The Vannevar Bush Legacy

Science—The Endless Frontier. A Report to the President on a Program for Postwar Scientific Research. VANNEVAR BUSH. National Science Foundation, Washington, DC, 1990. xxxiv, 192 pp., illus. Paper. Reprint with new introductory material. Distribution limited.

American Science Policy Since World War II. BRUCE L. R. SMITH. Brookings Institution, Washington, DC, 1990. x, 230 pp., illus. $34.95; paper, $14.95.

American science is about ready to celebrate an important anniversary of the founding of its modern policy framework and institutional structure. Fifty years ago, some time between the establishment of the National Defense Research Committee in 1940 and the enactment of authority for the Office of Naval Research in 1946, the concrete was poured and the pipe laid for the unique and wonderful edifice that supports American science to this day. The chief architect surely was Vannevar Bush. In celebration of its own 40th anniversary, the National Science Foundation has republished Bush's *Science— The Endless Frontier* with a new and lengthy preface by Daniel Kevles entitled "Principles and Politics in Federal R&D Policy, 1945–1990: An Appreciation of the Bush Report."

Kevles's purpose is to trace the continuing influence of Bush's powerful ideas on the manner of federal science support. The central importance accorded to basic research in academic institutions and the necessity that the organization of scientific research programs be under the control of independent scientists are the most enduring of these ideas. Bush clearly stated the view inferred from wartime experience and readily endorsed by academic scientists that basic research is essential to genuine advance in three essential parts of American life—defense, industry, and health. He strongly recommended that the federal government assume responsibility for its support. He also clearly believed that only the scientific imagination could sustain that perspective. He surely thought but less clearly said that bureaucrats—military or civilian—and politicians were likely to be short-sighted and to push science into applied efforts. Kevles handily traces the dispute between Senator Harley Kilgore and Bush about basic vs. applied research and merit selection vs. equity distribution that Bush won in principle. The victory was pricey, however. The delay in authorization forestalled any possibility of the dominant and centralized role in science policy and management that Bush envisioned for the NSF. The Kilgore-Bush "debate" was, as Kevles makes clear, a prototype for the continuing debate about scientifically determined over socially targeted research programs as well as for the role of independent science in making science policy. This reprint and retrospective make a handsome and handy book.

Bruce L. R. Smith in *American Science Policy Since World War II* has set out to examine such science policy questions as What is the best structure of the "research system"? What is the state of university, government, and industrial laboratories? Do their interactions need attention? Is the relationship between defense and non-defense objectives in science "unhealthy"? and Can the use of science in regulation be improved? Smith has been a student and analyst of the American science scene for many years, and his selection of historical highlights and observations about them carry a certain weight on that basis. The book covers a lot of ground in a sophisticated and worthwhile fashion.

Smith has chosen a foreshortened historical approach that divides the story into a prelude from the 18th century to World War II, a golden age from *Science—The Endless Frontier* to mid-Johnson, a time of troubles up to the first Reagan budget, and a subsequent renaissance in the decade begun in 1981. According to his interpretation a postwar consensus lasting to about 1965 was propelled by enthusiasm derived from victory, from a belief in progress, and from assessment of science's contribution to both. The consensus was enabled by prosperity underlying economic and budgetary growth. In the middle '60s budget demands, exposed social divisions, and campus turbulence carried over into science policy. The debate about priority of applications was revived. The "utility" of basic research was challenged, the "value" of an independent role for scientists was questioned, and priorities among problems were disputed. A renewal of consensus began with the Carter defense budgets designed by Harold Brown and the alternative-energy-sources projects of that era. It culminated with renewed faith in basic research to support American competitiveness and vastly increased defense R&D in the Standing Tall atmosphere of Reagan's administration. Smith concludes with some general assessments of the situation of American science and identification of a number of current unsolved difficulties in science policy.

Science policy is a matter of interest and concern to scientists and others with a stake in social and economic activities that have a significant component of science or science-based technology. In any study of science policy we really need to start by defining our subject. What can we legitimately consider to be the science policy of the federal republic, or for that matter of the government of the United States? Is it government policy aimed at fostering scientific activity in government and outside, à la Vannevar Bush? Does it comprehend education and training of scientists and practitioners of science-based professions such as physicians and engineers? Is it government effort to apply the findings of science to the development of new technologies in government and out? Is it policy that draws on science to understand events and forecast the future? Is it policy to grapple with social, physical, economic, or whatever kinds of problems have been perpetrated by science and particularly new technology?

Smith has taken the position: all of the above. I am not sure his capacious approach is an optimal strategy. Though the narrative makes sense, it is not clear that it illuminates in particular the deep and complex matters that he set out to scrutinize. Nor is any other organizing principle readily apparent. Rather, one is left wondering why this selection of material rather than some other. In the end we have an accessible brief history of a complicated matter, but the challenging questions raised at the outset remain largely unexplored.

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Working with Experts

The Fifth Branch. Science Advisers as Policymakers. SHEILA JASANOFF. Harvard University Press, Cambridge, MA, 1990. xvi, 302 pp., illus. $27.95.

In the November election, California voters faced a number of health and environmental initiatives, the best-known of which was "Big Green." Scientific experts arrayed themselves on both sides of the debate, including former Surgeon General C. Everett Koop, who urged defeat of the measure in television commercials. Most voters, thoroughly confused about the political, scien-

tific, and economic consequences, simply voted no.

These debates about science and politics underscore the timeliness of Sheila Jasanoff's new book. Arguing correctly that the activities of science in government policy are poorly documented and difficult to understand, Jasanoff explores the role of independent science advisers in federal regulatory decision-making. The problem of integrating science into politics is not new. From the creation of health and environmental agencies in the early 1970s through the deregulatory era under Reagan, government experimented with a variety of techniques to use scientific advisers in highly controversial regulatory issues.

Jasanoff's goal is to use regulatory case histories to develop a richer conceptual framework for understanding the challenges facing scientific advisory committees. Her case studies, particularly those dealing with the Environmental Protection Agency, are fascinating. The promised framework never completely materializes, however. Rather, we are presented with a brief but thoughtful discussion of relevant concepts and their normative implications for science policy.

The title of this book is puzzling. We all know the Constitution established three branches of government; the administrative bureaucracy has been accused of being an implicitly illegitimate fourth branch. Jasanoff identifies scientists as part of a "more unscrutable" fifth branch used by the bureaucrats to manipulate scientific knowledge for political purposes. There is nothing in her fine and detailed analysis to support any notion that scientists have created a fifth branch, nor does she advocate such a role. Indeed, she concludes that despite the trend toward wider use of advisory committees, regulatory science is still dominated by politics within the administrative process. Sporadic and largely discretionary consultation does not a branch of government make! Readers would be advised not to search for evidence of an elusive fifth branch, but should be prepared to learn about the more interesting and subtle ways in which scientists have contributed to the regulatory process.

The case discussions are organized around two formulations of science policy. The technocratic view is that scientists should play a greater role in policy formulation. At the other end of the spectrum is the democratic view that the public should participate in these essentially political decisions to protect against abuse of authority by experts. These formulations can be simplified to express the continuum from pure science to pure politics.

Jasanoff critiques both formulations. She concludes that science cannot be separated from politics and that there is no simple formula for injecting expert opinions into public policy. The case studies illustrate a variety of successful and unsuccessful experiments in science policy-making.

Three central chapters describe the efforts of the Environmental Protection Agency (EPA) to integrate science into its policy decisions. Jasanoff discusses the evolution of EPA's broad-based Science Advisory Board (SAB), the Clean Air Scientific Advisory Committee (CASAC) set up to deal with air pollution, and the Science Advisory Panel (SAP) set up to address pesticide risks. A number of interesting insights emerge. The most successful interactions occur when scientists and regulators negotiate the boundaries within which the scientists will work. Though complete separation between science and politics is not possible, clarification of the zones between them improves the credibility of decisions. After many years of struggle, the SAB emerged as powerful and respected in part because of its self-defined distance from policy. The CASAC improved its credibility when it developed set procedures and allowed for negotiation and compromise at early stages in the review process. When scientists are pitted against one another in adversary proceedings, Jasanoff finds that the results are less successful. The SAP was too structured procedurally and lacked mechanisms for reconciling alternative constructions of science.

After the vivid EPA cases, readers may be disappointed by the less extensive treatment of the Food and Drug Administration (FDA). The discussion here focuses on drug policy and food additives. As was found in the case of EPA, FDA advisory bodies are most successful when there is flexibility at the boundaries between science and policy, and less successful when highly structured and rigid. Jasanoff's FDA discussion would have been more complete if she had applied her analysis to its most pressing and controversial problems, namely AIDS drug approvals and biotechnology issues. Both these new developments have plunged FDA into a maelstrom of conflict between science and politics.

This reviewer was also disappointed that medical device advisory panels, which account for a large share of FDA's advisory bodies, are not treated. Mandated by Congress in 1976, these panels incorporate aspects of both the technocratic and the democratic models. They are technocratic in that scientists and other technical experts review data presented to them and democratic in that both industry and consumer interests are represented by non-voting members. Consensus and negotiation must occur not only between FDA scientist-regulators and the outside science advisers, but also among other non-science participants.

This book will leave readers feeling optimistic. There is a wealth of creativity demonstrated by both Congress and the agencies in bringing science into the regulatory process. As our science base grows, there is need for continuing creative responses. Jasanoff asserts that the challenge for regulatory reform is to determine where science policy-making should be situated under particular scientific, legal, administrative, and political circumstances. Though she doesn't develop a framework, the discussion she provides of important concepts is useful and necessary. Her prescriptions include: interactions between scientists and regulators should be regular and predictable; experts should be broadly, not narrowly, focused; issues of political balance and conflict of interest should be recognized; and adversarial procedures should be avoided.

In November, the *New York Times* reported that six members of a 16-member EPA panel of independent scientists whose task is to assure the accuracy and objectivity of two EPA studies concerning the health effects of second-hand cigarette smoke have ties to a tobacco industry group. The EPA denied any conflict of interest; anti-smoking groups expressed outrage. The problems of science in politics continue. Jasanoff's work will surely enlighten the debate.

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A System under Strain

Peerless Science. Peer Review and U.S. Science Policy. DARYL E. CHUBIN and EDWARD J. HACKETT. State University of New York Press, Albany, 1990. xiv, 267 pp. $49.50; paper, $16.95. SUNY Series in Science, Technology, and Society.

Does the sociology of science have a specific contribution to make to public debate over the functioning of the science system? Daryl Chubin is a scholar whose work and career insist that it does. In this book, Chubin and fellow sociologist of science Edward Hackett examine the strengths and the limitations of the peer review system. How to explain the fact that while studies of NIH and NSF review procedures all seem to show that things work reasonably well criticism continues unabated?

Peerless Science is neither a quantitative study of outcomes of peer review processes of the sort that agencies are wont to com-