major problems as the development of the Megalithic complex, copper metallurgy, Aegean civilization, and the early Bronze Age. Here one often agrees with his broad strategy but frequently disagrees with his tactics and at times wonders if another day will bring the emergence of a neodiffusionist view of prehistoric development in Europe.

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Government Support

Science and the Evolution of Public Policy. JAMES A. SHANNON, Ed. Rockefeller University Press, New York, 1973. xviii, 260 pp., illus. $11.

The Chaining of Prometheus. Evolution of a Power Structure for Canadian Science. F. RONALD HAYES. University of Toronto Press, Toronto, Canada, 1973. xx, 218 pp., illus. $15.

Well may foreigners envy Americans, who even when they are convened to lament the sad state of their country's science policy do so with the aid of grants from the National Science Foundation and a private philanthropy. And when the time comes for the editor to assemble the contributions for the press, he sits down to his onerous chores at the Rockefeller Foundation's Study and Conference Center in Bellagio, Italy. Almost all of the 11 distinguished Americans and one eminent Briton whose lecture-seminar presentations are collected in the Rockefeller volume manage, however, to ignore their affluent auspices. The keynote, sounded in the editor's introduction (drawn from the 1970 grant application) and reiterated in most of the essays that follow, is the "erosion of federal support." Joseph S. Murtagh calls 1967 "the end of the Augustan age for science." Harvey Brooks wonders whether "the endless frontier" envisioned by Vannevar Bush "has come to an end, like the geographical frontier of a century ago from which it draws its name."

Unfortunately for the dramatic effect of this collective *cri de coeur,* by the time the papers were being prepared for publication, in September 1972, even the editor felt compelled to add a postscript pointing out that "the downward move of appropriations in support of science programs has been reversed, at least for some programs of some agencies." As one examines the recently announced projections showing federal expenditures for research in colleges and universities reaching toward an estimate of $2.26 billion in fiscal 1975, up from slightly over $1.4 billion in 1970, the plaintive tone adopted in this volume seems somewhat excessive, or at least premature.

In fairness, it should be noted that if the prospects for the support of science seem to have brightened lately, one reason is that scientists, administrators, and publicists, including the contributors to this book, have scored some persuasive points against prevailing policies. One such point is made by Brooks when he observes that the preoccupation with military R&D and space exploration has left the United States at a serious disadvantage in terms of international economic competition. This country, he notes, makes a smaller investment in civil industrial technology, in proportion to gross national product, than most other advanced countries. Government cutbacks have imposed strains on engineering, mathematics, and physics, professions that are vital to progress in such fields as energy, information processing, optics, and superconductivity. Against the background of the sudden rediscovery of the need for energy R&D, Brooks's argument carries the ring of true prophecy. With respect to biomedical research, both Shannon and Murtagh, reflecting on their intimate experience of programs of the National Institutes of Health, suggest that past policies put the programs at risk by concentrating on research while neglecting the training of physicians and the actual delivery of health services, which were left to the states and the private sector. As this implies, the failure to provide for the actual improvement of health care may have contributed to a backlash against the support of biomedical research and training.

These and other, equally apt criticisms are put forth effectively. Nevertheless, the book as a whole suffers from two defects not uncommon in collections of this sort. Some of the essays deal with tangential issues, thus diffusing the focus of the book; and most of the others simply state separate positions, taking no account of disagreements. Henry Riecken devotes his paper to the exposition of a proposal for "controlled and focussed" social science experiments; Walter A. Rosenblith concentrates on the need to design new organizations uniting government, industry, and the universities in addressing social problems; Patrick Haggerty spends half of his essay posing as the businessman's Ivan Illich, proposing to deschool society by introducing televised courses in the workplace, and the other half on a rather more edifying discussion of the criteria for federal support of civil technology. Each of these issues would benefit from extended and critical commentary, but none is treated by any of the other contributors.

Only one contributor, Gerard Piel, makes his disagreements with some of his colleagues explicit. This is a pity because, as is clear from Piel's polemic, there are some sharp and interesting cleavages among the participants. Piel takes a position similar to that advanced by Michael Polanyi in his defense of the autonomy of the "republic of science," and recently echoed in Jacob Bronowski's call for the "disestablishment" of science. He lights into some of the other essayists for not challenging the American predilection for supporting academic science on grounds of pragmatic social utility. Piel would prefer to see pure science subsidized "as an end in itself, as the supreme expression of our humanity and our success in the attempt at civilization." He argues that the crisis of the universities arose because support for academic science came "by overflow" from expenditures for research on weapons, space, and health instead of from a direct commitment to the advancement of learning.

To perpetuate this system, Piel contends, with its overemphasis on project grants and on tying support for basic research to the development of useful technologies, is to invite recurrent crises and to undermine both the moral authority and the intellectual autonomy of the scientific community. Instead, he urges that the federal government provide stable institutional support for the universities, matching funds from other

sources and merging financing of research and education, in order that "the making of policy for pure science . . . be returned from Washington to the universities." He cites the British University Grants Committee as a model worth emulating in the effort to devise a new federal agency for the distribution of support for higher education.

The two principal targets of Piel's critique are Edward David, Jr., the last of the special assistants to the President for science and technology, and Sir Harold Himsworth, former deputy chairman of the British Medical Research Council. In contrast to the Piel view, David argues that science policy cannot be considered "a subject isolated unto itself" but must be treated as "an integral part of national policy." This seems to imply, as Piel recognizes, that neither research, whether basic or applied, nor graduate education should be supported as ends in themselves, but only to the extent that they are necessary instruments of changing social objectives.

Himsworth seems to arrive at a similar conclusion by a different route. He makes it clear that he does not believe in segregating support for basic and applied research, inasmuch as modern scientific work occurs in interlocking patterns defined more by common subject areas than by any typology of research activities. Each of these subject areas, whether it be energy, materials, or cancer research, forms a "province of knowledge" in which researchers cooperate in a kind of division of labor. For this reason, he argues, it is better that policy be set and support provided by government agencies with comprehensive responsibility for each of the provinces rather than by separate agencies in charge of basic research and others concerned with research related to particular missions. Like David, he would apparently not favor supporting basic research as an end in itself or giving funds to the universities to allocate as they see fit.

In between these two sharply opposed views fall those of the other contributors. Ivan C. Bennett comes closest to the Piel position when he warns that a system designed to serve the needs of government agencies cannot at the same time serve the interests of higher education. In order to make political manipulation less likely, Bennett urges the universities to unite and enter into agreements as to who should produce doctorates. Brooks calls for more stable funding of universities and also urges scientists to compose their differences in private so as to present a united front to the government.

Robert S. Morison tries to locate the golden mean. He agrees with the David view in proposing that applied research be tied to social needs rather than scientific leads, but leans toward the Piel position in arguing that basic research be supported by a variable charge against the total R&D budget. Like Bennett and Brooks, he would have allocations for basic research determined by criteria internal to science, though he too is vague about how this is to be done, suggesting only that scientists make their decisions in concert, as "men of good will," after reading "each other's reports to the Committee on Science and Public Policy of the National Academy of Sciences."

Caryl P. Haskins and William D. McElroy veer toward the David position without actually embracing it. Haskins seems to take it as a fact of political life that the health of science will depend on the health of society and that the direction of research will change as one social priority displaces another. McElroy observes that scientists need to do a better job of explaining to the taxpaying public that basic research is likely to be of enormous ultimate benefit and so should be generously supported. He cites the Illinois Institute of Technology TRACES study as an effective example of such explanation. Like Haskins, however, he does not seem as troubled as Piel that support for science should now be coming in the name of improving the environment or enhancing economic growth, as it previously came for military purposes or space exploration.

It would have made for a livelier and perhaps a more definitive treatment of the issues if these differences had been made more explicit and brought into direct confrontation with each other. As it is, too much of the argumentation is hortatory rather than analytic and certain crucial questions are given only cursory attention. One of these questions is whether a central mechanism for setting and coordinating science policy is or is not desirable. There is some pleading in these essays for "better planning" but little detailed discussion of how this can be achieved. In view of the recent changes in the treatment of science policy in the executive branch, this omission is especially regrettable.

By contrast with the Rockefeller volume, the book by Ronald Hayes takes a look at the issues of science policy that is both comprehensive and critical, if not overpoweringly persuasive. Having served for five years as a scientist-administrator in Ottawa, Hayes has now returned to the academic shelter of Dalhousie University, where he holds the distinguished title of Killam Professor of Environmental Science. In this book he reflects on his experience and offers an engagingly personal and sharply opinionated view about what he sees as the threat to Canadian science posed by recent proposals for a greater degree of centralized planning.

His hostility to the recommendations contained in the "Lamontagne report" (*A Science Policy for Canada,* 3 vols., 1970–1973, available from Information Canada, Ottawa) is unabashed and acerbic. More than once, this hostility tempts him into gross exaggerations and caricatures, nowhere more obviously perhaps than in his comparison of the Lamontagne proposals with the management of research in the Soviet Union and Czechoslovakia. In fact, all that the report urges is that Canada commit itself to a national science policy aimed at raising the level of public support (without detracting from support for basic research) with the immediate aim of encouraging high-technology industry and the ultimate aim of improving the quality of national life. Although it urges the creation of a ministry for science and technology, it does not envision this ministry as a Canadian equivalent of the Soviet state planning agency. It scarcely proposes a collectivization of Canadian private enterprise or the creation of national research institutes separate from the universities and industry. In short, therefore, the comparison Hayes draws between these proposals and Eastern European practice is mainly propagandistic.

Stripped of such distortions, however, Hayes's argument reflects the suspicions of many Canadian scientists, who view the call for greater intervention in their affairs by bureaucrats and economizers in Ottawa with exactly the same misgivings as their counterparts south of the 49th parallel. At his best, Hayes make some telling points in behalf of this attitude. He points out, quite rightly, that the Minister of State for Science and Technology now serving in the Canadian cabinet and the Science Secretariat which assists him are bound to be overshadowed by ministers with operative responsibilities and by the Treasury Board, which is the

Canadian equivalent of the Office of Management and Budget. Because parliamentary committees are considerably weaker than their congressional counterparts, the Treasury Board is, if anything, an even more powerful force in the determination of budgetary allocations than the OMB. Hayes is dubious about the ability of any nonscientist experts to decide on priorities in scientific research, but he is especially leery of the ability of the civil servants in the Treasury Board to make such decisions. As he puts his case, in a typically pungent remark, "Learning about natural science policy from economists and bureaucrats is like learning about love in a brothel; the lessons are clear enough but oversimplified."

Rather than trust in the bureaucrats and futurologists, Hayes would rely on what he thinks of as the old-fashioned laissez-faire approach decried by the Lamontagne committee. This approach would work by the method of successive approximations. It would emphasize respect for the views of distinguished scientists. And it would introduce a novel quasi-judicial forum for big science projects—on which the staff of the Treasury Board would presumably be disqualified from serving. These suggestions are not without merit, though Hayes is so haunted by the combined specters of Karl Marx and Franz Kafka that he doubts scientists will long remain free in Canada. Anyone who reads the Lamontagne report with a measure of detachment and consults the other recent books on Canadian science policy—G. Bruce Doern, *Science and Politics in Canada* (McGill–Queens University Press, 1972) and N. H. Lithwick, *Canada's Science Policy and the Economy* (Methuen, 1969)—will be likely to conclude that Hayes's worst fears are grounded more on his own vivid imagination than on the realities.

As these two books demonstrate, however, the question of how governments should support science remains subject to a surprising degree of uncertainty and confusion. Despite fairly long experience and much learned disputation, there is still wide disagreement about what needs to be done to balance the advancement of learning with the application of research and education to social needs. Could it be that this controversy is so fundamental as to resist consensual resolution?

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Progress in China

Medicine and Public Health in the People's Republic of China. JOSEPH R. QUINN, Ed. Fogarty International Center, Bethesda, Md., 1973 (available from the Superintendent of Documents, Washington, D.C.). xii, 334 pp. $2.45. N.I.H. 73-67. Geographic Health Studies.

Public Health in the People's Republic of China. Proceedings of a conference, Ann Arbor, Mich., May 1972. MYRON E. WEGMAN, TSUNG-YI LIN, and ELIZABETH F. PURCELL, Eds. Josiah Macy, Jr. Foundation, New York, 1973. x, 354 pp., illus. Paper, $7.50. Macy Foundation Series on Medicine and Public Health in China.

Modern China and Traditional Chinese Medicine. Proceedings of a symposium, Madison, Wis., Apr. 1972. GUENTER B. RISSE, Ed. Thomas, Springfield, Ill., 1973. viii, 168 pp. $8.95.

Medicine and Society in China. Report of a conference, New York, Mar. 1973. JOHN Z. BOWERS and ELIZABETH F. PURCELL, Eds. Josiah Macy, Jr. Foundation, New York, 1974. viii, 176 pp. Paper, $7.50. Macy Foundation Series on Medicine and Public Health in China.

The Amazing Story of Health Care in New China. K. K. JAIN. Rodale, Emmaus, Pa., 1973. viii, 184 pp., illus. $6.95.

Serve the People. Observations on Medicine in the People's Republic of China. VICTOR W. SIDEL and RUTH SIDEL. Josiah Macy, Jr. Foundation, New York, 1973. xiv, 318 pp., illus. $10. Macy Foundation Series on Medicine and Public Health in China.

Peking is justly proud of the outstanding progress China has made in the health field, and much publicity has been given to these achievements by the Chinese news media. Because medicine is the most universal of sciences and because China is eager to make its accomplishments known to the outside world, members of the medical profession have constituted a disproportionate number of all visitors to China during the past few years. It is not surprising, therefore, that much of what the American public has heard and read about China has come to them through the eyes of physicians and biomedical scientists and that much curiosity on the part of both professionals and laymen has centered on public health, on medicine, and, of course, on acupuncture. The six books under review here are both causes and results of the remarkable interest in these subjects; they should satisfy the curiosity of some and will only stimulate that of others.

Four of the books are collections of papers on various aspects of health and medicine in China—most of them presented or submitted just after President Nixon's week of negotiations with Premier Chou En-lai in February 1972 and before their agreement to facilitate the development of scientific, technological, and cultural exchanges had time to be implemented. Consequently, relatively few of the almost 40 contributors to these publications (some of them with papers in more than one of the books) had yet been to the People's Republic of China; this does not detract from the validity of the commentaries. Despite the inevitable variations in quality in any collection of articles, the analysis is generally sound, the topics are handled well, and the reader should get an accurate picture of how the Chinese managed to improve the health of the population and of how the public health system is currently functioning.

The volumes edited by Quinn and by Wegman, Lin, and Purcell are very similar in coverage. Both include something of the history of medicine and public health, Chinese traditional medicine, the organization and delivery of health care, the control of infectious and parasitic diseases, nutrition, and other basic health topics. The volume edited by Risse discusses some of these topics, but more than a quarter of the effort is devoted specifically to acupuncture and particularly to acupuncture anesthesia. Almost two-thirds of Bowers and Purcell's volume deals with the pre-1949 period, but the selected topics are all relevant to China's contemporary health policies and problems, which are presented and discussed in the last third of the book. Useful perspective is provided by the interdisciplinary background of the participants, and the informal presentation makes for easy reading.