problems and responsibilities encountered in critical issues of policy and planning. Robert Kreidler supplements this from his direct experience on the staff of the President's Special Assistant for Science and Technology, now the Office of Science and Technology, with a lucid and thoughtful exposition of the work of that office and its relations with other offices and agencies of government which are concerned with administration, coordination, and program formation.

A more general view of the role of American scientists in policy making is given by Wallace S. Sayre, who points out that the role of scientists in governmental policy is, in principle, no different than that of other specialists. He then pursues this question: Who are the scientists and who speaks for them? Among scientists influential in governmental policy discussions, he finds particular individuals, high ranking government officials, and representatives of scientific and academic organizations. In this he is evidently thinking of testimony before congressional committees, because, with the exception of the National Academy of Sciences, this kind of representation is not as a rule recognized in deliberations of the executive branch; neither is it recognized as authoritative by the scientists themselves. The representative of an organization may speak authoritatively for the aims and activities of his organization, but on science policy matters he may speak only as an individual, unless he is spokesman for a group explicitly formed for dealing with science policy.

After outlining the requirements for a fully developed science policy, Sayre is inclined to think that no such formal program is feasible, and he is reasonably sure that such is not desired by the scientists themselves. In his opinion this leaves science policy with a "fictional" quality and confronts us with a number of difficult questions. Are we to depend upon a full complement of science advisers or should some formal organization be evolved for the purpose? According to views expressed by the Executive Branch and by the scientists, a department of science is not the answer. However, if we accept Sayre's initial thesis that the problem of the scientists is no different from that of other experts, then there is no more reason for formal government organization of natural science than there is for economics or political science.

In his observations, "Scientists, Foreign Policy and Politics," Warner R. Schilling discusses the characteristics of scientists and their biases, among which he lists a conviction that science and technology are justifiable ends in themselves, a sense of service to mankind, a naive Utopianism, and an urge to make their own independent analyses. He agrees that stronger organization of the government may make for increased efficiency but points out that this will not solve the problem of the relation of science to policy. One senses his feeling that the moves to incorporate science and technology into the highest councils have come too rapidly. Perhaps policy should originate at lower levels and be transmitted upward, if only to give play to multiple sources of advice. Schilling voices the thought that the United States already has stronger advisory representation at top levels of government than other countries, including the U.S.S.R.

In the chapters "Strategy and the Natural Scientists" and "The Scientific Strategists," Albert Wohlstetter and Bernard Brodie trace the evolution of the part played by scientists in councils on strategy, a role which had its origins in military technology but which has since been broadened and strengthened. An important prerequisite to this role, also mentioned by Price, has been the increasing degree to which on such occasions scientists are given the complete picture, instead of merely being asked to provide expert advice on technical questions. This has led to the formation and support by the government of special groups or centers for the express purpose of making continued studies of the strategic implications of science and technology. These, in turn, have made considerable progress, as Brodie relates, in the systematic development of strategy where science and technology are involved, and in valuable techniques to improve forecast and decision making, which are themselves based upon such scientific and engineering analysis as operations research, systems engineering, and game theory. The reader interested in this subject will find Wohlstetter's detailed discussion of numerous examples instructive. As the latter points out, by far the most difficult analysis concerns the "conflict" type of problem where one is matching wits with an intelligent opponent who is playing the same game and may be expected to devise countermeasures.

In the concluding chapter "Scientists and the Establishment of Science Affairs," Wright adds his emphasis to that of the preceding authors with respect to the critical importance of collaboration between scientists and nonscientists on policy making. Among scientists the broader role is still comparatively new and is entered by only a relatively small and select group. Although in his view both scientists and nonscientists are laymen in understanding one another, it is urgent that they find a mutually constructive approach to policy problems. Undoubtedly this will require some adaptation on the part of both. Moreover, the number and variety of functions which scientists have been called upon to perform raises the question whether these functions may at some point be assumed by others or whether this presages the growth of a new professional category for scientists —that of scientific affairs. In this connection it may be pertinent to remark that, in contrast to the arts and humanities, there has developed no professional class of critics of science. Expositors there are, but by and large the only valid critics are themselves recognized contributors to progress in science. This is doubtless due to the nature of the subject, in which opinion as such is discounted unless reinforced by active and distinguished research participation.

On the whole, the verdict seems to be that the scientist is indispensable to policy making but that he has much to learn about a game which has so many human and political complexities and so much social tradition behind it. At the same time, those who have studied the subject at close hand concede that the point of view of scientists is valuable, even apart from their technical knowledge, and that the nonscientist should make a more determined effort to meet the scientist half way.

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## Ecology

**Patterns in the Balance of Nature.** And related problems in quantitative ecology. C. B. Williams. Academic Press, New York, 1964. viii + 324 pp. Illus. $9.50.

"Some Biological Applications of the Logarithmic Series" would have been a far more descriptive title for this book. Far from being an introduction to the study of ecosystems or communities, this highly specialized monograph is largely concerned with

the author's own investigations. More than 20 years ago Williams noted that, as a group of organisms is collected and sorted according to species, a rather constant number of new species is added to the previous total each time the sample size is doubled. A logarithmic series could be fitted to such data. In subsequent years, the author gathered together information from a variety of sources about frequency distributions to which this series could be applied. This book represents, in large part, a compilation of such data, including numbers of genera per family, numbers of parasites per host, and estimates of species diversity among a large number of situations. There is some reference to the log-normal and the negative binomial distributions, which, in some ways, are theoretically superior to the logarithmic series. Because it is pertinent, although, at the moment, somewhat heterodox, a recent comment about one of these is worth quoting: "It is possible, therefore, that the fact that the number of individuals per species in plant and animal communities tends to follow a log-normal distribution results simply from a tendency for the factors which influence abundance to combine in a multiplicative manner" [P. J. Clark, P. T. Eckstrom, and L. C. Linden, *Ecology* **45**, 367 (1964)].

The general problems associated with species diversity have recently become an increasingly active area of research in ecology. Thus, the data assembled by Williams should provide useful information, since many are not easily accessible elsewhere. However, anyone who expects a seasoned assessment of the various contributions that have distinguished progress in this field over the last few years will be disappointed. Although some of the contributions made by Margalef, MacArthur, and Preston are listed in the bibliography, for example, no attempt is made to synthesize them in the text. In fact, the author fails to discuss most of the important contributions made during the last 5 years. One must also point to a curious lack of editorial judgment in the makeup of the book. Identical data are repeatedly presented on successive pages, once in tabular and again in graphic form. For the level of specialization achieved, the text at times is unduly didactic. In a book of this kind, one does not expect half a page of discussion about a simple change in the bases of logarithms.

The title of this work misled me into thinking that Williams might have aimed at an evaluation of the important and sweeping generalizations that have recently been suggested as applicable to biological communities. Unfortunately that book remains unpublished, and probably unwritten.

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## Botany

**The Living Plant**. Alan J. Brook. Aldine, Chicago, 1964. x + 529 pp. Illus. $10.

I began this book with considerable optimism, having observed in the preface the statement that ". . . subjects where great and exciting advances are at present being made and which are of fundamental biological importance, have been given special prominence." Unfortunately, this claim was not substantiated. The content of the book is not significantly different from that of a botany textbook of 20 years ago. Indeed, the book serves as a good example of the type of text that the author was attempting to avoid. Examples could be provided, almost *ad infinitum*, of the extremely conservative nature of the text, but only a few can be afforded here. Chapter 16, "The products of plant metabolism: Carbohydrates, fats, and proteins," is ten pages long, of which one entire page is devoted to a full-page plate that illustrates starch grains from four different species (the starch grains would appear to be nearly alike to a student). In the next chapter, "Enzymes," which is five pages long, one-half page is used purportedly to show the digestion of starch grains by amylase in human saliva. Chapter 14, "Transpiration," is the same length as chapter 25, "Heredity." Perhaps more important than mere length of treatment, the content of many sections is conspicuously outdated. Chapter 19, "Catabolism and respiration," six and one-half pages long, is replete with illustrations of trivial laboratory experiments but devoid of cogent modern treatment of energy exchange.

Terminology is excessive, so that no botanical usage, however archaic or superfluous, is withheld. Hence, we see such terms as *rhytidome*. Even such words as *land utilization* are italicized. Many of the illustrations are extremely poor. The author is more effective in his treatment of the basic descriptive aspects of the subject, and the line drawings are good.

Since the strongly stated prefatory remarks and the subsequent content were so extremely divergent, I was led unavoidably into a preoccupation with the paradox—to try to comprehend it, and to extrapolate the situation in some way to botany at large. Much of the content of the book is adequate and, in proper intellectual context, important. Yet, from this book, botany emerges once again at the periphery of modern biology.

Somehow, the fact that the chronological molecular topology of the developing plant represents a dynamic system, indistinguishable in fundamental attributes from other forms of life, must be reiterated until this axiom and all of its implications are generally appreciated. The present book has, unfortunately, failed to go beyond the platitude.

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## Antarctic Research

**Soviet Antarctic Expedition, Information Bulletin**. vols. 1 and 2. Translated from the Russian by Scripta Technica. Elsevier, New York, 1964 (vol. 1, 420 pp. $17.50; vol. 2, 328 pp. $15). Illus.

In expeditionary-exploratory science there is usually a long time lag between field operations and final reports, particularly when the work is a multidiscipline, multiagency, or multination effort and data from many sources must eventually be combined in the final product. There is, therefore, a need for preliminary information, presented in as much detail as possible, on the areas covered, the types of work performed, and the equipment used. This will allow others to avoid expensive duplication of efforts in areas where the logistic costs are usually far greater than the science costs.

The *Information Bulletin of the Soviet Antarctic Expedition* provides such information, describing in general terms the progress and achievements of the U.S.S.R. in Antarctica, since the impetus for research in this area began under the aegis of the International Geophysical Year. The two vol-