influence of "group" or "system" needs of a psychological character with his predominant emphasis on the baneful role of Stalin's "political realism." This reader thinks these two lines of interpretation are complementary, but Joravsky does little to clarify the relationships between them. Among other seeming contradictions that are left to the reader to resolve, the view that the pragmatic Kremlin began to abandon Lysenkoism in the late 1930's, and especially from 1950 on, clashes with abundant evidence offered regarding its efflorescence from 1948 to 1952, and also with evidence, adduced by Medvedev and others, of its continued, though of course greatly reduced, influence even after Khrushchev's ouster.

This reviewer finds plausible Joravsky's thesis that under Soviet conditions, especially in the 1930's, it was all too easy both for the supreme political chiefs and their Lysenkoite junior partners to engage in a self-serving combination of self-deception and conscious fraud. However, he feels that an aspect of the situation to which Joravsky pays insufficient attention is that some of the information on which official agricultural and scientific policies were based was, so far as the users of the information knew, generated by "scientific" methods. The trouble seems to have been that the agronomists and agricultural officials who conducted "experiments" in the field to test Lysenkoite methods were woefully lacking in mastery or even knowledge of such techniques as controlled experiment and replication, and were oblivious to the scientific values of consistency, rigor, and objectivity.

Joravsky seems to overlook, or at least leave in almost total obscurity, possible relationships between the Bolsheviks' destruction of private property, the market economy, and other sources of countervailing power, and the helplessness of scientists vis-à-vis politicians in Soviet Russia. Whatever one's preferences regarding economic systems may be, it seems clear that in a collectivistic dictatorship the fate of science is likely to be grim if a dictator decides to impose his possibly ignorant and misguided preferences on scientists, many of whom, in such a setting, unlike that provided in a more pluralistic socioeconomic structure, may literally find themselves with no place to hide and with no source of livelihood.

We should restrain the impulse to sweeping generalization on the basis of even the most interesting case study. However, it appears to this reviewer that non-Soviet readers in the 1970's can derive from such studies as Joravsky's increased understanding not only of the problems confronting their Soviet colleagues but also of problems that are increasingly at the forefront of public attention in the West. In an era when, even in America, doubts are voiced in some quarters regarding the very legitimacy of the scientific enterprise, it is salutary to be reminded, by reflection on relevant aspects of Soviet experience, of the dependence of many values, both material and nonmaterial, on the vigor and security of a nation's scientific and intellectual community.

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A Worldwide View

Global Effects of Environmental Pollution. An AAAS symposium, Dallas, Texas, Dec. 1968. S. FRED SINGER, Ed. Springer-Verlag, New York, and Reidel, Dordrecht, 1970. xii, 218 pp., illus. $12.

The purpose of the symposium from which this volume results was to "discuss the worldwide effects which may arise from local pollution, and to try to uncover hitherto [unsuspected] effects which might have serious consequences." In addition, it was felt that the symposium would help to provide a public forum in preparation for the United Nations Conference on Human Environment to be held in Sweden in 1972. The proceedings volume contains edited versions of the papers that were given (plus a few additional invited contributions) and a brief review of the panel discussion that followed the presentations. The book is divided into four sections, with a brief introduction (in general, a preview) to each. A number of the papers could have been placed in any of the sections, however. There is a great variation in the quality and length of the papers, but although some seem trivial or parochial, most represent significant contributions to what is known concerning the global environmental problem.

The earth's atmospheric envelope has been constantly evolving, chiefly as a result of degassing from the earth's interior. Although the changes that have taken place over geological ages are the result of natural processes, man's activities during the past century have contributed significantly to local and global variations in the concentration of the so-called trace gases. The first section of the book deals with the origin and distribution of atmospheric constituents. The evolution of the oceans and of life provided the necessary conditions for cyclic exchange among the atmosphere, biosphere, and oceans. An interesting background paper by F. S. Johnson on the processes by which the major constituents (N_2, O_2, H_2O, and CO_2) developed to their present state and the resulting time constants for the different exchange processes constitutes the lead article. In the same section, the sources and distribution of some of the minor gases (CO, SO_2, and NO_x) are discussed separately by Louis Jaffe and by Elmer Robinson and Robert C. Robbins. These two papers summarize what is known of the concentration and variations of these contaminants. Whereas at present most of the NO and NO_2 and SO_2 enters the atmosphere through natural or biological sources, it is pointed out that practically all atmospheric CO is man-made, with approximately 60 percent coming from motor-vehicle exhaust. Jaffe also indicates that the CO cycle in the atmosphere is still imperfectly understood and that no adequate sink has yet been suggested. In this same section Syukuro Manabe reviews some of his previous calculations of the possible effect of changes in the concentration of atmospheric CO_2 on the surface and free air temperatures. Manabe correctly points out that such calculations need to be made more realistic by extension of the radiation models to three dimensions and inclusion of atmospheric motions. There is also a need, not mentioned in this paper, for including in such a model a mechanism for cloud generation, variations in cloudiness being closely linked with the energy cycle of the earth-atmosphere system. (There is a very brief comment on some aspect of the role of clouds in a later paper by Manabe on page 156.)

Man's activities through the extensive use of inorganic fertilizers and through direct contamination of the atmosphere resulting, for example, from increased automobile exhaust and industrial combustion processes have seriously disturbed the natural nitrogen cycle. This is the chief topic of the second section of the book. In the first article of this section, Barry Commoner, in an excellent overview of the

problem, reviews the evidence concerning the real and potential hazards of excess nitrogen introduced as a result of technology. He points out that if fertilizer residues find their way into the river streams, the nitrate concentration can be so high as to induce eutrophication. In some cases this has also resulted in contamination of well water by amounts of nitrate-nitrogen compounds exceeding the public health limit for potable water. Commoner urges that new methods be explored as a substitute for the widespread use of inorganic nitrogen fertilizers. This view is disputed in a very brief article by T. C. Byerly, who claims that there is "no clear and present danger" due to nitrogen compounds used in crop production. The disagreement between these two experts points up the need for more interdisciplinary research on the matter. As is well known, excess fertilization of lakes, streams, and estuaries is caused also by phosphate products. Evidence for such "contamination" is presented by Arthur D. Hasler, who discusses in a clear manner the causes and consequences of man-induced eutrophication of lakes. It is heartening to read that where corrective measures have been taken degradation due to eutrophication has been effectively reversed.

One of the most serious possible effects of changes in atmospheric environment conditions, either natural or man-made, is on the climate. Yet because there does not exist any satisfactory theory of climatic variations it is not possible to state with certainty what climate change would result from any one of the myriad of suggested causes. Indeed, fluctuations in climate may well involve a whole set of stochastic processes. Attempts must nevertheless be made to understand and evaluate atmospheric variables as they may affect the earth's climate. Two of these factors that are of great concern, because they are closely tied to man's activities, are the increasing particulate load and CO_2 concentration in the atmosphere. These factors are reviewed in the third section of the book. In this group, the paper by J. Murray Mitchell, Jr., dealing with atmospheric pollution as a cause of recent global temperature fluctuations contains a reasonably well-balanced treatment of the problem with a strong appeal to physical reasoning. Mitchell points out that to the extent that the dust content of the atmosphere may have been responsible for temperature fluctuations in the past, natural (volcanic) rather than human activity would have been the chief causative agent. Man's contribution to the particulate load in the atmosphere could well become dominant over the next 25 years, however. A very brief paper by Manabe reviews an earlier study by Manabe and Weatherald on the effect of cloudiness on surface temperature. Manabe points out that although high clouds would have a negligible effect, an increase of about 3 percent in low clouds would (because of an increased albedo) result in a lowering of surface temperature equivalent to that produced by decreasing the atmospheric CO_2 content by a factor of 2. (The two brief articles in the book by Manabe should certainly have been combined for continuity and clarity.)

The final section discusses the problem of ocean pollution by toxic wastes. The subject is introduced by Edward Goldberg, who provides some interesting data on the injection rates of mercury, lead, DDT, and polychlorinated biphenyls into the oceans. An additional indication of the complexity of the pollution problem is the ironical fact pointed out in the contribution of George Woodwell that DDT, which is used to increase agricultural productivity, could destroy a significant part of oceanic fisheries.

A theme that recurs throughout the more thoughtful papers in the book is best expressed in the comment of Woodwell that the solution to worldwide pollution problems lies in controlling the pollutants and "equally importantly in providing a general context within which there is not strong, potentially overwhelming, pressure to use the earth so intensively as to pollute it. . . . It must quickly become the policy of nations to limit population and to restrict those aspects of technology that degrade the common resources, including air, water and land."

This volume is a mixed bag. However, it contains much material of value to the nonspecialist who wants a rational and balanced view of the impact man has had on his environment. In addition, most of the articles cited here have comprehensive references and suggestions for additional reading for those whose interest has been stimulated. The subject matter needs visibility, and this book helps to make that visibility possible.

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Antigens

Immunological Aspects of Neoplasia. ROBERT S. SCHWARTZ, Ed. Karger, New York, 1970. x, 222 pp., illus. $16.30. Progress in Experimental Tumor Research, vol. 13.

This monograph consists of four chapters, two of general interest and two that are relatively highly specialized. The book is not for those who are seeking a concise survey of knowledge relating to tumor immunity, since it makes no reference to tumor-specific or tumor-associated antigens and has only scant reference to the immune response against tumor antigens. F. M. Burnet's chapter, "The concept of immunological surveillance," is provocative but unsatisfying. Burnet discusses the hypothesis that antigenic polymorphism arose in cyclostomes as a defense against parasitism by other cyclostomes. He argues that if a cyclostome preyed on another cyclostome of a related species the result would be catastrophic, because the host would be exterminated and with it the parasite. He cites the devastation caused to Great Lakes trout by the influx of lampreys, but this is tangential arguing because the trout has a highly evolved immunologic system, must be antigenically far removed from the lamprey, and still apparently cannot defend itself adequately. The chapter was written in 1968, and Burnet was evidently unaware of the rapid development of information about tumor-associated antigens of man and laboratory animals, for he concludes his section on "Evidence from clinical sources" by stating, "In general, the more critically the work has been done the more consistently negative the results." His chapter is entertaining but dated.

M. Schlesinger's chapter, "How cells acquire antigens," provides an abrupt contrast in style and content. In discussing the passive acquisition of antigens by coating, he points out how important such a process may be in physiology and that apparent antigenic changes may really be a reflection of a physiologic change—a provocative thought well illustrated by reference to transferrin. The section on recessive genes is short, but compensated for by fuller treatments of "silent" genetic information and of the modifiers of antigenic expression. This and the two following chapters are complemented by comprehensive bibliographies.

An abrupt change from a general to