

mammals "We see, from this sketch of division and subdivision, how a subject, extremely delightful and amusing in itself, may be darkened and rendered disgusting." That passage is missing in this new abridgement, as is the whole of Goldsmith's text on the Earth and humanity. One can see why his account of human races is left out, for it is pretty strong stuff for today's taste (some of it evidently seemed strong to Goldsmith, since he dropped into Latin for the racier bits). As for the remainder — mammals, birds, testaceous fishes and so on — it is all neatly abridged here; authors who have got beyond rejection by *Nature* will know that even the best hackwork can always stand substantial cuts. I cannot disagree with Goldsmith's hope that his work "may be found an innocent amusement for those who have nothing else to employ them, or who require relaxation from labour." □

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Safety control

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The Fifth Branch: Science Advisers as Policymakers. By Sheila Jasanoff. Harvard University Press: 1990. Pp. 302. \$27.95.

CHEMO-REGULATORY drama is America's contribution to political stagecraft.

The substances at issue may be as different as pesticides and food colourings. But the elements of plot are similar: New or rediscovered research suggests a menace in public exposure to what, ironically, was intended to be a beneficence. An alarm is sounded by a public guardian, official or self-appointed. And suddenly, a previously obscure product soars to prominence on allegations of risk to health. The manufacturer indignantly protests that a human would have to ingest brobdingnagian quantities to suffer the misfortunes of sacrificial rodent consumers — a contention scornfully disputed by public-interest organizations. A film celebrity earnestly denounces the product. Meanwhile, the regulatory system is set rolling. The federal agency responsible for regulating the product summons scientific specialists to assess the risk. Charges of bias and conflict of interest are raised. Litigation ensues, suspicious congressmen call hearings, and nimble journalists hurry in quest of wrongdoing.

Why is it not possible for science to sort these things out with the precision and finality attributed to it by impatient politicians, anxious citizens — and self-confident scientists?

That is the central topic of this provoca-

tive and original work by a leading scholar of the role of scientists in regulatory affairs, Sheila Jasanoff, Director of the Cornell University Program on Science, Technology and Society. The 'fifth branch' in her formulation consists of the hundreds of advisory committees that serve US government regulatory agencies; the latter are the fourth branch, which modern needs have appended to the original Constitutional trio of executive, legislature and judiciary.

The author's principal analytical tools are, first, the sociological concept of "the social construction of science", which holds that scientific 'truth' is a product of society rather than a reflection of "what is out there in nature"; and, second, 'boundary' setting, the process whereby matters in dispute are delineated as the responsibility of scientists or policymakers.

Focusing on the Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA), Professor Jasanoff is a confident guide to some of the most tortuous regulatory conflicts of recent years — eponymously known by their chemical designations, marketplace names, or statutory titles: Alar, formaldehyde, aspartane, ethylene dibromide, dicofol, propranolol, 2,4,5,-T and the Clean Air Act in relation to ozone and carbon monoxide.

Reflecting a statutory requirement, or a faith or hope that science can be sifted from politics in regulatory strife, the agencies in each instance solicited advice from panels of experts. But, as Professor Jasanoff points out, "Evidence of consultation with expert committees rarely proved sufficient to silence controversy", the reason being that "the questions regulators need to ask of science cannot in many instances be adequately answered by science." In the case of the plant-growth regulator Alar, conflicting scientific assessments led to what the author refers to "as a complete breakdown of scientific authority". The final resolution, discontinuation by the manufacturer, was prompted by a surge of public alarm arising from a television report describing Alar "as the most potent cancer-causing agent in our food supply".

The Fifth Branch stresses that, although regulators hopefully seek scientific guidance, the problems they present to their advisers are not the common grist of scientific problem-solving: How much risk is too much? What trade-offs are permissible between public safety and economic loss? How should regulation proceed in the presence of ambiguous or conflicting scientific and medical data? And what is to be done when experts disagree?

Attempts by regulators to extract usable answers from the orthodox processes of science almost invariably lead to contention, Professor Jasanoff argues, because these questions necessarily in-

volve social and political values and personal judgements. "Regulatory science", she observes, in contrast to conventional laboratory research, "is more often done at the margins of existing knowledge, where science and policy are difficult to distinguish and claims are backed by few, if any allies, or black boxes" — that is, undisputed facts or claims.

Peer review, the standard tool of the sciences for awarding funds and screening manuscripts, is commonly looked to by the "technocratic reformers of regulation" as a way out of regulatory morasses. But the author reminds us that science itself is discovering, through scholarly scrutiny, that peer review "is not the objective, dispassionate process that its advocates represent it to be."

Despite the battering that scientific advice has often suffered on regulatory battlefields, Professor Jasanoff says the advisory process has gained in political sophistication and is becoming more assured and effective in assisting its federal patrons. "The realities of scientific advice at EPA and FDA", she concludes, "contradict many of the myths and preconceptions that have grown up around this relatively unstudied process. The notion that scientific advisers can or do limit themselves to addressing purely scientific issues, in particular, seems fundamentally misconceived. Other common myths — for example, that scientists are always conservative in assessing risks or that advice is merely a pretext for delaying decisions — also seem exaggerated. Rather, the advisory process seems increasingly important as a locus for negotiating scientific differences that carry political weight . . . The primary concern for regulators, then, is not how to guard against capture by science but how to harness the collective expertise of the scientific community so as to advance the public interest."

The author's observation post is far above the regulatory fields of fire, and her account conveys almost nothing of the squalid dealings and political connivings common to regulatory warfare. In that respect, it has a remote, antiseptic quality, as though relating events of another era or civilization. Professor Jasanoff seems to have sensed this, for in a passing reference to 'political manipulation' of advisory committee appointments, she states: "Here, corrective action by Congress may be helpful, though the issue requires fuller investigation than it has received in this book."

Professor Jasanoff has pioneered the exploring of the workings of the gears and sprockets of the Fifth Branch. Let us hope she now turns her skills and understanding to its politics, particularly the underside. □

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