A Case Study in Patronage

A Fragile Power. Scientists and the State. CHANDRA MUKERJI. Princeton University Press, Princeton, NJ, 1990. xiv, 253 pp. $24.95.

Chandra Mukerji, a sociologist at the University of California at San Diego, set out to study how technological innovation shaped the work worlds of her colleagues at the Scripps Institution of Oceanography. She found that this issue was of little interest to the ocean scientists she was interviewing. Despite their dependence on instruments and techniques, they were much more concerned with their scientific identities, with the character and reception of their research, and with raising the funds needed to sustain their investigations and reputations. She ended up focusing on the relationship between contemporary American scientists and their federal patrons.

Although this shift in orientation broadened her purview, Mukerji decided that her ongoing study of the oceanographers could shed much light on the scientists' relationship to the state. Oceanography is a particularly promising research site because the federal government provides much of its funding—for example, in 1986, 1900 university and college oceanographers averaged $145,000 per capita while 15,900 physicists and astronomers averaged $45,000. In fact, many academic ocean scientists depend upon federal funding for large fractions of their salaries. Hence, Mukerji argues, oceanography is an extreme case that highlights the principal features of the soft-money system that nurtures so much contemporary science. Following out this logic, she concentrated in her interviewing on scientists working in two expensive deep-ocean specialties—research related to seabed disposal of nuclear wastes, a field that was killed in 1986 when the Department of Energy finally abandoned it, and research on the geology and ecology of hydrothermal vents. She also analyzed several of the tapes made during exploration of the vents with the submersible *Alvin*.

Relying heavily on her interviews and the tapes for examples, Mukerji advances a provocative, and for the most part persuasive, picture of the symbiotic relationship between scientists and the state in contemporary America. In her view, no more than a minuscule fraction of federal patronage for science is motivated by curiosity about nature. Rather, the federal bureaucracies—in particular, NSF, NIH, and mission-oriented agencies and departments (such as NASA, DOE, and especially DOD)—fund academic scientists as a means of sustaining a cooperative reserve labor force of elite specialists who collectively possess the expertise and status needed to serve and legitimate the state's practical policies. In exchange for keeping their side of the bargain, funded scientists are provided with the wherewithal for their research. They do not, however, share the state's utilitarian orientation toward nature. Hence they are constantly seeking to maximize their control of the intellectual life of science. So long as they continue acquiring and refining what the bureaucrats regard as useful instruments and techniques, they are likely to enjoy substantial success. Indeed, their quest after autonomy is in itself useful, for it lends credibility and authority to their expert counsel. Mukerji's conclusion, therefore, is that federally funded academic scientists have paid dearly for their support and the considerable intellectual freedom in thinking about nature that has accompanied it—they have traded away control of the politically powerful voice of science.

In the course of her main argument, Mukerji develops many interesting auxiliary concepts and themes. My favorite is the idea that successful principal investigators and their laboratories have distinctive identities or "signatures" constituted by the unique, steadily evolving sets of tools that they use for expanding the domain of science. It is a straightforward extrapolation of this idea to suggest that specialties and disciplines also have signatures. I find the extended idea particularly congenial in the present context.

The typical historian would have gone about investigating oceanography as a case study in the relationship of scientists and the state in a very different way from that taken by Mukerji the sociologist. While the historian would have relied primarily on documents and publications for evidence, Mukerji relies primarily on interviews and the *Alvin* tapes. While the historian would have used the recent work on postwar science of Paul Forman, Daniel Kevles, Robert Seidel, Joan Bromberg, David DeVorkin, Robert Smith, and others to depict the historical context, Mukerji draws upon an older literature. While the historian would have recounted the case histories in some detail, Mukerji leaves the reader largely in the dark about the scientists involved, their institutional affiliations and patrons, the evolution of their instruments and techniques, and turning points in the research. But, while the historian would have provided a more textured and satisfying account of oceanography in the last two decades, Mukerji has been more systematic and daring in her exploration of the workings of soft-money science in contemporary America.

KARL HUFBAUER
Department of History, University of California, Irvine, CA 92717

Transformations in Physics

The Restructuring of Physical Science in Europe and the United States, 1945–1960. MICHELANGELO DE MARIA, MARIO GRILLI, and FABIO SEBASTIANI, Eds. World Scientific, Teaneck, NJ, 1989. xiv, 813 pp., illus. $86. From a conference, Rome, Italy, Sept. 1988.

As events in Europe signal a new turning point, historians are grappling with the impact of World War II upon culture and society. In few areas of human activity is this impact more controversial than in science. Physicists who have lived through the period and their younger colleagues who seek redefinition of their enterprise have become active participants in this struggle to understand what happened to their discipline as a result of its involvement in the war. In September 1988, the physics department at the University of Rome organized a conference on the restructuring of the physical sciences after World War II. Historians and physicists were invited from the United States, Japan, the Soviet Union, and Western Europe to comment upon the evolution of physics and astronomy after the war. Their papers are reproduced here much as they were given. One must sort out the dross without much assistance from the editors, who neither reproduce the discussions occurring at the conference nor provide guidance in their introduction.

The first set of papers deals with where the action was: with the transformation of physics in the United States after the war. Historian Daniel Kevles reflects in his paper that the postwar diversification of science was fed by and integrated with the technological demands of national security. This was especially true after the Korean War "generated a pervasive psychology of permanent mobilization" in American society. Lillian Hoddeson, who has recently written an as-yet-unpublished history of wartime Los Alamos, contends in her paper that the development of the implosion process for the atomic bomb there became the model for the research style of big science after the war. The first claim is unexceptionable; the second is not supported by an analysis of the research style in peacetime laboratories.

Other social scientists see the postwar