board of directors has never presumed to play any role in Union Carbide's management of ORNL or to advise the AEC concerning its management or programs. In the far west the University of California continued unperturbed with its contracts for the radiation and Los Alamos laboratories. The midwestern universities looked on Associated Universities, Incorporated, as the ideal model for the operation of Argonne, but the AEC, with a host of other pressing problems, did not want to change the contractor for a major facility which played a vital role in the achievement of its mission when it already had an established and adequate one in the University of Chicago.

When the AEC built the multi-Gev cosmotron at Brookhaven and the bevatron at Berkeley, a strong movement arose for such an accelerator in the midwest. With Associated Universities as a model, however, the midwestern universities were determined not to have the accelerator built at Argonne under the University of Chicago contract. Instead they formed a separate corporation, Midwest Universities Research Association (MURA), in 1954 and chose a site in Madison, Wisconsin. Then four years later many of the same institutions and others incorporated Associated Midwest Universities, and it contracted with AEC two years later to carry out liaison functions between the universities and Argonne. Thus arose the anomaly of two university associations, one anti-Argonne and the other pro-Argonne, a majority of whose members were the same institutions! The anomaly was intensified when in the fall of 1963 authorization was being requested which would have resulted in two 12-Gev accelerators in the midwest, one at Argonne and the other at Madison under MURA. One of Lyndon Johnson's first acts as president was to kill this authorization and along with it MURA.

Throughout this academic bickering over its control, Argonne itself was developing steadily as one of the nation's great scientific institutions. Its staff had a distinguished record of publication representing substantial contributions to 20th-century science. Increasing numbers of professors and students from midwestern institutions, particularly in nuclear engineering, were using the laboratory. One of the great discoveries of recent science, the chemical compounds of the noble gas xenon, was made there by a visiting faculty member in collaboration with Argonne staff. Thus while the controversy raged at the upper level of university deans and administrators, Argonne was all along playing the role with faculty and students originally intended for it by the Council of Participating Institutions.

By way of healing the deep wounds left in the wake of the MURA decision, the universities, with the support of the AEC, dissolved both MURA and AMU and formed in their place Argonne Universities Association, which now shares with the University of Chicago the contract for the operation of Argonne. At long last the idea of the universities' "controlling" and "governing" the laboratory was actualized. One suspects, however, that the association's board of trustees may be discovering that this is a hollow victory. In all AEC multipurpose laboratories, mission-oriented programs are controlled and governed almost exclusively by the headquarters division responsible, while basic research programs are governed by the scientific staff, as they are at universities, within the limits of the funds the headquarters division is willing to provide. The board of trustees of the contractor, after the crucial step of appointing the laboratory director with AEC approval, is left in practice with no very significant input into the process.

This book provides an interesting and informative object lesson for academic institutions and scientists in general when they choose to enter the arena of American politics. Its title comes from a comment made by Oppenheimer, who through much of the controversy was chairman of the AEC General Advisory Committee: "I think on this we probably pushed the Commission and they regarded us as people who were, after all, largely professors and university presidents and we were pleading a special interest. We did plead a special interest, but we believed it to be in the national interest, too." Many other special-interest groups in our society believe also that they are working for the national interest. But what this book teaches very clearly is that even so influential and nominally objective a special interest as a group of our most distinguished academic institutions, when they push a federal agency, and ultimately the President and the Congress, too far, must yield to the power of these authorities to finally decide what the national interest is.

The legacy left to the nation by the Manhattan District for the operation of large federal laboratories and industrial plants by private and other nongovernment corporations is a precious one from which the nation has gained great strength. The AEC has retained this mode of operation and a few other agencies have used it in a few cases. The great hope is that more federal agencies will come to see the great potential of this method for carrying out their missions. If they are to do so, the responsibility rests primarily on the AEC contractors to demonstrate that this arrangement does not generate intolerable problems for the agency employing it and that contractors can be depended upon to genuinely cooperate with the agency toward the maximum achievement of its mission. The nation faces grave problems in the '70's and '80's for which our very best science and technology will be required. The best and the most lasting service which the publication of this book will perform will be to persuade contractors, and especially incorporated university associations, of the grave responsibility that rests upon them to make the system work, not for any special interest, but for the greater national interest.

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The Uncloistering of Science

The American Ideology of National Science, 1919–1930. RONALD C. TOBEY. University of Pittsburgh Press, Pittsburgh, 1971. xiv, 264 pp. $9.95.

In this slim volume Tobey relates the fascinating story of attempts made by a group of leaders of the American scientific community to transfer the new organization and high status that science achieved during World War I into the postwar period. The war with its new demands upon science had accelerated the tendency, which had existed before the beginning of the century, toward cooperative effort and centralization of scientific activity. It had brought scientists out of their cloistered laboratories and placed them in the public eye as never before. To many scientists—George Ellery Hale, Robert A. Millikan, E. E. Slosson, and others—the days of individual effort were gone forever and science had been launched into a new era in which continued productivity would depend upon unity on the part of scientists and broad popular support. Thus they embarked

upon a dual campaign aimed at continuing the wartime organization and also at convincing the public of the "explicit relevance of the values of professional science to the values of nonscientists" (p. xi). These are the two meanings the author gives to his label "national science," and he indicates that he will be more concerned with the second.

The author carries the story through Science Service, an organization founded by E. W. Scripps for the purpose of convincing the public that pure science was the basis of social progress, through the controversy, to which he attaches enormous importance, over Einstein's theories, to the abortive campaign for a National Research Endowment, which he sees as the final death of the movement.

One can quibble with the author at certain points. This reader, for example, believes that he attaches far too much importance to the Einstein controversy as a cause of the alienation of the public. To say that it "shared national attention with the strike of coal workers, . . . disagreement between President Wilson and the Senate critics over ratification of the Versailles Treaty, the Russian civil war, and the political struggle over prohibition" (p. 105) is to suggest too great a degree of public interest in science and to mistake a few editorials in the *New York Times* for a national furor. One could even question the existence of a well-organized "movement" and could wonder whether the idea of a "national science" was ever as clear to those involved as it is to the author.

But saying the obvious—the book is not perfect—should not detract from the recognition that Tobey has an important story to tell and that, in general, he tells it well. That the effort, well organized or not, confused in the minds of proponents or not, to develop a "national science" during that period failed did have the consequences that Tobey suggests, and those consequences are still with us. Neither the values nor the method of pure science have been integrated into the liberal consensus, engineering and technology do still continue to possess the name of science and to be more highly regarded than pure science, and the failure did make inevitable the conclusion that war, hot or cold, is the only justification for national science (p. 230).

The reasons for the failure are clear. The conservative ideology of leading scientists made it difficult to secure the necessary primary relationship with the general public and to maintain the independence of pure science from industrial capitalism (p. 200). On the other hand, the effort to convince business to subscribe to a fund for pure science out of self-interest failed because industrialists could not be convinced that pure science, rather than engineering or applied science, was the basis of industrial profits (p. 217). Pure scientists, faced with a similar difficulty today, may find it instructive to study their predecessors' efforts.

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Ecological Perspective

Ecosystem Structure and Function. Proceedings of the 31st Annual Biology Colloquium, Corvallis, Ore., April 1970. JOHN A. WIENS, Ed. Oregon State University Press, Corvallis, 1972. 176 pp., illus. $5.

The global ecosystem is permeated everywhere by man the exploiter, whose behavior as such is so inextricably linked to a complex web of social, economic, and political mores that simple solutions will work only rarely. Ecological understanding has been sorely missing in the past, but the ultimate resolution of mankind's awesome problems will require the collective wisdom of all elements of society, incorporating a sound ecological perspective.

This neat book contains the proceedings of a colloquium on the timely topic of ecosystem structure and function. Eugene Odum as colloquium chairman gave the opening address and led the discussion. The concept of the unity of organisms and environment is an old one, but the use of the word ecosystem to express it was first proposed by A. G. Tansley in 1935. Ecologists have derived the following significant ideas from their analyses of ecosystems: Energy declines and materials, including pollutants, concentrate with each step in the food chain. High biological productivity is achieved through energy subsidies. Both harvest and pollution stresses reduce the energy available for self maintenance, and man will have to pay the cost of added maintenance including instabilities, vulnerability of plants to insects, and social disorder. Diversity is directly correlated with stability of ecosystems and perhaps inversely correlated with productivity. Human population will overshoot some vital resource unless man can reduce growth rates. Recycling of water and minerals must become a major goal of society. Odum concludes, "In an industrialized society energy is not likely to be limiting, but the pollution consequences of the use of energy and exploitation of resources are limiting."

Nutrient cycling is closely geared to all ecosystem functions and chemical weathering is regulated by decomposition. G. E. Likens and F. H. Bormann elegantly describe how man will protect his own interests if he harvests ecosystems more intelligently. For example, if the bark is stripped from logs before they are removed from the forest much calcium will be returned to the forest floor. Frank Golley in his lecture on energy flux through ecosystems gives a splendid summary of net and gross primary production in the global ecosystems. He goes on to comment in answer to a question that man will err in his interaction with parts of the biosphere and that we must preserve the repair processes to bring the system back to equilibrium. Golley suggests that these repair processes exist within the natural habitats of the world. The book is enlivened by inclusion of the questions and answers following each paper. Gordon Riley following his fine description of patterns of production in marine ecosystems was asked about the productivity of the open oceans, the harvesting of which he described as an engineering and economic challenge to man.

By far the most technical paper of the colloquium is one by E. C. Pielou on the measurement of structure in animal communities, in which she describes "the innate unpredictability of ecosystems" but notes that we should avoid errors which are avoidable by the use of factual knowledge and sound reasoning. A splendid description of the evolution of natural communities is given by R. H. Whittaker and G. M. Woodwell. The colloquium discussion ends with several astute comments by Whittaker to the effect that we need to relate population and biosphere, resources and economic function, cultural morale and political means, and that there "might emerge an integrated strategy for the human future."

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