The Star Wars Story

A Shield in Space? Technology, Politics, and the Strategic Defense Initiative. SANFORD LAKOFF and HERBERT F. YORK. University of California Press, Berkeley, 1989. xvi, 409 pp. $35. California Studies on Global Conflict and Cooperation, vol. 1.

The Strategic Defense Initiative's political fortunes are on the decline. Two years ago, while its progenitor Ronald Reagan was still in office, Congress dealt SDI the first of its cuts in inflation-adjusted funding. A larger reduction followed last year, despite the dazzle of "brilliant pebbles," the miniaturized space rocket concept put forward as the latest supposed SDI miracle weapon. This year, the parallel declines of the Soviet military threat and the U.S. defense budget are leading congressional sentiment toward much deeper SDI cutbacks, over the protestations of President Bush and Secretary of Defense Cheney, who continue to call for deployment of a nationwide missile defense as soon as possible. With the SDI budget facing such continued declines and with strong majorities of both houses of Congress continuing strongly to support the Anti-Ballistic Missile (ABM) Treaty's ban on all development, testing, and deployment of space-based missile defenses, the chances of any widespread missile defense actually being built appear slimmer than ever.

How did we get here? How did a technically uninformed president convince the public that it might be possible to create a defense so perfect as to render nuclear weapons "impotent and obsolete"? How did the United States come to spend some $20 billion on the program, without ever coming to a clear definition of its goal? What are the technologies involved, and what barriers do they face? What factors have fostered the growing consensus that maintaining the ABM Treaty would better serve U.S. security than abrogating it in order to build a first-phase SDI system?

The reader seeking an answer to these questions could find no better source than *A Shield in Space?* Lakoff and York provide a telling critique of the "illusory faith" that security can be achieved through all-out technological competition and a defense of the alternative path of negotiated restraint, symbolized by the ABM Treaty.

The book's sweep is particularly impressive, aptly combining Lakoff's political science expertise and York's extensive background in military technology. (Among other posts, York was Director of Defense Research and Engineering in the early 1960s, when the previous major research effort exploring space-based ABM rockets—brilliant pebbles's equally oddly named predecessor, BAMBI—was under way.) From the technology of space lasers to the strategic implications of a renewed race between missile defenses and offensive countermeasures, from SDI's origins to its impact on arms control, virtually every issue associated with the SDI program is cogently analyzed and placed in its historical context.

Even brilliant pebbles, which did not take center stage in the SDI program until after *A Shield in Space?* was completed, receives effective brief treatment. York and Lakoff point out that the costs and schedules put forward by advocates of these space rockets are wildly optimistic and that, like other missile defense concepts, such a system could be overcome by offensive countermeasures, which would then require new defensive measures, provoking new countermeasures in turn, "so long as those who are asked to pay the costs are gulled into believing there can be a last move in a technological arms race." Since the book's publication, that point has been confirmed by an SDI-commissioned report from the JASON group of independent scientists, which pointed out that fast-burning Soviet rockets and other countermeasures could greatly reduce the effectiveness of a brilliant pebbles defense and warned that the technologies of brilliant pebbles could also be applied to offensive weapons, creating maneuverable "brilliant reentry vehicles" that would be extremely difficult to intercept.

Unfortunately, however, the authors' efforts to leaven their critique of SDI with similar criticism of Soviet efforts lead them to overstate the magnitude of the (admittedly sizable) Soviet strategic defense program. Their assertion that the size of the program "has grown steadily, despite the ABM Treaty" is contradicted by public CIA testimony showing marked ups and downs in Soviet strategic defense spending, with the most recent figures noticeably below the peaks in the late 1960s and mid-1970s; their estimates of Soviet spending on ABM and air defense cannot be derived from the sources they cite and for air defense alone are nearly twice CIA estimates of total Soviet strategic defense spending; their judgment that Soviet development of an antisatellite weapon is evidence of their "readiness to exploit the loopholes in the ABM Treaty" is undermined by the fact that the system was already undergoing testing when the ABM Treaty was negotiated, without U.S. complaint, and by the system's slow attack approach, which would be of little use against a sudden ballistic missile attack.

Most surprisingly, by claiming that the CIA has predicted that the illegal Soviet radar near Krasnoyarsk "will provide battle-management support for a widespread ABM system" York and Lakoff essentially accept the charges of Star Warriors who have attempted to justify the abandonment of the ABM Treaty by warning that the Soviet Union itself is on the verge of creating a prohibited nationwide missile defense. In fact, though expressing concern over the possibility of such a widespread Soviet ABM, the CIA has never predicted that the Soviet Union would build one, much less that Krasnoyarsk would provide battle management for it. And there is overwhelming evidence that the never finished Krasnoyarsk facility was designed primarily as an early-warning radar and has little ABM battle-management potential. Oddly, Lakoff and York do not mention that construction at Krasnoyarsk was halted in 1987. (The Soviet pledge to dismantle the facility came in the fall of 1989, after *A Shield in Space?* was complete.)

Overall, however, *A Shield in Space?* clearly ranks among the most informative and penetrating analyses of the SDI program yet to reach print. Lakoff and York make an overwhelming case that "at this historic juncture in the cold war . . . it would be senseless and an act of gross irresponsibility to embark unilaterally on an effort to build space-based defenses." If only the President and Secretary of Defense would come to share that wisdom.

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A Scientific Ascent

Science in Germany. The Interaction of Institutional and Intellectual Issues. KATHRYN M. OLESKO, Ed. History of Science Society, Philadelphia, 1989. 313 pp., illus. $29; paper, $18. *Osiris*, vol. 3.

During the course of the 19th century Germany developed from a welter of essentially agrarian states whose scientific standing compared poorly to that of France or England to a unified empire whose scientific

enterprise provided a model of academic science that was to spread throughout the world.

There is much in this rise of German science that needs to be explained, and the study of the subject has undergone an efflorescence during the last two decades. The writings of such scholars as Joseph Ben-David, R. Steven Turner, Fritz Ringer, and Charles McClelland have shifted the focus of many observers from the cognitive development of the sciences to the institutional, social, and political contexts within which the enterprise was carried out. In the process, new and powerful analytical approaches have been framed and utilized, focusing on competition between the states, between university administrators, and between the professorial ranks; on the influence of state interests in promoting science for the purposes of modernization and industrialization; on the origins, rise, and effects of the "research ethic" both within and without the Germanic lands; and on the social organization of the universities, institutes, foundations, and research schools. But cognitive history of science has not been neglected. *Science in Germany*, focusing especially on teaching and research in the 19th- and early 20th-century universities, is an outstanding example of a genre that seeks to integrate the two historiographic traditions by depicting the symbiotic dynamism of cognitive and social factors.

Kathryn Olesko has assembled a fine cast of ten historians addressing as many topics under four rubrics: *Wissenschaft* and Reform, focusing on the early part of the 19th century; Science and Education, centered on Prussia and Hesse-Darmstadt, chiefly before 1866; Institutions and Scientific Creativity, concerned with the Imperial and Weimar periods; and Science and Political Institutions, dealing with electrification at the turn of the century and eugenics through the Third Reich. Olesko has written a useful historiographic introduction, and James Albisetti, Charles McClelland, and Steven Turner provide thoughtful commentaries at the conclusion of the volume. There is a good index (a rarity in a collection of this kind), the typography and production are excellent, and footnotes are found where they belong.

The character of the volume can be indicated by brief accounts of three papers that span its chronological and subject coverage. In "Kant, Schelling, and the administration of science in the romantic era" Frederick Gregory depicts the faculty recruitment choices made by state ministries in Baden (for the University of Heidelberg) and Prussia (for the University of Berlin) and how those choices were affected by both philosophical and political developments. Gregory's clear delineation of the Kantians' predilection for experimental science, as opposed to the commitment to intellectual intuition of the *Naturphilosophen* and their partisans, makes sense both of the political maneuvering by advocates of the two schools in the ministries and of the science pursued during this critical period.

Frederic L. Holmes provides a masterly treatment of the relation between teaching and research in Justus Liebig's laboratory at the University of Giessen up to around 1840, demonstrating that Liebig's teaching underwent remarkable shifts in response to the evolution in his research. Inter alia, Holmes argues that Liebig's laboratory institute and pedagogy developed only gradually, starting from a mere professional school for training pharmacy students and only in the late 1830s attaining the mature form for educating academic chemists that is so well attested. He also believes the impact of Liebig's potash-bulb apparatus for elemental organic analysis has been exaggerated—first and foremost by Liebig himself.

David Rowe discusses Felix Klein, David Hilbert, and the Göttingen mathematical tradition. Despite their different agendas and emphases, Klein and Hilbert transformed "the remote little town of Göttingen" into the future center of Weimar mathematics, while at the same time directing the field into a renewed focus on its general foundations and its applicability to modern physical science.

Gregory, Holmes, and Rowe all break important new scholarly ground; in fact, almost any of the ten papers in this collection might have been singled out for mention, for all are outstanding contributions. The volume is a model of its type.

Both Olesko and Turner draw attention to the explosion of scholarly interest in 19th-century German science. Research on the subject not only is more extensive and diverse, it has become more thoroughly founded on materials from hitherto little-used archival collections in both Germanies. Although Olesko rightly emphasizes the new historiographic directions, Turner—one of the protagonists in the changes—goes on to argue that there is nonetheless considerable continuity between the new and the old scholarship. *Science in Germany* may be taken as emblematic both of the continuities and the novelties. It is a collection that no historian of 19th-century science will be able to (or want to) ignore, and one that will interest many browsers as well.

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Our Continent

The Geology of North America. An Overview. ALBERT W. BALLY and ALLISON R. PALMER, Eds. Geological Society of America, Boulder, CO, 1989. x, 619 pp., illus., + boxed maps and microfiches. $60. The Geology of North America, vol. 4.

As a part of its vast Decade of North American Geology Project (DNAG), the Geological Society of America is publishing a 28-volume synthesis series on the geology of North America and flanking oceans. Almost half of the volumes have now been published, and, except for some of the volumes that are being published jointly with the Geological Survey of Canada and will be delayed by the need for simultaneous publication in English and French, the rest are expected to be published by 1992. The general level of the papers is excellent, and they contain a vast amount of new synthesis.

Most of the 20 papers in the present overview volume for the series summarize subjects to which other entire volumes are devoted. A few of these reviews are by editors or major authors of the primary volumes and are valuable summaries of those volumes: Vogt and Tucholke on the evolution of the North Atlantic Ocean basin; Sheridan on the Atlantic passive margin; Winterer *et al.* on the northeast Pacific Ocean; Trettin on the Canadian Arctic Islands.

Most of the papers, however, have no direct counterparts in the other volumes. Some cover ground similar to that covered by other volumes but incorporate different perspectives; other topics treated here are not treated at all in the primary volumes or are treated more broadly here. Bally *et al.* present Phanerozoic global-reconstruction maps. Hanna *et al.* describe the gravity map of North America and comment on some of its anomalies, and Hinze and Hood do the same for the magnetic map. Mooney and Braile discuss the seismic structure of the continent. Worrall and Snelson give a major new synthesis of sedimentation and synsedimentary deformation, particularly growth faulting and salt tectonics, in the Gulf of Mexico. In the longest paper in the volume, Oldow *et al.* give a coherent overview of and important new perspectives on the vast U.S. and Canadian Cordillera. They view the Cordillera as "an orogenic float" produced by "the mechanical separation of sediments and crustal units from the underlying continental and oceanic lithosphere," major decoupling systems separating complex structures of the "float" from simpler lithospheric roots. The geology of Mexico is described by de Cserna. Donnelly summarizes the