ment will become evident from the descriptions that follow."

For a first edition, breaking new ground, a high level of accuracy has been maintained. Inevitably, one could make criticisms of detail—object to an example, to confusion of notation, and so on—but this is not the place to argue these. This is an important book. All who want to master its subject matter will be grateful for its thorough exposition and the drawing together of so much material between two covers.

H. FAIRFIELD SMITH
Department of Experimental Statistics
North Carolina State College

Chemistry and Biochemistry

Physical Properties and Analysis of Heavy Water. Isidor Kirshenbaum. Harold C. Urey and George M. Murphy, Eds. New York–London: McGraw-Hill, 1951. 438 pp. $5.25.

This book by Kirshenbaum, with Urey and Murphy as editors, constitutes a valuable addition to the National Nuclear Energy Series.

The first chapter gives a number of useful tables listing all the known physical properties of D_2O. In the second chapter one finds a discussion and description of the theory and experimental data for isotopic exchange equilibrium constants; in particular, there is included considerable information for deuterium exchange in the hydrogen ammonia system, that has never before been published. The next 300 pages contain detailed descriptions and directions for hydrogen-deuterium analysis, as well as for the isotopic analysis of oxygen by a number of different methods. Of these, approximately 200 pages are devoted to the mass spectrometer, and about 100 more to the methods involving the measurement of the density of water. Both the mass spectrometer and the density methods are described in great detail, so that the book contains a wealth of experimental observations and recommendations concerning techniques. Nowhere else can such a body of useful information be found.

The author draws freely on many unpublished Manhattan Project reports, so that one can find for the first time details of much of the secret work done during the war. In fact, this reviewer learned the disposition and utilization of some apparatus constructed for the Manhattan Project at Northwestern University in 1942; aside from the fact that the apparatus had been taken to and installed in the laboratory at Trail, B. C., we never knew whether any practical use had been made of it. The last chapter of the book contains a good review of present knowledge concerning the natural abundance of hydrogen and oxygen isotopes.

As Kirshenbaum himself did much of the work discussed in the book, he was amply qualified to write of it in an authoritative manner. With Urey and Murphy as coeditors one can feel sure that no important methods have been omitted and that the opinions expressed are entirely sound. The author and the editors are to be congratulated on an excellent and useful job well done.

MALCOLM DOLE
Department of Chemistry, Northwestern University

Light Hydrocarbon Analysis. Analytical methods compiled and tested for the Office of Rubber Reserve, Reconstruction Finance Corporation, by the Butadiene Committee on Specifications and Methods of Analyses. O. W. Burke, Jr., C. E. Starr, Jr., and F. D. Tuemmler, Eds. New York: Reinhold, 1951. 639 pp. $15.00.

The foreword, by E. R. Weidlein, states ". . . this presentation constitutes a valuable contribution to scientific knowledge." The preface states that the Committee on Butadiene Specifications and Methods of Analyses is completing its war emergency assignment with the publication of this book. The titles of the 9 chapters are: "History and Function of the Committee on Butadiene Specifications and Methods of Analyses," "Butadiene Production Processes," "Butadiene Specifications and Applicable Test Methods," "Schemes of Analysis," "Sampling and Handling of Light Hydrocarbons," "Safety Precautions for Handling Light Hydrocarbons," "Analytical Methods," "Preparation of Samples of Known Composition for Test Programs," and "Evaluation of Accuracy and Precision of Methods." In addition to numerous informative tables, photographs, and drawings, there are 114 appendix tables (one to a page, mostly in fine print) which present analytical data on various test samples. These data are both chemical and physical, including distillation, spectral, and data from combination methods.

Abbreviations used are seldom defined, although the meaning of RFC and the letters designating the various government rubbers is given in pages 1–3. Probably a good many foreign, and at least some American, readers might like to know what ORR, O.R.R., L.H., L.M., psia, DD, etc., stand for.

The 54 procedures as set forth in Chapter 7 (363 pp.) have "L.H." numbers. (The abbreviation "L.H." presumably, is for "light hydrocarbons" and facilitates cross-referencing.)

The three-page index is totally inadequate for a work of this magnitude. For example, it fails to list diamylamine, an important component in the reagent for 1,3-butadiene (p. 163). A few of the tables, such as Table 76, are scarcely legible. Methods are referred to without stating what they are—e.g., the gravimetric method (p. 467) for 1,3-butadiene (L.H. 510, p. 27). The book contains about 70 references to the scientific literature. Many more would be useful.

This book will be of interest to the large number of investigators who were, or still are, connected with butadiene analysis. It contains a large amount of miscellaneous information (only part of it still useful) under a misleading title. A more appropriate

title would be, "Light Hydrocarbon Analysis Pertaining to Government Synthetic Rubber." In spite of its high price, the book probably should be purchased by technical libraries because of the procedures given that are not available elsewhere.

DAVID CRAIG

B. F. Goodrich Research Center, Brecksville, Ohio

Agricultural Chemistry: Practical Applications of Agricultural Chemistry, Vol. II. Donald E. H. Frear, Ed. New York: Van Nostrand, 1951. 588 pp. $9.50.

Agricultural chemistry means different things to different people. However, no matter what may be the definition most favored by a reader, he is likely to find in this volume material that will interest and inform him with respect to the chemistry of agricultural products and processes. In preparing the 24 chapters of this book, Dr. Frear was aided by 22 authors, each a specialist in his own field. Dr. Frear himself prepared chapters on insecticides, fungicides, and herbicides.

The book is divided into four major parts dealing, respectively, with the chemistry of major agricultural products, the chemistry of fertilizers and soil amendments, nutrition of farm animals, chemistry of pesticides, and a final, relatively brief, fifth part discussing patent law and practice and the chemurgic utilization of some agricultural products.

A good deal of material is presented in useful tabular form (122 tables and 45 figures). Relevant summary tables of composition, properties, production, nutrient allowances, utilization, etc., are included —a desirable feature in a reference book of this type.

The level of treatment is perhaps a little uneven but in general calls for something more than an elementary knowledge of chemistry. In the preface it is indicated that the book is intended to be "a general reference text on agricultural chemistry" for advanced students, specialists, and research investigators. As such, it appears to be a good, workmanlike job.

A. G. NORMAN

Chemical Corps, Camp Detrick
Frederick, Maryland

Biological Antagonism: The Theory of Biological Relativity. Gustav J. Martin. Philadelphia–Toronto: Blakiston, 1951. 516 pp. $8.50.

This monograph is a comprehensive review and evaluation of studies related to the general phenomenon of biological antagonism. It should be of value to all investigators in the fields of biological science, for, as the author clearly brings out, biological antagonism is a basic aspect of all biological systems. The first chapter considers the specificity and kinetics of enzyme action and of enzyme inhibition. This is followed by 20 chapters on antagonists of the amino acids, vitamins, purines, pyrimidines, steroids, inorganic ions, etc. Although the treatment is extensive and detailed, these chapters were written with the needs of both the specialized and the general reader in mind. There is an outline at the beginning of each chapter and a liberal use of bold-face type, formulas, and summary tables. Each chapter is concluded with a recapitulation of the material—a valuable feature that should be more common in works of this type—and an adequate bibliography.

Dr. Martin, in order to present the scope and implications of biological antagonism in relation to enzyme systems, emphasizes the relative specificity of enzymes with respect to closely related compounds rather than the limitations of activity resulting from gross differences in substrate structure. This viewpoint, which is used in the discussions and interpretations throughout the volume, is evolved, in the final chapter, into a theory of biological relativity.

According to the author

> . . . the study of biological antagonism leads to the conclusion that there are no absolutes in biological systems which distinguish them from physical systems. . . . In any event, every phase of biology is relative; there are no absolutes beyond time. Enzymatic activity possesses only relative specificity. There are invariably several structural units possessing the power of functioning as a vitamin. No ion has been demonstrated to possess absolute specificity. Every phase of biological systems is relative. There can be no absolutes from the structural standpoint. The theory of biological relativity states that no single molecular structure possesses a function not shared in some degree by structurally related molecules.
>
> Another concept evoked by study of biological antagonism is that biological order is actually based upon disorder, upon antagonism. As with physical laws which are statistical, so biological systems represent the end results of chance. The orderly characteristics are in reality due to biological antagonism, to competing molecular units.

The author and publishers of this volume have made a valuable contribution to the literature of biological science.

C. R. TREADWELL

Department of Biochemistry
George Washington University School of Medicine

The Enzymes: Chemistry and Mechanism of Action, Vol. II, Part 1. James B. Sumner and Karl Myrbäck, Eds. New York: Academic Press, 1951. 790 pp. $14.80.

This volume is the third in a series of four designed to cover the major topics in enzyme chemistry. It has the most coherent organization of the series; the contributions with only a few exceptions deal with biological oxidations. Since the contributors are well-known authorities on the subjects they present, this volume, like the previous ones, is of a high caliber. The articles for the most part lack detailed information about methods. Considering how thoroughly dependent the progress, and even the language, of enzymology have been on the development of its methods, even a partial neglect of this aspect of the subject represents a serious limitation. These volumes thus do not replace the ***Methoden der Fermentforschung*** and an up-to-date version of the latter work is still very much needed.

The opening chapter on the theory of oxidation-reduction by the late L. Michaelis contains interesting comments on the mechanism of enzymatic oxidations. The critical importance of phosphate in the processes allied to biological oxidations is covered in three chapters. N. O. Kaplan classifies the various types of phosphate bonds, their biological generation and utilization, and calculation of their energy content. S. P. Colowick presents a much-needed lucid discussion of transphosphorylating enzymes and H. M. Kalckar summarizes information on the dephosphorylation of adenosine polyphosphates. A comprehensive review of the pyridine nucleotides and their apodehydrogenases is written by F. Schlenk. The general properties of flavoproteins and a treatment of the known flavin enzymes are covered by H. Theorell. Discussion of the iron-containing enzymes is divided among sections on the cytochromes by K.-G. Paul, the catalases and peroxidases by H. Theorell, and the nature of enzyme-substrate interaction by B. Chance. Copper oxidases are reviewed by C. R. Dawson and W. B. Tarpley.

There are chapters on amino acid oxidases by H. A. Krebs, amine oxidase by E. A. Zeller, lipoxidases by R. T. Holman and S. Bergström, and organic sulfur oxidases by C. Fromageot. Anaerobic glycolysis, which still holds many secrets, is reviewed by F. Dickens, and the subject of yeast and mold ferments is thoroughly reviewed by F. F. Nord and S. Weiss. Chapters are also included on aldolase and isomerase by Meyerhof, on keto acid decarboxylases by B. Vennesland, amino acid decarboxylases by O. Schales, desulfinase by Fromageot, succinic dehydrogenase by F. Schlenk, hydrogenase and hydrogenlyase by W. W. Umbreit, and the enzymes in luminescence by E. N. Harvey.

ARTHUR KORNBERG

National Institute of Arthritis and Metabolic Diseases, National Institutes of Health

Aspects of the Constitution of Mineral Oils. K. Van Nes and H. A. Van Westen. Houston-Amsterdam: Elsevier Press, 1951. 484 pp. $9.00.

This is a most important book for all who are interested in the chemistry of petroleum oils. The authors are members of the research staff of the Koninklijke/Shell-Laboratory in Amsterdam, and they acknowledge supervision of the work by J. J. Leendertse. As stated in the preface, "The primary object . . . was to introduce a hitherto unpublished method for structural group analysis." The book also includes a fairly comprehensive survey of our present knowledge concerning the constitution of mineral oils, more especially the lubricating oil fractions. "The new method referred to can be considered as a thorough revision of the 'ring analysis' or 'Waterman analysis.' It is based on the same principles but has a sounder experimental background and is of simpler application."

The essential thesis of the present work could have been presented as a monograph of about 200 pages, but the authors have naturally included much well-reviewed material on the physical properties of hydrocarbons, methods of separation, characterization, and identification that serve as background to make the purpose and value of their own contributions clearer.

It is of especial interest to the reviewer that the authors have included an excellent chapter of 51 pages, including a bibliography of 101 references, on the genesis of mineral oils. However, they have been unable to find, in any of the references cited, any clue to the formation of the complex polycyclic hydrocarbons in which they are primarily interested, nor do they speculate as to how such complex hydrocarbons have been formed. They seem to favor the catalytic action of silicates. "For lack of a better explanation of the numerous reactions that must have taken place . . . it seems best for the present to adhere to the hypothesis of low-temperature catalytic cracking."

The "ring analysis" method as developed by Vlugter, Waterman, and Van Westen was first published in 1932. This method involved hydrogenation of the oil fractions and determination of physical properties before and after hydrogenation. Since 1932 a great deal of work has been done. The data required by the method evolved by the authors include only the refractive index (n), density (d), and the molecular weight (M)—hence it is referred to as the *n-d-M* method. It is doubtful if this method could be published in any of our scientific journals with anything approaching the thoroughness of the present volume. It seems likely that more and more original work will be published in the form of monographs.

BENJAMIN T. BROOKS

405 Lexington Avenue, New York

The Biological Sciences

Genetics and the Origin of Species. 3rd ed. Theodosius Dobzhansky. New York: Columbia Univ. Press, 1951. 364 pp. $5.00.

That a third edition of this book is required in less than 15 years is convincing evidence of its importance as an argument of the genetic mechanisms of evolutionary change, and even more of its lucidity and readability. The first edition, published in 1937, won immediate recognition as the most competent analysis of the origin of species since Darwin. Like Darwin's work, it contained no new facts but it marshaled the available genetic data and, in terms of the principles of population analysis developed by Sewall Wright, made their evolutionary implications unmistakable. The second edition, which appeared four years later, was considerably larger and gave a much more extensive review of relevant genetic studies in plants as well as in animals. In 1941, recognition of the scientific merit of the second edition received public acknowledgment in the award to the author of the