history of the animal rights movement appears to confirm this conclusion.

Finally, the very extremism and intolerance we find so objectionable in the fundamentalists have been shown in other contexts to foster the solidarity and commitment necessary for movement success. By drawing a very stark moral line between "us" and "them," all manner of political radicals imbue themselves with the moral certainty and fervor that fuel action. Animal rights fundamentalists afford but the latest example of the political functions that flow from narrow minds.

Ironically, Jasper and Nelkin conclude the book with an editorial admonition that flies in the face of the empirical findings noted above. They warn that "in the long run, radical positions may be counterproductive. Fundamentalist tactics undermine the ability to engage those with competing visions in the democratic conversation necessary to develop acceptable policies." Much as I share the ideological sensibilities expressed by the authors, the history of social movements suggests an opposite conclusion. By leavening their descriptive account of the movement with more analysis grounded in the study of social movements more broadly, Jasper and Nelkin might well have tempered their final conclusion. More important, they would have deepened the reader's understanding of social movement processes as well as writing a first-rate history of the animal rights crusade.

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An Issue of Distribution

The Greatest Good to the Greatest Number. Penicillin Rationing on the American Home Front, 1940–1945. DAVID P. ADAMS. Lang, New York, 1991. x, 227 pp. $38.95. American University Studies, series 9, vol. 95.

The discovery of the antimicrobial action of the mold *Penicillium* by Alexander Fleming is one of the best-known stories in recent medical history, and the complex process of development pushed by English researchers, American government scientists, and the American pharmaceutical industry has also received ample treatment. David P. Adams has now added a compact, well-researched, and intelligently conceived account of the drug's impact on the public mind and the methods adopted by the Roosevelt Administration to make a limited supply of penicillin available to the public.

The focus is on the social impact not only of a scientific discovery but of the medical establishment that came to control the distribution of penicillin to civilians. During World War II, white males mostly of Protestant upbringing, usually with close ties to the eastern universities, ran a system of medical research and development that was relatively compact, frankly elitist, and highly effective. Prominent academic physicians held posts in an interlocking directorate that included the medical corps of the armed forces, the Army Epidemiological Board, the relevant committees of the National Research Council (NRC), and the Committee on Medical Research of Vannevar Bush's Office of Scientific Research and Development. They operated in the heyday of Rooseveltian bureaucratic management, and in a time when Americans—at least by comparison with the present—tended to be deferential to authority figures.

The group that dealt with penicillin fairly represented the whole, being small, homogeneous, and self-assured. In 1943 clinical trials convinced the armed forces of the efficacy of penicillin, and their sudden heavy demands for the drug impacted on a pharmaceutical industry in which output was low and the techniques of mass production were still in process of development. At about the same time, stories of wonderful cures also began to spread in the news media, creating a roaring public demand. Some of the excitement was driven by a vague belief that penicillin cured anything, including cancer. Some of it was grossly sentimental, featuring newspaper accounts of deathbed appeals for sick children, whose illnesses might or might not be treatable. Much of it, however, was driven by the genuine needs of sick people who hoped to benefit from the "wonder drug" and their physicians who hoped to save them.

Somebody had to say no to many of them, and he had to have some logical and politically acceptable basis on which to do so. Adams's hero is Chester Keefer, M.D., chairman of the Committee on Chemotherapeutic and Other Agents of the NRC's Division of Medical Research, who enforced rationing in the face of severe public criticism during the period when escalating demand pressed hardest against still inadequate supplies. Basically, Keefer ran a system under which the drug was allotted free of charge, first to cases in which clinical research promised results useful to the armed forces, and second to acute cases of diseases that were known to be treatable by it. Adams argues that alternative methods of distribution would have been less equitable and that bureaucratic impersonality and the appearance of scientific objectivity must have allowed many physicians to refuse to make attempts to obtain the drug in inappropriate cases without feelings of personal guilt.

Despite the book's title, it seems evident that penicillin allotment had little to do with the greatest good for the greatest number and very much to do with the war effort. With 85 percent of the supply going directly to the armed forces and military relevance determining in substantial part who got the rest, Keefer operated a system that Adams properly compares to triage, under which chronic conditions and the needs of nursing home patients got short shrift. The system was able to work largely because the nation accepted its basic premises as a wartime exigency.

Hence Adams's repeated comparisons of the penicillin issue to organ donation, bone marrow transplants, AZT, and other problems of today, where cost largely determines the outcome, seem to have limited real significance. The problem of distributing scarce resources recurs ever more urgently as medicine's miracles become more costly, but the solution, whatever it may be, cannot be the same as during World War II. The voice of history, as usual, speaks in tones of irony, offering suggestive analogies but no answers.

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Centuries of Science

The Science Matrix. The Journey, Travails, Triumphs. FREDERICK SEITZ. Springer-Verlag, New York, 1992. xiv, 146 pp. $39.50.

In this series of essays Frederick Seitz describes how the natural sciences arose and what they mean to our present civilization. About half of the book is devoted to the past, with the remainder given over to comments on the present and future interactions of science and society. Seitz has brought to these topics an unusual background. He was one of the early workers in and professors of solid state physics and was a founding editor of a well-known series of books on the subject. Later, he was president of the National Academy of Sciences and then of the Rockefeller University. A lifelong student of the history of science, he has approached it from a physicist's viewpoint in identifying crucial factors and discoveries. He has provided capsule biographies of key contributors, with brief descriptions of the circumstances surrounding them. He emphasizes the important role of the Greeks, including Pythagoras, Plato, Aristotle, Euclid, and Archimedes. Their contributions were pre-

served and extended by the Arabs and ultimately the knowledge was transferred to western Europe. Seitz traces the flowering of science during the 17th century and then describes its development in the United States. As might be expected, he devotes considerable attention to the early role of the National Academy of Sciences.

From observations of the way in which science developed in various regions, the author lists the principal factors required if science is to move ahead. In brief these are: the existence of a leisure class, freedom to ponder, logistical support, an institutional environment, communication among investigators, pressure for valid conclusions, experimentation, and proper indigenous culture.

One of the puzzles Seitz addresses is the failure of the very gifted Chinese to invent science. Two thousand years ago, they made many technological advances. Seitz concludes that the culture was not conducive to science. In addition, he was told by a Chinese scholar that an individual who discovered a scientific law would have been inclined to keep it a family secret.

Essays in the second half of the book deal with such present-day topics as "Science, technology and the environment," "Fraud, piracy and priority in science," "Big science—small science," and "The future of science." As to the future, Seitz is slightly optimistic but cautious. Factors favorable to science include the innate curiosity of humans, practical needs, national pride and global problems such as pandemics. Unfavorable factors include costs of equipment, decline of interest among gifted individuals, and anti-science movements. The future of public opinion is not predictable. In the past, charismatic leaders have been able to sway the public in directions that have seemed irrational and turned out to be highly destructive.

The book can be read with interest by all natural scientists, engineers, and physicians. It would provide knowledge and perspective to undergraduates, and it would be informative to intelligent lay persons.

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