

(the latter is also given). Кидание, киданный is not abandoning, abandoned. It acquires this meaning only with the prefix по, that is, покидание, покинутый. Небесполезный is preferably rendered as "not without use" rather than "of some use." Some of the alloys are capitalized while others are not. True, compared to the value of the dictionary, these are minor points. However, the use of "press" for издательство is inadmissible. John Wiley and Sons, Inc. is not a "press" but a publishing house or publisher, and they are likely to take strong exception when referred to as a "press."

The physical make-up of the dictionary—the font, printing, edge index, appendix, and introductory matter—is very good. But why the inaccurate rendition of the Library of Congress transliteration scheme on page xix? And what is meant by "standard letters" (line 4, p. xix)? Does it mean roman? I sincerely hope these irritants will be eliminated in future editions.

M. HOSEH

Biomedical Directory, Fordham University Project, Washington, D.C.

Lichen Anatomy

Encyclopedia of Plant Anatomy. vol. 6, pt. 9, *Lichens*. P. Ozenda. Borntraeger, Berlin, 1963. 199 pp. Illus.

Ozenda's *Lichens* is the first revision of volume 6 of the *Handbuch der Pflanzenanatomie*. Wilhelm Nienburg's *Anatomie der Flechten* (1926) was published as volume 6 of the first edition of the *Handbuch*.

Ozenda has attempted to provide an up-to-date treatise with respect to contemporary lichenological research on anatomy, morphology, cytology, and related topics. The author's aims are essentially fulfilled, and according to the preface, these aims included that of providing new chapters on the reproductive structures of lichens, on parasitism, and on growth. The volume fills the need for a thorough reference source on lichen structure; for this reason, it should be useful to all botanists and should also serve as a manual for instruction in lichenology.

Ozenda's publication is primarily a text on lichen anatomy, a fact that may be overlooked by those who see in its all-inclusive title, *Lichens*, a more general work. Nienburg's more

specific title, *Anatomie der Flechten*, leaves no doubt in this respect. Lichenology includes a large number of works entitled "Lichens," and of these there are a few old but still authoritative publications that give more comprehensive descriptions of lichens, among them Annie L. Smith's *Lichens* and Zahlbruckner's *Lichenes*. Questions on lichen phylogeny, nomenclature, ecology, and economic uses, as well as details on lichen anatomy may be found in these earlier studies. Consequently, Ozenda's treatise does not displace the earlier and more general works in lichenology, although it does bring together contemporary research on lichen anatomy into one very useful volume, and thus it supplements the older references. This may be noted by examining its table of contents.

In a well-prepared introduction, Ozenda refers to the work of his predecessor and to that of his contemporaries. However, there is no formal reference to Nienburg's *Anatomie der Flechten* in either the text or the bibliography. Although Ozenda's monograph is some 40 pages longer than the earlier volume, the 177 pages of text includes 128 figures. The book has an appendix (3 pages) and indexes to subjects, Latin plant names, and authors. Asterisks are used in the indexes to identify materials that are illustrated. Illustrations have been used generously and to good effect to support the text, and the selection includes the excellent drawings from Galloe's *Natural History of the Danish Lichens*. The nomenclature used throughout conforms to either Rabenhorst's *Kryptogamen-Flora* or Zahlbruckner's *Catalogus Universalis Lichenum*.

Lichens is a conservative, straightforward exposition on lichen anatomy. The text, which is written in French, consists of three principal sections, in which are considered the constituents of lichens, the anatomy of the thallus, and the reproductive structures. The discussion on the algal and fungal constituents includes systematics and is followed by a brief review of the growth of lichen constituents in pure culture. The second and lengthiest part of the text gives considerable details of the lichen unit, the thallus. The material is arranged according to thallus type, beginning with the least developed, the granulose, through all intermediate types to the most advanced, the fruticulose. Ozenda brings

to this discussion pertinent studies and theories, including some phylogenetic and ecological notes, which add considerably to the treatment. Under each type of thallus, brief summaries have been prepared of the appropriate families or genera. In this section soridia and isidia and their relationships to vegetative reproduction are also described, and data on the development and growth of thalli of both sexual and asexual origins are reviewed; the chapter closes with a description of thallus deformations caused by lichen parasites.

This final part contains an excellent description, including nomenclatural and systematic data, of the plant parasites of lichens. The third and last section of the text is on reproductive organs, apothecia and pycnidia, and on their products, spores and pycnids. This material is also well presented, in considerable detail, with many illustrations that provide a fairly comprehensive review of the sexual reproductive structures of lichens.

One would expect contemporary research to be reflected in the documentation of the text by a relatively large number of recently published works. Yet it appears that more than three quarters of the references in the bibliography were published between 1850 and 1925, the greatest peak about the turn of the century, a time of considerable activity and development of which Nienburg was very much a part. As I noted earlier, the title of Nienburg's treatise is not cited in the bibliography; a number of other lichenologists are referred to by name in the text but are not identified by their works. For example, although Frey's systematics in *Umbilicaria* may be preferred to Llano's the reader should be given references to the works of both authors. How else can the student or researcher evaluate the facts or find the pertinent literature? The description of lichen culture research is incomplete without reference to the work of British workers or without information on experimentation in the field of lichen antibiotics. Lichen acids are mentioned, but almost in passing and, unfortunately, are poorly illustrated. Several aspects of this subject are of increasing significance, and the subject might well have been given more consideration. Lichenology is a branch of the botanical sciences founded on the remarkably stable relationship between two dis-

crete plants, an alga and a fungus. This union forms the characteristic lichen unit, described as the thallus, which exhibits as much variability as other plants. Therefore, it is important to have authoritative texts on the anatomy of lichen thalli and on all other structures of the thallus, which will serve to advance knowledge of lichens in general and of lichen terminology pertinent to anatomy. The field of lichenology is far from static; it is attracting the attention of physiologists, biochemists, and others who find in this unique association problems of great interest. These investigators, as well as students of lichenology, will find that Ozenda's volume is the most recent source to present knowledge on lichen anatomy.

GEORGE LLANO

*National Science Foundation,
Washington, D.C.*

Chemical Analysis

Organic Functional Group Analysis.

F. E. Critchfield. Pergamon, London; Macmillan, New York, 1963. viii + 187 pp. Illus. \$6.50.

This compact volume was designed "to provide a collection of versatile and reliable chemical methods for determining most of the more common organic functional groups." It accomplishes this objective in a very precise and practical manner. The selected material, while largely determined by the needs of the laboratory with which the author is associated, is sufficiently broad in scope to cover the majority of functional groups encountered routinely in most laboratories. The organization and style provide a considerable amount of information in a most concise and clear manner. The scope and limitations of each method are discussed, and the clarity with which the procedures are presented is in accord with the author's statement that they can be performed by competent nontechnical personnel. A praiseworthy feature is the inclusion of directions for preparing the reagents for which directions are needed. Almost all of the references (which are placed at the end of each chapter) are to the original literature and thus give direct access to actual experimental results rather than to the generalities often encountered in secondary references. The index is reasonably complete.

The treatment of acids and bases is exceptionally well done and includes consideration of both aqueous and non-aqueous media. The latter deals mainly, but not exclusively, with acids in pyridine solvent, but considers bases in acetic acid, nitromethane, acetonitrile, and acetic anhydride. The problem of changes in relative acidities, including inversions in order, is discussed. Also included are the determinations of epoxides, esters, anhydrides, and imines by indirect methods, differentiation titrations in water and in several non-aqueous solvents for both acids and bases, and a very readable coverage of indicators, also for both aqueous and nonaqueous solvents.

In summary, this book can be recommended to the chemist who has a considerable number of analyses to perform, with or without the aid of a technician, and also to the chemist who needs to use such methods less often but at that time wants a concise but reasonably complete write-up of well-tested procedures conveniently at hand.

ARTHUR G. ANDERSON, JR.

*Department of Chemistry,
University of Washington, Seattle*

Mathematics

The Teaching of Mathematics. From intermediate algebra through first year calculus. Roy Dubisch and Vernon E. Howes. Wiley, New York, 1963. xii + 124 pp. Illus. Paper, \$2.95.

The first draft of this handbook was written during 1951 and 1952 while Dubisch was a Faculty Fellow of the Fund for the Advancement of Education. According to the preface, he intended "... to provide the new teacher of mathematics with some general guidelines on the teaching of mathematics and some specific suggestions in regard to classroom procedures. . . . [and furthermore] . . . to provide both the inexperienced and the experienced teacher with an annotated bibliography of articles on the teaching of mathematics from the intermediate algebra level through first-year calculus."

In three preliminary chapters the authors deal with teaching in general, the aims of mathematics teaching, and problems in the teaching of mathematics; they then consider specific suggestions for teaching algebra, trigo-

nometry and logarithms, analytic geometry, and differential and integral calculus. In these latter chapters, an extremely judicious selection of topics is examined in a lucid manner. The pedagogical as well as the mathematical problems associated with each topic are reviewed, and references to sources contained in the extensive bibliography are skillfully woven into the discussion. The bibliography consists of 402 items published during the period 1884 to 1963, of which about 10 percent are post-1958 works.

Throughout the handbook many practical suggestions are provided. The following quotations are typical examples: "A rough estimate [of the time required for homework] can usually be obtained by the instructor if he works the problems himself and multiplies the time it takes him by four"; ". . . rules and methods of algebra should always be first explained from the numerical viewpoint"; and "The instructor should use care, however, that he not make the work too lengthy and boring to the average student by excessive harping on the theory."

Every graduate assistant or instructor at the undergraduate level should have access to this volume. The more experienced teacher will find it extremely valuable, and although it appears to be directed more toward the college instructor, the teacher of advanced secondary school mathematics courses will also find it useful.

DONALD J. DESSART

*Department of Mathematics,
University of Tennessee*

Inorganic Solution Chemistry

Metal Ions in Aqueous Solution. John P. Hunt. Benjamin, New York, 1963. xii + 124 pp. Illus. \$5.50.

The resurgence of inorganic chemistry following World War II was due, in large measure, to the careful work done on the nature of species in aqueous solution. In the past few years, such studies have been eclipsed somewhat by the vast amount of preparative work stimulated by the successes of ligand field theory. There has been a definite need for a book to introduce the student to inorganic solution chemistry, particularly for a work that emphasizes the newer theoretical studies and experimental methods. With certain res-