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-

mission these days nor a juicy blow-by-blow account of instances of alleged malpractice. Both types of account are familiar, and they are typically embedded in well-rehearsed arguments regarding the adequacy, or not, of peer review processes. In this book substantial chunks of material of both sorts are introduced, but in the service of a more complex argument. Chubin and Hackett want to understand *why* dispute regarding the adequacy of peer review is so persistent and so rancorous. Only then does it become possible to consider possible resolutions. At its core their argument consists of an elegant piece of sociological reasoning.

To some extent dispute about the way science works is inevitable, and indeed proper. Differences in perspective derive from

> . . . the tension between politicians' calls for greater regulation, oversight, accountability, and responsiveness from science, and scientists' pleas for freedom, autonomy, and the intrinsic benefits of scientific research. The difference in views is rooted in the social roles of politicians and scientists in the U.S. and is unlikely to change easily or rapidly [p. 46].

But this is far from a sufficient explanation. Such differences in perspective have, presumably, been there for decades at least. Why do they lead to dispute specifically over peer review, and why is it so heated now?

Peer review is a central focus for dispute because it means such different things to different groups involved—and necessarily so:

> Peer review serves the practical ends of allocating rewards and resources at the same time that it embodies and enacts the most cherished values of science—values that are essential to the very definition of science [pp. 121–22].

This "decoupling of symbolic and practical ends" is the same kind of phenomenon that underpins current debate over the future, roles, and responsibilities of the universities.

These ends are becoming incompatible with one another. Chubin and Hackett's argument is that the system is breaking down under growing pressure. This is due principally to competition for scarce resources, exacerbated by institutional pressures on scientists and by the growing costs of research. What happens when proposals judged to merit funding vastly exceed available resources?

> Peer review suffers because funding decisions must be made at a level of discernment that exceeds the "resolving power" of the evaluation instrument. In other words, a system that might be able to evaluate proposals within, say, a half-point margin of error, is now forced to make funding decisions on proposals that differ by only a few hundredths of a point [p. 73].

The peer review system cannot cope, not because of human failings but because the relations between modern science and the modern state have become inherently contradictory. Clearly an argument of this kind lends itself to all sorts of further articulation and to all kinds of empirical testing. Thus "contradictions" ought to find expression outside the peer review system, and under different institutional circumstances the peer review process ought to be more or less problematic. Broadly speaking it seems to me a plausible argument, though not one likely to attract much attention from policymakers.

At this point Chubin and Hackett look to turn their sociological analysis to practical use. They do so by first considering the claims of bibliometric analysis as a possible alternative means of evaluating science. This discussion (pp. 165–190), leading to the idea that bibliometrics—though in need of further development—can usefully *augment* peer review, is fair enough. It shows nothing, however, of the subtlety with which the peer review process was analyzed. Biblio-

metric data, and the applications claimed for them, are not the escape from the real world of interests, values, and competition that Chubin and Hackett imply. With their use new actors, with new skills and new interests, climb on the stage, and authority is redistributed.

The book ends very reasonably, with some modest proposals for improving the way peer review typically works (for example, the right of rejoinder before decisions are made) as well as for continuing analysis of the way the system works. The sociologist of science, showing that the discipline has a useful contribution to make, pleads for the right to continue to make it. Though it is unlikely to have a major impact on the social-studies-of-science community, this analysis of what lies behind current dispute over the merits and demerits of peer review is a worthwhile and readable piece of work.

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