month-old girls and non-employed mothers of boys.

In conclusion, the full promise of longitudinal research on this very important topic is not realized by this collection of studies. Since significant associations between maternal employment and child developmental indicators were found to be so rare in the particular socioeconomic stratum studied, more finely tuned assessments of the conditions, timing, and dynamics of influence become, for the most part, irrelevant. Longitudinal studies of more representative samples are needed to provide more definitive assessment of the role of maternal employment in child development.

JEYLAN T. MORTIMER
Life Course Center, University of Minnesota, Minneapolis, MN 55455

Weapons and Hopes

War Stars. The Superweapon and the American Imagination. H. BRUCE FRANKLIN. Oxford University Press, New York, 1988. x, 256 pp. + plates. $22.95.

Over the years Americans have shared an intense faith in technology as the efficient solution to our messiest social problems. No matter that a serious problem may be essentially political—ineffective schools, industrial pollution, labor difficulties, declining productivity, infant mortality—we have looked to American "know-how" for the primary answers. Nowhere are the alarming consequences of this delusion, if it is one, more obvious than in our quest for the ultimate "techno-fix," the weapon to end all war. Bruce Franklin's cultural history of "the superweapon and the American imagination" offers the disturbing suggestion that in placing such confidence in our technology to meet this most intractable political challenge we have entrusted our future to our machines instead of ourselves.

Believing that popular perceptions somehow inform, as well as reflect, public policies, Franklin searches over a century and a half of our cultural landscape for clues to the social meaning of the American superweapon. What he has found may well surprise those readers who assume that the frightening implications of the superweapon only exploded into public consciousness at Hiroshima.

A century ago, Americans devoured a kind of pulp fiction Franklin calls war fantasies, visions of future apocalyptic conflicts pitting a virtuous America against powerful and evil adversaries. What these forgettable novels shared, beyond their improbable plots and xenophobic strain, was the conviction that only American ingenuity—death rays, anti-gravity ships, bacteriological bombs—could tip the scales toward truth, justice, and (most important) the American way. Always these were weapons fashioned not by bloodthirsty militarists but by peace-loving capitalists whose real goal was as much ending war as winning it. Appropriately, perhaps, one of the great heroes of the genre was a fictionalized Thomas Edison who, in *Edison's Conquest of Mars*, a bizarre take-off of H. G. Wells's cautionary tale of the wages of imperialism, *The War of the Worlds*, turns the tables on the Martian invaders with a sinister death ray. "The quick technological fix fantasized by this fiction has turned out to be what is now called the fallacy of the last move, the will-o'-the-wisp that the United States has pursued in plunging the planet into the colossal arms race of our age," argues Franklin. "Faster and faster we chase this mechanical rabbit, always believing that American technological ingenuity is capable of creating an ultimate weapon that can grant perpetual world peace through either universal disarmament or American global hegemony" (p. 26).

Like their fictional counterparts, American engineers sincerely believed that better weapons would make the world, if not the entire solar system, safe for democracy. Franklin traces this conceit to Robert Fulton, who, when he wasn't working on steamboats, was inventing and selling wondrous (and usually unworkable) naval weapons to both sides fighting in the Napoleonic wars. Fulton, with the engineer's typical self-assurance that his inventions could transcend the flaws of human institutions, called his submarine "a curious machine for mending the system of politics" and predicted that, by neutralizing the foremost strategic technology of the day—the British ship of the line—it would launch a new era of free trade, peace, and international prosperity. And though his private experimenting added little more to the arts of war than Fulton's, Thomas Edison's public pronouncements about miraculous electric weapons and mobilizing American ingenuity almost certainly helped shape American public opinion (and policy) on military preparedness. "The way to make war impossible," he argued, "is for the nations to go on experimenting, and to keep up to date with their inventions, so that war will be unthinkable, and therefore impossible" (p. 54).

Franklin follows America's infatuation with the superweapon down to the present through literature, science fiction novels, and films and suggests that sometimes the line between fantasy and fact is none too clear. Though a few writers and film-makers, say Joseph Heller in *Catch-22* or Stanley Kubrick in *Dr. Strangelove, or How I Learned To Stop Worrying and Love the Bomb*, have challenged our simple-minded equation of superweapons and social harmony, most have simply reinforced it. Even more troubling, perhaps, is the extent to which those with the most to gain from superweapons development have attempted to influence public opinion through fiction. Franklin recounts, for example, the massive and long-standing public relations campaign behind the rise of American air power. From Clark Gable and Spencer Tracy's *Test Pilot* (1938) to Jimmy Stewart's *Strategic Air Command* (1955) to the recent Tom Cruise hit *Top Gun*, the armed services and their industrial contractors not only supplied the indispensable hardware for these Hollywood epics—like assigning the entire fleet of B-17 prototypes for *Test Pilot*—they virtually wrote the scripts.

Franklin's strident tone and overbearing prose ("only one kind of appetite could gobble up the productive excesses of post-war American heavy industry: the ever-growing, insatiable bulimia induced by war or the threat of war," pp. 112–13), as well as some of his more outrageous accusations (that the Strategic Defense Initiative was designed to undermine an increasingly active and aggressive nuclear freeze movement) may put off some readers. Others may question whether Americans are any guiltier of the panacea mentality than the rest of the world. H. G. Wells and Jules Verne, for instance, held many of the same hopes for a world peace established and enforced by miraculous weapons, though perhaps it is significant that Verne's "Master of the World" was an American. Curiously, Franklin ignores this side of the literature. Somehow, he also missed Joseph Corn and Brian Horrigan's delightful, and revealing, chapter on future wars and weapons in *Yesterday's Tomorrows*, which more persuasively places both the American obsession with superweapons and the conquest of space in the broader continuum of the frontier ethic and the winning of the West. And curiously, given the title, Franklin says virtually nothing about the Star Wars saga and what, if anything, it suggests about the persistence of American cultural values in shaping defense policy.

Nevertheless, whatever you may think of Franklin's answers, he deserves some credit for asking original and important questions about the cultural constraints of defense policy. Who could listen to the latest rhetoric promoting the Strategic Defense Initiative—much of it, as Franklin points out, served up by science fiction writers like Robert Heinlein or former copy writers for

the defense contractors now scrambling for SDI research contracts—without hearing some echoes of that earlier apocalyptic fiction? Or read Edward Teller's latest pronouncements without being reminded of Fulton and Edison? To believe that our scientists, engineers, and political leaders are somehow removed from the prevailing cultural mythology may be the most dangerous illusion of all.

STUART W. LESLIE
Johns Hopkins University, Baltimore, MD 21218

An Interagency Struggle

U.S. Coast Survey vs. Naval Hydrologic Office. A 19th Century Rivalry in Science and Politics. THOMAS G. MANNING. University of Alabama Press, Tuscaloosa, 1988. xii, 202 pp. $21.95. History of American Science and Technology.

During the last third of the 19th century the United States Coast Survey and the Naval Hydrographic Office fought for control of hydrographic research conducted by the federal government. At first glance, these clashes might be dismissed as continuations of the antebellum turf battles between the directors of the Coast Survey and the Naval Observatory, from which the Hydrographic Office was spun off in 1866. In this interpretation, the postbellum clashes resulted from the personal ambitions and jealousies of the heads of the two oldest science bureaus in the federal government, each striving for domination of particular scientific disciplines as practiced within the federal government.

Manning demonstrates that such an interpretation would be much too narrow. The history of the struggle between the Coast Survey and the Hydrographic Office can be used to illuminate larger themes in the history of American science. The clash was an instance of the continuing conflict between civilians and the military for control of government science. It also demonstrated the sensitive balance between basic and applied science within science agencies. Although basic research produced international reputations, applied research provided necessary protection against political attacks.

The history of these two agencies also reveals that the financial health of federal science, like other government activities, may vary according to which party controls the Congress and White House. Utilizing information on some 142 members of Congress, Manning argues that, during the last third of the 19th century, Republicans were generally sympathetic to the expansion of federal support of science. Better educated than their Democratic counterparts, they celebrated scientific achievement and defended the presence of basic science in government agencies. Democrats, in contrast, wished to cut government spending and saw science bureaus as prime candidates for budget reductions. Republican presidents were either supportive or neutral toward science. Grover Cleveland, the only Democratic president during this period, is presented as one of the Coast Survey's greatest enemies. Once again, history shows that politics influences all aspects of American life, even scientific research.

MARC ROTHENBERG
Smithsonian Institution, Washington, DC 20560

Contributions of Chemistry

Biotechnology and Materials Science. Chemistry for the Future. MARY L. GOOD *et al.*, Eds. American Chemical Society, Washington, DC, 1988. xx, 135 pp., illus. $24.95; paper, $14.95.

This book is an outgrowth of an American Chemical Society select conference on biotechnology and materials science. In the preface, the society's president, Mary Good, describes its motivation for preparing this slim, attractive, and readable book: "American science, the nation's competitiveness, and ultimately our standard of living may come to depend on these two areas of scientific and technological endeavor." A similar message is also clearly conveyed in Philip Abelson's introduction. Biotechnology and materials science are both highly interdisciplinary fields, with chemistry a major component. This book describes in historical terms the role that chemistry has played in forging these fields and points to the exciting future for chemists and chemical engineers working in these areas. Its 11 chapters are written in nontechnical language by prominent chemists working in these interdisciplinary sciences. The book should be of interest to students, scientists, and administrators interested in hearing of chemistry's contributions past, present, and future to the materials and biological sciences. In particular, it should appeal to chemists with fairly traditional synthetic or physical backgrounds who are in the early stages of broadening their scientific outlooks. Interestingly, many of the authors were trained in more purely chemical pursuits, nearly half having made their early contributions to science in the field of physical organic chemistry.

The first chapters describe several chemical contributions to biotechnology. Many of the methods—peptide and oligonucleotide synthesis, biopolymer sequence and structure determination, spectroscopic methods, and computational approaches—widely used and often taken for granted by the biotechnological community are the results of the pioneering studies by chemists. These techniques along with molecular cloning, monoclonal antibodies, tissue culture, and fermentation technologies form the mainstays of biotechnology. J. K. Barton, H. E. Simmons, S. J. Lippard, and P. B. Dervan describe how these techniques are being used side by side with more traditional chemical methods to attack such problems as the mode of action of biologically active small molecules, including herbicides and antitumor drugs. E. T. Kaiser and G. A. Petsco also see biotechnology as providing the tools to prepare very large molecules with well-defined chemical and structural properties. A recurring theme is that as the biological sciences become increasingly molecular in focus the opportunities for chemists will expand.

The course of materials science has largely paralleled that of biology, in that a largely empirical, macroscopic science has, in recent years, become a molecular science. As is described in W. P. Slichter's and W. A. Goddard's chapters, materials scientists are now able to build structures from the ground up, beginning with atoms or molecules and progressing toward microscopically defined macroassemblies, a capability with increasing importance to materials science. In the final chapters of the book, G. M. Whitesides, M. S. Wrighton, and J. Economy provide very brief overviews of some of the more chemical aspects of electronic devices, materials for energy production, and composites. As is true for the other chapters, these discussions serve to whet the reader's appetite for more substantial, technical discussions.

The book is a good testament to the commitment of the American Chemical Society to support and influence the future of all aspects of chemical research. The editors have obviously expended a considerable amount of effort to ensure a degree of homogeneity, both in illustrations and textual style, that is unusual in a collective volume. The page layout and quality of the illustrations make for easy, enjoyable reading. More documentation and lead references for the interested reader would have been helpful, as the number and type of references are highly variable from chapter to chapter (and many do not have any references). Also, the strict avoidance of technical terminology or chemical details (even benzene is defined, as a six-membered ring of carbon atoms) is, at