

frantic national site competition, when it met the federal government and its accelerator on the prairies of Illinois. The scientists wanted this accelerator in a reasonably convenient place and the state and local county governments, organized interest groups and later the federal government wanted it in Illinois, even if the project would not necessarily further other national goals, such as the advancement of civil rights in terms of open occupancy, desegregation and job opportunities for black people in the Chicago metropolitan area.

In part II the working-class/sometime farmer culture and the emerging middle-class culture of the accelerator site area, as well as the impact that the accelerator had on the people involved, are examined. If the AEC and the scientists are the villains of part I, DuPage County and the Illinois Department of Business and Economic Development are the heavies in this section of the book. The newly formed DBED seemed determined to show the federal government, and incidentally everyone else, how effective it could be even at the expense of a few villagers and farmers. In an attempt to show this over-zealousness the authors get bogged down in the politics of land acquisition and the idiosyncrasies of DuPage County beyond what is necessary to make their point. Lowi and Ginsberg deem the taking of the citizens' land and buildings and the destruction of the web of social relationships at the site to be nothing less than "conquest." But one still wonders, even given the evidence, how many of those affected were indifferent to it all. Moreover, others might attribute the aggressiveness of the DBED to the peculiar nature of the tournament-like competition in this case and thus the need for speedy action on the part of the contenders, rather than to some general property of government officials or their departments.

Lowi and Ginsberg conclude that from the standpoint of good government the accelerator project was a failure. They take this critical stance not only because of the results of what appeared to them to be an intentional policy of ignorance about the impact of the accelerator on its environment and ignorance of the policy perspectives and motives of other actors by any one actor (for example, the federal government remained ignorant of the DuPage County Government's original plans for the site area), but also because scientists were unable to show how the project met some set of stated overall national policy objectives. The authors are greatly disillusioned by the scientists, who value knowledge highly but chose in this case to be ignorant, and they conclude that the scientific community constitutes just another special-interest group and thus a potential social problem.

All actors and levels of government are seen as culpable, but the federal govern-

ment is singled out for blame because it funded the project without producing guidelines or standards of behavior that, if observed, would lead to fulfilling national objectives. Lowi and Ginsberg prescribe that any further science (or other) public works projects require "... a recognition of the variations in goals and perspectives among the intervening levels of government, and makes absolutely necessary some kind of continuous central planning (pre-audit) and a never-ending supervisory process (post-audit)." We all know that it is exceedingly difficult to operationalize prescriptions like these, but one is encouraged that it can be accomplished by a national government for a large, one-of-a-kind, technological project if it has the will to do so, such as the recent inquiry on the Mackenzie Valley Pipeline in Canada demonstrates. (See D. J. Gamble, *Science*, 199, 946 (1978). The proposed pipeline would run through more than one subnational jurisdiction so the analogy is imperfect.)

As a work of social science there are problems with this book. The authors often confuse and contradict what is known about what social scientists have come to call "artificial" and "natural" systems. These are seldom, if ever, congruent. The book does not disclose newly discovered regularities to speak of in the political process, but illuminates some that are already known. It does reacquaint the reader in a detailed and scholarly way with the painful fact that political processes in the United States—allowed a free rein in this case by the scientific community once the commitment to build the accelerator *some-where* had been made—are often inadequate for the high standards we set for government. This is especially so in the decision-making arena of public works, where log-rolling, inconsistencies in standards, and budget irresponsibility are often a way of life.

Scientists and others will find many things to disagree with in this book. But it will tweak a thoughtful reader's moral sensibilities. This book should be read by students in courses on "science and society." Persons who have been or are now involved in any way with the accelerator at Batavia should read it. Researchers, research administrators, science writers, policy analysts, politicians and government officials should read it. Reflecting on this case I wonder if they would then resolve that scientific-political decision-making will "... never quite be the same again?"

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The Chemical Physics of Surfaces

S. R. Morrison

415 pp. Plenum, New York, 1977. \$39.50

The science of solid surfaces is concerned with problems ranging from the basic physics of perfect crystal faces to the complicated chemistry of industrial catalysts. The field has grown rapidly over the last ten to fifteen years, attracting scientists from traditional areas such as solid-state physics, physical chemistry and metallurgy; special experimental techniques have been developed and a variety of theoretical models are being explored. An interdisciplinary approach to the subject is almost a necessity because a reasonably complete understanding of a particular surface phenomenon may require information regarding the electronic structure and crystallography of the surface together with result for diffusion rates, chemical bonding and reaction kinetics. The synthesis of these elements must be done in spite of difficulties in the exchange of data and ideas between the different areas.

Roy Morrison, the author of *The Chemical Physics of Surfaces*, is fully aware of this situation. He has been active in surface research for many years and is particularly well known for his work on the electrochemistry of semiconductor surfaces. In the preface Morrison writes that in preparing the book he had in mind "the mature surface chemist who wants to become more familiar with recent developments in surface physics, and the mature surface physicist who wants to become more familiar with the chemistry occurring on his sample surfaces." The writing probably favors the chemists, but both groups should find this an interesting and useful book.

After introducing some of the important concepts specific to surfaces (such as surface states, surface sites, chemisorption and space charge), Morrison devotes chapters to experimental methods, clean surfaces, surfaces with adsorbates and additives of various types, the solid-liquid interface, photoeffects and heterogeneous catalysis. He emphasizes semiconductor surfaces throughout, but not to the exclusion of metals and insulators, and in less than 400 pages he succeeds in giving an overview of these topics. He does it by keeping the discussion qualitative, often in the form of short synopses of representative studies, and by including only a minimum of details about experimental and computational procedures.

For example, one finds brief discussions of a number of surface systems that have been characterized by Auger electron spectroscopy, low-energy electron diffraction, photoelectron spectroscopy and related methods. However, the book does not attempt a thorough treatment of

the techniques themselves; thus Auger electron spectroscopy is covered in a page and a half—just enough to remind the reader of the principles involved. As another example, in the chapter on heterogeneous catalysis, Morrison uses a summary of the oxidation of olefins on molybdena catalysts as a major illustration, but anyone interested in how the experiments were done and how the various conclusions were reached must go to the original sources. For this reason the author provides an unusually extensive bibliography; the book lists more than a thousand references, covering the literature through 1975. Incidentally, this bibliography would have been even more useful if the titles of the articles had been included.

Judging from a few spot checks the format can be very effective. For instance, I had occasion to look up the photolysis of water on a TiO_2 surface and quickly found an outline of the currently accepted mechanism and a couple of key references. Inevitably, however, there are omissions. In another check, involving the subject of surface-free energy and surface segregation, I found nothing at all.

Morrison's book is not easily categorized. It does not develop the material as methodically as one would want in a textbook; it is too selective to be a research review, and it contains too few "facts" to serve as a handbook. However, better than any other book I know of, it catalogs the ideas and concepts that occupy surface scientists at this time.

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The First Three Minutes: A Modern View of the Origin of the Universe

S. Weinberg
188 pp. Basic Books, New York, 1977.
\$8.95

Cosmology, in the words of Steven Weinberg, is a subject that has always been surrounded by "an aura of the disreputable." It is a daring leap into the unknown, a high-wire walk on a slender empirical thread. Yet it never fails to attract some of the finest minds of our profession.

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