very important effects of hydrogen bonding and, more generally, of interactions and variations in charge distribution in altering characteristic frequencies receive inadequate attention. In all other respects, the book is an extremely valuable contribution which forms an excellent introduction to the subject for chemists and those more interested in the practical applications of infrared spectra. For the chemical spectroscopist, it is a storehouse of interesting information, which should prove very stimulating in the fascinating problem of correlating the spectroscopic and chemical properties of molecules.

G. B. B. M. SUTHERLAND

University of Michigan

Titanium: Its Occurrence, Chemistry, and Technology. Jelks Barksdale. New York: Ronald Press, 1949. 591 pp. $10.00.

Growing interest in titanium chemistry and applications of elemental titanium and its compounds in recent years has demonstrated an urgent need for a comprehensive and concise summary of information pertaining to the chemistry of the element. Such a summary is presented in the present monograph.

Although written largely in terms of the titanium pigments industry, and thus reflecting the author's major experiences and interests, the volume nevertheless strikes a comparatively good balance among the technical developments involving titanium materials. Its wealth of information about pigments is supplemented by adequate discussions of uses of the element or its compounds in alloys, in the electrical and ceramic industries, in dyeing processes, and in catalysis. Recent developments involving the production of the pure metal and its applications are discussed, as are miscellaneous applications of compounds running the gamut from gem stones to water purification and sewage treatment.

Emphasis througthout the book is primarily upon technology. Considerable space is devoted to the mineralogy and technical treatment of useful ores for the recovery of compounds of the element. The chemistry of the free element and of its compounds is, however, treated in considerable detail in three chapters, and methods for analyzing titanium materials are considered in one chapter. This last chapter is very brief and appears to be somewhat sketchy in character. On the whole, however, the treatment seems excellent.

Throughout, the book is well documented. References to both technical and patent literature are indicated clearly in connection with statements of fact in the discussion. These references are then collected by chapters into a section of 77 pages, placed just before the index at the end of the volume. The author's statement that these references are complete up to the time when the book went to press appears correct. Indexing is equally comprehensive.

The book is written in a clear prose which is easy to follow and free from ambiguity. In general, the author has been sufficiently critical of conflicting literature reports to render his presentation authentic, although there are some instances where he has not been. One might wish that he had explored more searchingly the basic chemistry of some of the processes he described and had thereby offered more adequate explanations for these processes. In these and most other instances, however, the viewpoint has been more technical than theoretical or experimental. The volume has been given careful handling by the publishers and is thus clearly printed, attractively bound, and free from significant errors. In the opinion of the reviewer, however, the price is excessive.

Barksdale's *Titanium* should prove useful to both technologist and teacher. It contains a fund of information and should fill a vital need in the rapidly expanding field of titanium chemistry. Its use is to be recommended.

THERALD MOELLER

University of Illinois

The Alkaloids: Chemistry and Physiology, Vol. I. R. H. F. Manske and H. L. Holmes, Eds. New York: Academic Press, 1950. 525 pp. $10.00.

This volume is not for the casual reader who seeks a little information on the subject of vegetable bases, but rather for specialists in the alkaloid field, or those who intend to become so. It consists of seven sections, selected apparently on the basis of interests and availability of the authors.

The introductory chapter by Manske, "Sources of Alkaloids and their Isolation," is well described by its title, and offers many valuable generalizations of technique which are more specifically illustrated in the later chapters, where the isolation and separation of individual members is usually given.

The section by W. O. James, "Alkaloids in the Plant," is a scholarly treatment of the subject which assumes more botanical knowledge than is possessed by most chemists. The old and fascinating question of why plants produce alkaloids (and why many do not) is treated in some detail, and leaves us just where we started; we do not know, and perhaps there is no reason to speculate.

There are two excellent chapters by Léo Marion, "The Pyrrolidine Alkaloids," "The Pyridine Alkaloids," which deal with the simple cyclic plant bases, and the commercially and medically more important members of the pepper, areca, lobelia, and tobacco groups, as well as some minor types.

The relatively obscure subject of the *Senecio* alkaloids is considered in elegant detail by N. J. Leonard. Although the plants are of little importance except as a menace to cattle, the alkaloid group is nevertheless of interest as the first known example of the pyrrolizidine ring structure, and for the methodical way in which the nature of the individual members was elucidated.

"The Tropane Alkaloids," by H. L. Holmes, includes such medicinally important drugs as hyoscyamine, atropine, cocaine, and scopolamine. In addition to discussion of reactions and structure, there is an exhaustive table of derivatives and properties which may serve as an up-to-date Beilstein.

"The Strychnos Alkaloids," also by Holmes, makes difficult reading, but any account of strychnine will have

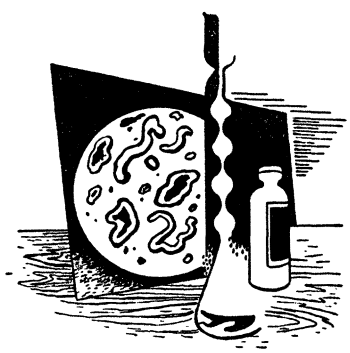
this property. All the important data accumulated prior to 1947 are presented, with emphasis on the interpretation of the facts when discovered, and the gradual evolution from them of the later formulas. The accepted strychnine structure was published by Woodward, Brehm, and Nelson in September 1947, and it is regrettable that this could not have been included to give the first complete story of this remarkable alkaloid. The tables to the chapter list the properties of hundreds of derivatives and represent a vast amount of labor.

Although the editors state in their preface that the pharmacology of the alkaloids will be included, this phase of the project had to be abandoned because of difficulty in assembling contributors.

When completed, this projected series will constitute the most exhaustive and authoritative reference work on alkaloids, and the plan to issue periodic supplements enhances its value.

LYNDON F. SMALL

National Institutes of Health



Chemical Activities of Fungi. Jackson W. Foster. New York: Academic Press, 1949. 648 pp. $9.50.

Every scientist interested in mold metabolism will find it extremely convenient to have available *The Chemical Activities of Fungi.* Nowhere else are as many facts concerning the chemistry of fungi as conveniently arranged. The author, experienced in both the academic and commercial aspects of his subject, has been able to use tools other than the scissors and paste pot.

A list of the 19 chapter titles would constitute a sound synopsis of the book. There are chapters dealing with the chemical nature of mold mycelium, with mutations, with trace element nutrition, and with methodology. Chapters are devoted to each of many of the most important mold products, such as penicillin, citric acid, gluconic acid, and others. Little of importance is omitted.

A writer, freshly liberated from the strait jacket of conciseness prescribed by modern scientific journals, is likely to make full use of his freedom. The present work is probably an example. Reactions become "incriminated" (p. 401), or "motivated" (p. 156); enzymatic effects are "aggravated" (p. 463), and difficulties are "circumnavigated" (p. 599). Much space is occupied by games of intellectual solitaire played by the author. A few examples of these may be given. In the chapter on citric acid, 12 pages are consumed in the erection and demolition of theories concerning citric acid formation before the mechanism finally approved is introduced. On pages 181 to 183 one finds a scholarly examination of definitions of reserve storage material. On page 245 begins an interesting three-page discussion of the familiar concept that seemingly new characters acquired by mutants are in reality due to loss of other characters. Such passages—and they are many—may require space, but will certainly prevent the book from being characterized as a dull compendium. Implicit in the criticism that inordinate space is given to the author's speculations is the appreciation of his ability to produce something more than a catalogue.

Throughout the book are numerous expositions of older concepts. These are first supported in an erect posture, then either knocked down or left to collapse. Although an occasional visit to the graveyard of forgotten theories is both useful and diverting, the mass exhumation often believed essential by authors of scientific books seems more likely to confuse than to instruct. The volume is, of course, not free from mistakes. In a comprehensive treatment of a large subject, occasional errors and inconsistencies serve to identify the work as that of a man rather than of a punch card machine. There are many ideas and conclusions with which this reviewer finds himself in disagreement. This is characteristic, for most readers, of all books in which ideas are to be found. The percentage of the author's ideas to which the reader will take exception will probably be small.

The reader of *Chemical Activities of Fungi* will find it an excellent guidebook to the original literature, and a serviceable textbook. He will find oracular pronouncements, wordy morasses, valuable data, and stimulating ideas. He will probably conclude, with the author, that the work is "an authoritative, critical book integrating and evaluating the field" (p. vii).

M. J. JOHNSON

University of Wisconsin

Advances in Enzymology and Related Subjects of Biochemistry, Vol. IX. F. F. Nord, Ed. New York-London: Interscience, 1949. 760 pp. $9.00.

The ninth volume of this stimulating series of books, like its predecessors, offers a thorough review of a few selected topics. The choice of subjects is not made with the purpose of complete coverage in the field of enzyme chemistry. Instead, each topic considered is given a critical and relatively leisurely examination that embodies much of the reviewer's own opinions. This personal approach, in conjunction with the thoroughness of the treatment, forms the major strength of these volumes. It enables the reviewer to develop his subject not only from the standpoint of present developments but with the important inclusion of past history and its influence on the development of the concepts with which he, but not necessarily the reader, is so familiar.

The 12 reviews presented range in subject matter from the industrial biosynthesis of fats through histo- and cytochemistry, to the metabolism of semen. It is clear that not all of these will be of universal interest. Neverthe-