In Book Two Starr narrows his focus to concentrate on the various schemes Americans devised and discussed for coping with the high cost of medical care. For decades the medical profession prevented (or at least limited) state-paid medical care; but as medicine became more and more successful "it seemed deeply unjust to withhold it," and the government increasingly intervened (p. 232). Thus, ironically, the very success of physicians threatened to reduce their independence.

In a series of finely crafted essays Starr relates the 70-year struggle in America to design a system to meet the ever-increasing costs of medical care. His account of the continuing debate over compulsory as opposed to voluntary health insurance is especially enlightening. During the 1910's Progressive reformers, convinced that sickness was the leading cause of poverty, began pushing for a compulsory system, particularly to cover the income workers lost during these times of illness. By the 1930's hospitalization and physicians' services had become so expensive that even middle-class Americans were growing alarmed, a development Starr identifies (p. 259) as "the key to explaining the new direction of the health insurance movement," that is, its shift from replacing lost income to expanding access to medical care. Largely because of the opposition of physicians, the United States, unlike other Western nations, failed to adopt national health insurance. "Instead of a single health insurance system for the entire population," says Starr, America would have a system of private insurance for those who could afford it and public welfare services for the poor" (p. 286). Legislators who sided with the medical profession demonstrated their concern about the nation's health by approving large sums of money for hospitals, medical schools, and medical research—an arrangement by and large acceptable to physicians.

Although organized medicine initially opposed even voluntary health insurance, it soon came to recognize it as a bulwark against the greater evil of compulsory insurance and set out to make sure that control remained in the hands of physicians. "By deflecting insurance first into the private sector and then away from direct services and lay control," writes Starr, "the profession was able to turn the third-party insurer from a potential threat into a source of greatly increased income" (p. 332).

Until the mid-1970's the sovereignty of the medical profession went virtually unchallenged. Although government agencies increasingly involved themselves in medical matters, they almost always did so in ways acceptable to physicians. Even the passage of Medicare in 1965, over the protests of organized medicine, accommodated the interests of the medical community. Few Americans questioned either the efficacy of medicine or the role physicians had come to play in the medical system. However, according to Starr, "Medicine, like many other American institutions, suffered a stunning loss of confidence in the 1970s" (p. 379). Despite the hyperbole in this statement, it is true that for the first time in recent memory many Americans began to wonder about the value of medical care and the desirability of letting physicians or their allies run the health care system. Confronted by such diverse forces as the sagging economy and the women's movement, "American physicians faced a serious challenge simultaneously to their political influence, their economic power, and their cultural authority" (p. 380). In this atmosphere, national health insurance came to represent a cost-control measure rather than a means of expanding medical care.

Starr wisely refrains from offering his own solutions to the problems now facing American medicine, but he does share his vision of the future. What he sees does not bode well for the continued independence of the medical profession. Given the prospect of a physician glut and escalating medical costs, he predicts not only "the weakening of professional sovereignty, but . . . greater disunity, inequality, and conflict throughout the entire health care system" (p. 421). But the greatest threat to the autonomy of physicians, he thinks, will come from a new quarter: medical corporations, such as chains of medical institutions, which will impose managerial control on doctors and perhaps place them on salary. "The failure to rationalize medical services under public control meant that sooner or later they would be rationalized under private control," he concludes. "Instead of public regulation, there will be private regulation, and instead of public planning, there will be corporate planning" (p. 449).

It would be easy in reviewing a book of this scope to identify minor points of disagreement. Suffice it to say that I have rarely read a book on the history of American medicine from which I learned more and dissented less. If you read only one book about American medicine, this is the one you should read.

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Conflagration as a Cultural Phenomenon

Fire in America. A Cultural History of Wildland and Rural Fire. STEPHEN J. PYNE. Princeton University Press, Princeton, N.J., 1982. xvi, 656 pp., illus. $35.

On rare occasions, the historical literature is enriched by the introduction of a broad new field for study, by a book that dramatically expands the boundaries of scholarly investigation. Stephen Pyne's *Fire in America* is such a book. It achieves the Promethean goal of bringing fire to history.

Certain large themes unify Pyne's history of wildland and rural fire, which he treats as a cultural phenomenon. Prometheus did indeed found all of the useful arts and sciences on his theft of fire. Wildland fire was a tool in the hands of aboriginal humans, and fire was employed during the agricultural age to clear land and for range improvement. For centuries fire was a universal explanatory principle; it was gradually replaced by a mechanical philosophy: "Chemistry separated fire from the elements; mechanics separated it from heat; optics, from light. With the development of thermodynamics, the concept of energy assumed the role previously held by fire." The industrial revolution moved the location of fire from the landscape into the new engines, except where industrial logging determined land use. Eventually the new physics put the atom at the intellectual base of our physical world, replacing fire, but fire remains a puissant force in the atomic age. And wildland-rural fire today is 90 percent anthropogenic in origin and only 10 percent natural (that is, caused by lightning). These historical processes may be summarized with the help of Pyne's reclamation concept. Europeans, in the Great Reclamation, burned the forests in the Old World to replace them with farms or pasturage for domesticated animals. In a parallel movement, Indians in the New World burned the woods to encourage the growth of forage for the animals they hunted. During the counter-reclamation, industry needed wood. Fire

protection was fostered in the face of opposition from settlers in unindustrialized areas; in the American South this meant converting farms to forests. Modern forestry allied with industrial interests until recently when, with the increasing popularity of ecological values, prescribed burning was reintroduced to the woods and brushlands.

Although such grand patterns are delineated throughout Pyne's volume, most of this big book (more than 500 pages of text and nearly 100 pages of notes and bibliography) is devoted to describing the history of forest fires in the United States and the ideologies, political policies, and changing practices of fire control. The eight "chapters"—the quotation marks are necessary because the structure of the book is as much of a novelty as the subject matter—cover eight successive periods, starting with the nature of fire and its aboriginal use. Each chapter contains at least one descriptive history of wildfires by region. A chapter will also contain an essay on fire prevention, fire protection, fire policy, manpower, the technology of fire fighting, or fire research. Material in the subdivisions transcends chronologically each chapter's period, which is an organizational flaw that results in confusion and redundancy. Repetition is a legitimate literary device to make what is written memorable, but (for example) we need not be told seven times, five times in 21 pages, that the Civilian Conservation Corps joined the fire line for the first time during the Tillamook, Oregon, burn of 1933, or to read on p. 275 and again on p. 324 that Tillamook "was to forestry what the Dust Bowl was to farming." Other major and minor repetitions occur too frequently. Withal, the writing is often brilliant, as in the author's lucid description of the physics of fire, in his dramatic accounts of the escape by railroad train from the Hinckley, Minnesota, fire of 1894 and of Edward Pulaski's adventures during the Big Blowup of 1910 in the northern Rocky Mountains, and in his witty asides. He writes of the western eucalyptus mania, "By 1920 the . . . craze had evaporated into that nirvana of wornout California enthusiasms." The book is rich in classical and modern allusions.

Space does not permit a review of more than three of Pyne's numerous, important conclusions. First, he appreciates the relationship of wildfire and wildlife, though, except in the case of Alaska, he slights the role of wildlife habitat enhancement and preservation as a goal of early American conservation. Second, he questions the Rousseauistic view that Indians "lived in some perpetual ecological harmony with one another or with their environment, upset only by European intervention." Instead, the relationship of indigenous Americans to the land was constantly changing, and Indians employed a powerful technology—fire—to alter the landscape significantly. They used fire for a variety of reasons, sometimes the fire escaped, and some Indian burn techniques were adopted by European settlers. Modern scientific forestry, says Pyne, "merely gave the old practices a new justification and shaped them into a new cycle of firing, one adapted to an industrialized society." Third, although the new American science of forest fire research was born at the same time modern physics emerged, the approach of the Forest Service was practical, not theoretical. Statistical analysis of wildfire behavior and fire damage was emphasized, not the phys-

"B17 dropping slurry, Wenatchee fires, 1970." [From *Fire in America*; courtesy U.S. Forest Service]

"Grass fire suppression with sprinklers, blankets, and buckets, Oklahoma, 1908. A water wagon typically accompanied such an operation to replenish the sprinklers." [From *Fire in America*; courtesy U.S. Forest Service]

ics, meteorology, or ecology of fire. After the Second World War the scientific investigation of fire entered the laboratory with Big Bucks for military research into the physics of mass fire and fire as a weapon. Many of Pyne's interpretations are, of course, arguable, as interesting hypotheses should be. Altogether, considering the strengths of this book, fire as a cultural force in history will probably not evaporate into any nirvana of worn-out enthusiasms.

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An Arena of Applied Science

JPL and the American Space Program. A History of the Jet Propulsion Laboratory. CLAYTON R. KOPPES. Yale University Press, New Haven, Conn., 1982, xiv, 300 pp., illus., + plates. $19.95. Yale Planetary Exploration Series.

JPL and the American Space Program chronicles and describes "the major technological developments in which the Jet Propulsion Laboratory has been involved," as well as the "scientific implications" of those developments. Beyond that, it provides, through discussions of JPL's changing relationship with the California Institute of Technology, the military, and the National Aeronautics and Space Administration, a thoughtful analysis of many aspects of the vastly expanded post-war partnership between scientists, their traditional university homes, and the federal government.

The advent of modern, university-operated, "big science" institutions is most often traced to the experiences and the relationships established between scientists and government during the Second World War. The wartime development of radar and atomic weapons clearly demonstrated the practical importance of the knowledge and the skills of academically oriented scientists and engineers. Those projects also revealed that decisively important branches of science, with their associated technologies (for example nuclear reactors and particle accelerators), required vast resources and new organizations and management structures for their effective pursuit.

Rocketry did not play as significant a role in the Allied victory as did radar or the atomic bomb. Nevertheless, as potential delivery vehicles for weapons (nuclear and otherwise), and as a means of obtaining access to the upper reaches of the atmosphere, rockets were recognized as having a considerable and perhaps essential role to play in maintaining American preeminence in strategically important areas of science and technology. They also had important economic implications for the United States aircraft industry.

At the end of the Second World War the Jet Propulsion Laboratory was in a unique position. The outgrowth of the Army-funded rocket project of Caltech's Guggenheim Aeronautical Laboratory, "the seedbed of American rocketry," JPL possessed expertise and facilities suited to further development of rockets and associated guidance, control, and communications technologies. During the 1950's several momentous events—not the least being the development of deliverable thermonuclear weapons and the 1957 launch of Sputnik—profoundly altered the nature and the activities of the laboratory. It is the forces, the events, and the reactions that have molded and continue to mold the evolution of JPL that form the subject of this book. Koppes treats clearly and in detail the development at JPL of the Corporal and Sergeant tactical nuclear weapons systems, JPL's entrance into the space age, its transfer to NASA, and its major role in the design, management, and operation of most of the unmanned lunar and planetary probes that have been launched or are planned by the United States. This is, therefore, an important book.

Koppes strives to provide a coherent structure to his account by presenting it "in relation to certain military and scientific policies of the national security state." The phrase "national security state" is taken from Daniel Yergin (*Shattered Peace: The Origins of the Cold War and the National Security State*, 1977). It is meant, by Koppes, to summarize what he sees as the most significant post-war changes in the nature and function of the federal government. His attempt to place the subject matter of his book in a broad context is laudable. However, the many goals of the book and the limited use made by Koppes of the staggering amounts of available primary source materials related to these wide-ranging concerns make for some serious weaknesses. For example, the extremely brief descriptions of the scientific significance of the planetary missions with which JPL has been involved suffer from the shallow documentary base on which they are constructed. This contrasts markedly with the excellent and well-documented accounts of the disputes over management practices and fees that have plagued relations between NASA, JPL, and Caltech.

There are problems with some accounts more central to the book's main concerns. The discussion in chapter 6 of the early JPL-managed Explorer satellites relies disproportionately on JPL publications and on the undocumented account given in *Countdown for Decision*, written in 1960 by Major General John B. Medaris (the retiring chief of the Army Ballistic Missile Agency and a leading advocate of a continuing Army role in rocketry and space). And, possibly as a result, the account of the Medaris-directed "reentry test vehicle" program understates the differences between the "Jupiter C" launch vehicle used to test Jupiter IRBM nose cones and the launch vehicle that eventually launched America's first artificial satellite; it treats only briefly the relationship between James van Allen, the Army Ballistic Missile Agency, and JPL, a relationship that led to the inclusion of cosmic-ray detectors aboard the early Explorers; and it gives a misleading account of the Explorer 4 satellite and Project Argus. (Project Argus, a classified project meant to determine whether the detonation of atomic weapons hundreds of miles above the earth would create magnetically trapped bands of radiation of military significance, had nothing to do with the International Geophysical Year or with the measurement of radiation "trapped in the atmosphere"; nor was it a simple follow-on to the radiation measurements made by Explorers 1 and 3, as one might conclude from Koppes's account.) The involvement of JPL and van Allen with Project Argus is an interesting story, but it is far more complex than is indicated in the published accounts Koppes has relied upon.

And later, when Koppes analyzes President Kennedy's 1961 decision to send astronauts to the moon (p. 115), he implies that direct military considerations played an important role (that is, in addition to more general national security concerns). "An aggressive man-in-space program emerged ineluctably as a key component of this [Kennedy's] military buildup, for reasons not only of prestige but of direct military capability." As far as is revealed in the notes, that statement is based on speeches and articles prepared several years after the fact. It is not very convincing as presented.

In his preface and in a note on sources, Koppes comments on the sparsity of historical scholarship on modern science and scientific institutions. *JPL and the*