Book Reviews

Global Environment

Man's Impact on the Climate. WILLIAM H. MATTHEWS, WILLIAM KELLOGG, and G. D. ROBINSON, Eds. M.I.T. Press, Cambridge, Mass., 1971. xviii, 594 pp., illus. $19.50.

Inadvertent Climate Modification. Report of the Study of Man's Impact on Climate (SMIC). M.I.T. Press, Cambridge, Mass., 1971. xxiv, 308 pp., illus. Paper, $2.95.

Growing numbers of scientists have begun to examine environmental problems, and moreover to present their conclusions in forums accessible to the public and in forms useful to the policymaker. These books originate directly from such efforts. The overlap in subject implied by the titles is more than a coincidence. The larger volume is a compilation of source materials relating to climate from a study of critical environmental problems that took place in Williamstown, Massachusetts, during the summer of 1970, under M.I.T. sponsorship. The editors of this source book were principals in organizing a second, more international study of three weeks' duration last summer, also under M.I.T. sponsorship and with the Swedish Academies of Science and Engineering Science as hosts. The smaller volume is the report of this second study, which was conducted by 30 assorted specialists (mostly atmospheric scientists) from 14 countries. In both studies the participants, with an eye to the United Nations Conference on the Environment to be held in Stockholm this summer, attempted to draw attention to potential problems caused by man's activities, to summarize briefly what is known about such problems, and to recommend steps for closing gaps in our present knowledge.

The larger volume contains a number of excellent papers, but the reader who wants a general introduction to climatology and the problems that man's activities raise will do better to acquire the smaller book. The specialist, too, may find the SMIC report valuable in that it includes an up-to-date discussion of the stratospheric ozone layer and provides a better bibliography than the larger collection.

For the most part, the SMIC report contains little that is new. Before we can evaluate the possibilities of man-caused climatic changes, the report points out, we need to ascertain the role that sea ice plays in moderating climate, to understand better the effects of particulates (natural and man-made) on the lower atmosphere, and to improve monitoring and modeling capabilities. One subject of special concern is the potential of nitrogen oxides and other trace contaminants of the upper atmosphere for depleting the ozone that shields the earth and its biota, including man, from dangerous amounts of ultraviolet radiation. Several investigators have recently suggested that nitrogen oxides injected into the upper atmosphere by supersonic transports could play a catalytic role in a series of photochemical reactions leading to removal of ozone, possibly to an extent that would admit biologically significant amounts of ultraviolet radiation. The contribution of the SMIC report to what is still an ongoing debate on the subject is to point out that, while the threat is real, it is not yet possible to determine the magnitude of the effect; there are uncertainties about the rates of some of the reactions involved, about the dynamics of the stratosphere and the amount of mixing to be expected, and about the naturally occurring concentrations of trace constituents in the upper atmosphere. Similar conclusions were reached by an ad hoc panel of the National Academy of Sciences that has recently looked into the question.

The SMIC report recommends, as do all parties concerned, that questions about ozone depletion should be answered before large numbers of SST's are permitted to fly. One gets the impression, however, that the SMIC study group does not believe there is an immediate danger from this problem. It is interesting that the earlier Williamstown study, whose recommendations concerning the climate are reproduced in the source book, dismissed ozone depletion entirely as a problem and overlooked the role of nitrogen oxides. These two books together thus provide us with a lesson—a warning, perhaps, that the considered judgment of assembled experts can be wrong, and a caution to accept the conclusion of this or any similar report only tentatively. What should be remembered, as the SMIC report itself emphasizes, is that the range of our ignorance about the climate is greater than that of our knowledge.

The SMIC report provides an important set of policy recommendations and a good treatment of man's potential impact on climate. Its most attractive feature, however, is its summary of our understanding of climatic processes and the discussion of research approaches and problems. Written for the nonspecialist, these sections of the report are clear and direct. A brief outline of climatic history, for example, points out the extent of climatic changes in the past, thus providing a perspective that is important for evaluating man-made changes. The discussion of the types of mathematical models of climate and their assumptions and limitations makes clear both how difficult it is to provide unambiguous answers to questions about climate and how crude, relative to the task, our present research tools are.

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Science

Marine Pollution

Impingement of Man on the Oceans. DONALD W. HOOD, Ed. Wiley-Interscience, New York, 1971. xii, 738 pp., illus. $24.95.

There is a lot of arrant nonsense being written and said about pollution of the ocean these days. When well-known ocean specialists imply that the open oceans are going to "die" (whatever that means) in a few decades it is clearly time for a responsible look at the facts. Of course, such assessments seldom achieve the global publicity that is accorded to the prophets of doom, but they are essential if sensible actions are to be taken to protect the marine environment. Exposure to the facts may also have a salutary effect on those who consider the ocean too vast to be spoiled by man.

For these facts one can turn to the excellent studies, such as those on radioactivity in the marine environment and on chlorinated hydrocarbons, pub-

lished by the National Academy of Sciences, or to other recent committee reports. Now a commercial publisher has produced a broad treatment of the problem. The book is a compendium, edited by an able marine chemist and containing 26 chapters written by some 30 marine specialists. The introduction states, "This book is not intended to be a comprehensive document on the subject of man's effect on the oceans; it is directed, rather, at arousing serious thought on the subject." However, it is difficult to focus the thoughts of such a multitude of authors, and one cannot escape the impression that the publishers saw this substantial and relatively expensive volume more as a technical reference than as an opinion-molding monograph.

The two major sections, on transport processes and reservoirs and on "artifacts" of man, constitute about 60 percent of the book and contain most of the papers of lasting value. The former includes an important and illuminating review of horizontal and vertical mixing processes in the ocean (Okubo) and useful discussions of river inputs (Turekian) and atmospheric transport (Goldberg). The latter section has nine chapters on major classes of pollutants. Particularly noteworthy are those on lead (Patterson), carbon dioxide (Broecker, Li, and Peng), radioactivity (Rice and Wolfe) and heavy metals (Merlini). The paper on chlorinated hydrocarbons is an interesting mix of fact and opinion; a large paper on the petroleum problem makes good reading but is pretty short on solid information; articles on domestic wastes and on the biological effects of petroleum are disappointingly thin.

There are brief sections on chemical and other models and a section on man's alteration of the coastal environment, the only concession to "impingement" other than pollution. The discussions of coastal engineering, living resources, and marine environment are not substantial, and there is no mention of the effects of major engineering projects such as the Aswan Dam or sea-level canals. The final section, on implications of man's activities in ocean resource development, contains papers on regulation of pollution from offshore oil pollution and on public policy on the ocean, both of which seem out of place in a publication of such permanent nature. The final paper, on uses of the oceans (Hood and McRoy), would have made a good introduction to the book.

Better coverage of the subject might have been achieved if topics had been combined into fewer and more systematically integrated chapters. There is much of value in this book, but it is a less effective weapon against misinformation and propaganda than is wanted.

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Differentiation

Developmental Genetics. CLEMENT L. MARKERT and HEINRICH URSPRUNG. Prentice-Hall, Englewood Cliffs, N.J., 1971. x, 215 pp., illus. Cloth, $6.95; paper, $3.50. Foundations of Developmental Biology Series.

It has been clear since the turn of the century that the central paradox of development—the problem of differentiation—was best stated in genetic terms. Now there is a new language, the language of molecular biology, and a vast new array of powerful laboratory tools. Markert and Ursprung set out to present in modern terms what is known about the various means by which differential gene action occurs, and how differential gene expression is translated into the drama of epigenesis. They tackle head on, in clear prose and well-chosen examples, the issue: why and how are different genes expressed in different places at different times? The new molecular vocabulary now available allows them to state questions with precision in terms of the control of transcriptional, translational, and post-translational mechanisms.

Only one chapter and parts of a few others deal extensively with the materials that would have been found in a book on the same topic 15 years ago—pleiotropy, phenocopies, regeneration, lethal mutants, maternal effects, and interspecific hybrids. Most of the book is devoted to such topics as the evidence for differential transcription and its mechanisms, the control of protein synthesis, the stability of proteins and messenger RNA molecules, the assembly of enzyme subunits, and chromosome structure. Many will wish some other examples had been included, or that some included had been enlarged upon. For instance, cyclic AMP is not mentioned in connection with hormone action, nor is the concept of prepattern introduced (although pattern is), nor is the danger of the use and interpretation of experiments employing actinomycin underlined. One inadequacy is the very short and sometimes cryptic figure legends, especially in the early part of the book. There are well selected, but somewhat short, reference lists at the end of each chapter. The book covers wide ground, its omissions are relatively minor, and on the whole the examples and issues are remarkable for their thoughtful choice and presentation.

The book is aimed at "initiated" undergraduates and beginning graduate students. The explanations are so clear I imagine that undergraduates with only a semester or two of introductory biology could understand and profit from it.

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Experimental Gerontology

Principles of Mammalian Aging. ROBERT R. KOHN. Prentice-Hall, Englewood Cliffs, N.J., 1971. xiv, 172 pp., illus. Cloth, $7.95; paper, $4.95. Foundations of Developmental Biology Series.

Two central problems facing experimental gerontologists are the diverse nature of the field and the distinguishing of causes from effects. The first difficulty, as well as the apparent lack of conceptual framework, discourages many capable investigators from selecting this research area at an early stage in their careers. *Principles of Mammalian Aging*, organized primarily for such individuals, outlines ample representative studies on topics ranging from the aging of isolated macromolecules to aging and mortality in the intact organism. Pretense of encyclopedic coverage is avoided and interested readers, acquainted with essentials through this exposure, are referred to reviews and the more detailed works of Comfort and Strehler.

On the more problematical questions concerning proposed mechanisms and distinction between cause and effect relationships the author frequently is at variance with a sizable segment of the scientific community involved in this research area. In essence he argues that there is no substantial evidence to support theories suggesting that intrinsic cellular alterations lead to aging in the whole animal. Instead he believes that cross-linking theories, especially applied to collagen and other extracellular pro-