, ignoring the R&D work of the civil service, the military, and corporations before and during the war. The "declinist" vision of twentieth-century Britain was challenged only in the 1980s—by, I might add, the first generation of historians that were not born into the shadow of World War II.

Edgerton's analysis has serious implications for the history of science and technology of twentieth-century Britain and the United States. He maintains that there is too much emphasis on academic science, which in terms of government monies occupies a minuscule percentage of its R&D budget. Most of these funds are channeled into government laboratories and contracts with corporations. While Edgerton sees the history of science of twentieth-century America after World War II as a useful model, he also notes its emphasis on academic research. The shape of the history of science and technology would change dramatically if we follow the money and focus on the labors of the majority of the R&D workforce rather than marginalizing them. Without such histories we will never understand the relationships between governments, scientists, and engineers or the place of science and technology in the politics and economics of the twentieth century.

Edgerton is apt to create and overuse terms like "anti-history" and "declinist," and there are some issues he does not address. What now are the meanings of the actions of British governments of the 1930s formerly labeled as pacifist? And why, in the summer of 1940, were the magnetron and details of academic work on the possibility of an atomic bomb so liberally given to the Americans? The British continued with their own radar development work throughout World War II and beyond and developed their own atomic devices. Edgerton also does not explore the ways in which the declinist image of Britain was useful for the Roosevelt and later administrations in World War II and the Cold War.

ELIZABETH GARBER

David Gugerli; Patrick Kupper; Daniel Speich. *Die Zukunftsmaschine: Konjunkturen der ETH Zürich 1855–2005*. 524 pp., app., bibl., index. Zurich: Chronos, 2005. €44.80 (cloth).

This is one of several publications connected to the 150th anniversary of the famous Swiss federal polytechnic, the Eidgenössische Technische Hochschule (ETH). (See also Werner Oechslin, ed., *Hochschulstadt Zürich: Bauten für die ETH 1855–2005* [Zurich, 2005]; Monika Burri and Andrea Westermann, eds., *ETHistory 1855–2005: Sightseeing durch 150 Jahre ETH Zürich* [Baden, 2005]; and the Web page www.ethistory-ethz.ch.) What distinguishes this volume from its companions—and from many other typical university histories, for that matter—is its critical

distance on the actors and events it treats. Nor is it a documentary compendium treating the school's seventeen-hundred-plus past professors and sixty-four thousand graduates. Rather, it scrutinizes the rhetoric that surrounds such celebrations, maintaining a sometimes surprising distance with regard to its subject—and this despite the fact that all three coauthors teach history of science and technology at the institution (which, incidentally, ranks among the ten best technical universities in the world).

The ironic tone taken toward university jubilees begins with the title. It takes up a favorite term in speeches held on earlier occasions, the ETH's 75th and 100th anniversaries. Initially—in the context of a patriotic institution founded only shortly after the creation of the Swiss confederacy itself, in 1848—"Zukunftsmaschine" meant a generator of a future; eighty years later, it meant a tool for securing a future in the "service of the community." For the 150th jubilee year, 2005, its purpose was once again redefined: this time as a think-tank, a deviser of scenarios, and an anticipator of future challenges. The authors focus on "Konjunkturen," defined by Hans-Jörg Rheinberger as "unforeseeable events in the development of experimental systems, which lead to solutions to issues that had not even been considered problems requiring resolution" (p. 413). The somewhat postmodern selection of themes and the heavy load of contextual information, often wandering well away from the main topic, make the search for particular subjects in the book rather difficult. There is a name and location index, but a subject index would have been helpful.

The book is rigidly structured in temporal slices. The six chapters (demarcated by blue borders at the bottom of the page, in telephone-book style) cover the following periods: from 1848 to 1855 (documenting the intense debates in the Swiss parliament and diet pertaining to the school's founding and other early issues); 1855 to the end of the nineteenth century (with a focus on the discussions about the polytechnic's curriculum and goals); 1905–1910 (on the reorientation of the polytechnic, in particular; renamed the Eidgenössische Technische Hochschule in 1908, it was finally granted the right to confer doctorates); 1911 to the early 1960s (the chapter title, "Between Economy, Politics, and Science: New Cooperations in the Twentieth Century," takes up Herbert Mehrrens's concept of "Kooperationsverhältnisse"); the ten years following the student revolts in 1968, which saw experiments in university policy; and, finally, the "postindustrial" era after 1975, with science

management and "flexibility as an agenda." The inclusion of this recent history is particularly noteworthy. The overall historiographic approach in this section, filling 150 pages—a third of the book—will certainly serve as a model for future studies on universities during this period. More than a hundred well-chosen (but not always well-printed) illustrations document student life, new laboratories, buildings and campus maps, and, notably, cartoons from newspapers and teach-in posters from 1971. Colorful diagrams summarize statistics on the development of the student body and its origins (often over 25 percent were foreigners) and the professoriate (more than 50 percent of the faculty came from abroad both during the founding years from 1855 to the 1870s and in the years since 1997; see p. 238).

My compliments to the authors for having avoided the pitfalls of in-house history and to the ETH directorate for having generously financed such a well-researched study.

KLAUS HENTSCHEL

Frederic Lawrence Holmes. *Reconceiving the Gene: Seymour Benzer's Adventures in Phage Genetics.* Edited by **William C. Summers.** xiv + 334 pp., figs., index. New Haven, Conn.: Yale University Press, 2006. \$50 (cloth).

In 2000, the History of Science Society awarded Larry Holmes the Sarton Medal, its highest honor. The award recognized Holmes's unique approach to scientific discovery through meticulous, detailed documentation and analysis of what he called the "investigative pathways" of individual researchers. Holmes was driven by curiosity about how the creative scientific process of discovery works. He selected individuals who kept meticulous records and were accurate recorders and, therefore, whose paths he could follow in detail. In his last projects, Holmes studied living scientists who worked with him to help interpret their records, apparently without interfering with the interpretive process and without trying to reconstruct or "correct" the record. Holmes was a genius in selecting his subjects.

Reconceiving the Gene looks at the scientific work of Seymour Benzer, who was trained as a physicist and then worked at the intersection of genetics and molecular biology. Benzer followed promising methods, experimental systems, and questions, learning as he interacted with stimulating people, labs, ideas, and practices. They led him to the fine structure of phage molecular DNA, just as Benzer led Holmes to the fine