to be a little too much "substituting into formulas." I find it helpful to emphasize the "principal equilibrium" (to borrow a term from E. L. King), calculate an approximate answer first, then check the approximation to see if it is valid. But this is a subjective matter. There is no doubt that this book will help many thousands of students understand ionic equilibria.

HAROLD F. WALTON
Department of Chemistry,
University of Colorado

Botany

Botanique. Anatomie, cycles évolutifs, systématique. Pierre-Paul Grassé, Ed. Masson, Paris, 1963. vi + 1040 pp. Illus. F. 98.

Botanique, one of a series of volumes that summarize the present state of knowledge in various fields of biology, deals with structure and life cycles throughout the vegetable kingdom, with emphasis on phylogenetic interpretation. It is designed as a textbook for French students who are working towards a first degree in biology, and it combines the knowledge of a number of specialists, each dealing with a particular group of plants. Essentially the volume falls into three parts: the first chapters are devoted to the bacteria (Prévot), Cyanophyceae (Grassé), algae (Feldmann), fungi (Chadefaud), and lichens (Abbayes); the second, which is preceded by a special chapter on the general principles of evolution (Gaussen), includes chapters on Bryophyta and Pteridophyta (Ferré), gymnosperms (Gaussen), and the morphology and reproduction of the angiosperms (Ozenda), a general chapter that precedes the systematic account of the angiosperms (Leredde) in which the families are arranged according to the system of Hutchinson. The third section, which includes an account of ecology and phytogeography (Gaussen), is of special interest.

There is no marked unevenness among the accounts; each chapter is preceded by a summary of its salient features and then enters into more detailed systematic treatment. The necessarily brief accounts are explained and illuminated by profuse and excellent illustrations, mostly black-and-white line drawings (many are originals). The excellent diagrams that illustrate growth and the life cycle in the lower orders are noteworthy in that they are the kind students delight in reproducing in examinations and workbooks. The sections that deal with the lower orders are most successful because they do not wholly dissociate biochemistry and function from accounts of structure and life history. Function is largely ignored in the discussion of form in the higher groups and, although we are promised a separate volume on plant physiology, the unfortunate tendency to overcompartmentalize botany is not resisted.

There is probably no up-to-date survey of the structure, life history, and presumed phylogeny of the entire vegetable kingdom that can compare with this volume; in addition to its undoubted value to the student, the volume will serve as a valuable reference book for the nonspecialist. The simple, lucid French will not tax the resources of the amateur linguist, although the tendency to refer to plants solely by their common name may do so.

Unfortunately there is no information about sources and there are no guides to further reading. That the work is not intended to be a complete survey is indicated (on p. 725): "Il est certain que chacun de ces paragraphes peut à lui seul, pour les Angiospermes faire l'objet d'un volume." It would have been worthwhile to indicate to what extent these volumes are already available. Certainly there is ample space in the book for references to further reading.

P. B. TOMLINSON
Fairchild Tropical Garden,
Miami, Florida

Protozoology

Essays on Protozoology. H. Sandon. Hutchinson, London, 1963. 143 pp. Illus. Paper, 15s.

One can read this pleasant little book in an evening or two. In it Sandon attempts to do "what the guide-demonstrator does in a museum, namely to help the visitor to find his way by going around with him. . . ." He has brought together an interesting assortment of facts about the flagellates, amoebae, and ciliates, and he has collated the diverse topics very effectively. These three groups of protozoa are discussed with respect to their nutrition, locomotion, reproduction, osmoregulation, and various other aspects of their biology. In the introductory section on protozoa in general, Sandon comments briefly on the ecology of a variety of types, including symbionts, and on the difficulties of dealing with the possible lines of evolution among protozoa.

The text should have been warmed up a bit with some good illustrations. The only figures introduced are coupled to an appendix in which the classification of flagellates, amoebae, and ciliates is sketchily outlined. Some of these illustrations fall short of showing the details that are essential to an understanding of the principal taxa. Protozoan classification (even if the so-called sporozoa are summarily omitted) is surely not simple, and it cannot be very well explained by brief comments on the orders and a few representative genera.

There is a lively enthusiasm running through this book, and I think it will make enjoyable reading for students as well as biologists who look to the protozoa for help in their own particular studies.

EUGENE N. KOZLOFF
Department of Biology,
Lewis and Clark College

Maury's Biography

Matthew Fontaine Maury, Scientist of the Sea. Frances Leigh Williams. Rutgers University Press, New Brunswick, N.J., 1963. xxii + 720 pp. Illus. $10.

This well-written and well-printed book is a very complete biography of an energetic and surprisingly studious naval officer. The author has done an immense amount of research, and the end result far surpasses the other attempts with which I am familiar.

Maury was a controversial character during all of his adult life. For a naval officer to be accepted as an equal by the scientific community is not easy even today, and in the days before the Civil War most officers had very limited educational opportunities and were therefore not considered able to take up science. Maury also had difficulties with the Navy Department, which did not quite know how to deal with an officer engaged in scholarly work.

Maury maintained an immense correspondence, especially with European scientists, for his work was well thought

of on the continent. It is to his credit that a very high percentage of his letters were preserved. In fact, from this new biography one can almost know what he was thinking about week-by-week after injuries incurred in a riding accident prevented him from continuing to go to sea.

Maury has usually been considered the father of physical oceanography in this country. In my opinion, he actually contributed much more to climatology and to physical geography, but the practical applications of his pioneering pilot charts have usually attracted the most attention.

Frances Leigh Williams does not try to refight the Civil War or to evaluate Maury as a scientist. She simply records what happened.

It is significant that about 240 pages of this book are devoted to notes, bibliography, and index. The reader is entirely free to judge the scientific contributions of an interesting man and to enjoy the contemporary picture of the Navy, life in Washington, the Civil War, and the European scene.

C. O'D. ISELIN
Woods Hole Oceanographic Institution

AGARD-NATO Symposium

Advances in Materials Research in the NATO Nations. Proceedings of a symposium held at NATO, May 1961. H. Brooks, N. H. Mason, N. E. Promisel, and G. H. Cooper, Eds. Published for the North Atlantic Treaty Organization by Pergamon Press, London; Macmillan, New York, 1963. x + 549 pp. Illus. $15.

In May 1961, a symposium on materials research, organized by the Structures and Materials Panel of the Advisory Group for Aeronautical Research and Development (AGARD) of NATO, was held in Paris. The symposium was held at the request of Frederick Seitz, then science advisor to NATO, in recognition of the importance of materials in modern technology. It was hoped that bringing together people interested in fundamental research, in applied research and development, and in the organization and management of research would stimulate and make more effective materials research in the NATO countries. The volume under review records the proceedings of that symposium.

The volume is in three parts: Fundamental Research; Role of Basic Research in Development; and Organization. The first part consists of an introduction and review by Harvey Brooks, a keynote address by Seitz, and a series of 18 talks in which leaders in their fields review various aspects of basic research on materials, including such topics as polymers, diffusion, surface properties, dislocation theory and observation, flow and fracture, energy bands, superconductivity, semiconductors, and ferromagnetism. The papers are somewhat uneven in scope, ranging from reviews of broad areas of research, designed for the nonspecialist, to rather technical discussions based mainly on original research. The second part provides examples of cases in which basic research has made significant contributions to particular developments as well as more general discussions of the ways in which advances in basic understanding aid development. The third part contains interesting discussions of the way scientific research in general and materials research in particular are organized in various NATO countries: Canada, France, Netherlands, Norway, Great Britain, and the United States.

By far the greatest emphasis is on structural properties, an area in which there is perhaps the greatest gap between basic research and practical developments. Only a dozen or so pages are devoted to semiconductors and ferromagnetism where applications depend very directly on basic research and where the same people are often involved in both. In the past, structural materials have been developed largely by empirical cut-and-try methods in which research on basic physical processes and electronic structure have played only a minor role. It is evident from the reviews presented here that tremendous strides have been made in fundamental understanding and that the gap, while still wide, is closing. Both approaches are important, and both will continue to be important in the future.

The book should be of interest mainly to those doing basic or applied research in structural properties of materials and to those in scientific administration.

JOHN BARDEEN
Department of Physics, University of Illinois

Chemical Analysis

Complexation in Analytical Chemistry. A guide for the critical selection of analytical methods based on complexation reactions. Anders Ringbom. Interscience (Wiley), New York, 1963. x + 395 pp. Illus. $15.

Complexation reactions owe their widespread use in chemical analysis chiefly to the work of Gerold Schwarzenbach, whose group, two decades ago, pioneered studies on ethylenediaminetetra-acetic acid (EDTA) and other exceedingly effective complexing agents based on the aminopolycarboxylic acids. Titrations with these "chelating" agents proved generally applicable to the great majority of metal ions, and EDTA has become a household item in all analytical laboratories. In 1957 Schwarzenbach published a monograph in which he developed the theory of "complexometric titrations" and gave procedures for a number of specific determinations. Anders Ringbom's intent is to extend Schwarzenbach's treatment and show "how to compare, without involved calculations, existing methods to determine their relative accuracy; how to choose the most favorable experimental conditions for each analysis; how to calculate and eliminate the interference of various side reactions; how to develop new methods for solving special analytical problems." He has fulfilled these aims with admirable lucidity, in a book which every analytical chemist should find useful and stimulating.

To simplify the involved calculations necessary for intelligent application of complexometry, Ringbom introduces the concepts of side-reaction coefficients and conditional stability constants. He applies the method consistently throughout the book and illustrates its effectiveness with numerous example problems. An appendix contains tabulations of coefficients for many common side-reactions as well as a long list of the equilibrium constants most likely to be needed.

Ringbom begins with a brief survey of complexation reactions, then presents a sensible approach to the law of mass action (in which he neatly sidesteps the sticky problem of concentration versus activity by pointing out that 0.1 log unit, an uncertainty quite acceptable for most calculations, covers the activity coefficient variation for most ions in the ionic strength range