to the simpler fermentation products. The author stresses the importance of those reactions capable of yielding free energy for bacterial growth. Assimilation of CO_2 and its reduction to CH_4 as proposed by Van Niel is discussed at some length in Chapter 1.

Each subject is introduced by an historical summary going back to the earliest recorded observations. Although the author disclaims any attempt at a complete bibliography he cites 162 references judiciously chosen so that the research worker wishing to pursue further study of the fields discussed could use the review as a starting point.

DEPARTMENT OF BACTERIOLOGY
UNIVERSITY OF FLORIDA A. M. BUSWELL
GAINESVILLE, FLORIDA

Radioaktive Isotope ihre Herstellung und Anwendung. By DR. KURT SCHMEISER, Knapsack-Griesheim A. G., Werk Knapsack Bei Köln, Früher Institut für Physik am Max-Planck-Institut für Med. Forschung, Heidelberg. Springer-Verlag, Reichpietschufer 20, Berlin W 35, Germany. 1957. xi + 246 pp. 17 × 25.5 cm. Price, DM 48.60.

The title of this book scarcely prepares the reader for the thorough treatise on radioactivity which the volume contains. Practically every topic conceivably pertinent to a discussion of radioactive processes from the experimental point of view is included. Beginning with an outline of the general features of nuclear structure, the author proceeds to give concise and easily comprehensible accounts of natural radioactivity, of artificially-induced nuclear transformations and the nuclear reactions by which radioactive isotopes are made. The principles governing the detection and measurement of radioactive radiations are developed with clarity and in detail. The application of these principles to actual detectors of the radiations is discussed with equal attention to the individual characteristics of each experimental device used in the measurement of radioactivity. No important method of measurement is overlooked.

It seems superfluous to give here a recapitulation of the contents of this book. The prospective reader can be assured that he will find in the pages of this volume the answer to practically any question which arises in the field of experimental radioactivity. A student could scarcely hope to find a better text from which to learn the elements of this important subject. A technician will find it a reliable guide in planning his work.

There is every evidence that the text has been prepared with great care. The information given is timely and accurate. Numerous clear and well-chosen illustrations and several extensive tables of data relating to nuclear processes enhance the value of the book.

NATIONAL BUREAU OF STANDARDS
WASHINGTON 25, D. C. LEON F. CURTISS

Advances in Enzymology and Related Subjects of Biochemistry. Volume XVIII. Edited by F. F. NORD, Fordham University, New York, N. Y. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1957. v + 435 pp. 16 × 23.5 cm. Price, $9.00.

This volume of the Advances in Enzymology appears to be of considerable interest to a number of areas of biochemistry and related fields. The authors selected to review these fields are particularly competent specialists in their areas. The chapter by Hartree on cytochrome in higher plants is an excellent review. An attempt is made not only to present information regarding plant cytochromes, but a comparison of these cytochromes to bacterial and animal cytochromes is discussed.

Singer, Kearney and Massey's article on succinic dehydrogenase reviews the authors' recent work and also attempts to reconcile information of past with present investigations. The discussion of the mechanism of succinic dehydrogenase action is of particular interest; an attempt is made by the authors to clarify the problem whether fumaric dehydrogenase and succinic dehydrogenase are one or two enzymes.

The section on the mechanism of toxicity of *Dichapetalum cymasum* by Sir Rudolph A. Peters deals with the action and properties of fluorinated compounds. The evidence that the toxic action of fluoroacetate is due to the plant synthesis of fluorocitrate is reviewed in detail and it is well documented. This review is an excellent attempt to integrate the information from Peters' own laboratory as well as that from other laboratories. Butler and Davison have reviewed some of the newer aspects on deoxyribonucleoproteins. The authors take particular cognizance of the possible role of the nucleoproteins as genetic factors.

In a timely review Kornberg has attempted to summarize the significance of pyrophosphorylases and phosphorylases in synthetic reactions. Workers in this area of enzymology, which is particularly active at this time, will gain much from this review. Kornberg has made a valiant attempt to integrate and classify the various types of pyrophosphorylases and phosphorylases.

Wiame has reviewed the role of the tricarboxylic acid cycle in synthetic reactions. This review covers a good deal of information and should be useful to investigators. However, the review is somewhat complex because of the inclusion of some information which appears not to be essential. The review, however, does give an excellent summary of the synthetic reactions leading out of the citric acid cycle in microörganisms.

The review by James is quite a complete one on the respiration of higher plants. Here again the information quoted is of use and will be of value to workers in plant metabolism.

The active investigations of the last few years on the chemistry and function of lipoic acid are adequately reviewed by Reed. He has given a particularly good summary of the chemical properties of lipoic acid.

The complex problems involved in lignification are reviewed in the chapter by Schubert and Nord. A good deal of material has been summarized and this should be of value to workers in this particular area.

In general this volume is well written and well documented and should become a valuable contribution to biochemistry.

GRADUATE DEPARTMENT OF BIOCHEMISTRY
BRANDEIS UNIVERSITY NATHAN O. KAPLAN
WALTHAM, MASSACHUSETTS

Annual Review of Physical Chemistry. Volume 8. H. EYRING, Editor, University of Utah, C. J. CHRISTENSEN, Associate Editor, University of Utah, and H. JOHNSTON, Associate Editor, University of California. Annual Reviews, Inc., Grant Avenue, Palo Alto, California. 1957. vii + 527 pp. 16 × 23 cm. Price, $7.00 (U.S.A.), $7.50 (elsewhere).

This volume is an excellent addition to an extremely useful, almost indispensable, series. The authors, as usual, are experts in their respective fields and represent a reasonably international selection. After the publication of seven previous volumes in the series there is little point in listing the more or less standard topics covered. Chapters included in the present volume on somewhat less conventional subjects are the following: High Polymers in Solution, Kinetics of Polymerization, Electrode Processes, Organic Reaction Mechanisms, Vibration-Rotation Spectroscopy, Combustion and Flames, The Physical Chemistry of Proteins, and Bond Energies.

Physical chemists owe a very considerable debt of gratitude to the editors and authors of this series. With the continued proliferation of the field of physical chemistry, these reviews become more valuable with each passing year.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF OREGON TERRELL L. HILL
EUGENE, OREGON

Kinetics and Thermodynamics in Biochemistry. By H. GEOFFREY BRAY, D.Sc. (Birm.), and KENNETH WHITE, B.Sc. (Lond.), Ph.D. (Birm.), F.R.I.C., Lecturers in Biochemistry, Department of Physiology, University of Birmingham. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1957. xii + 343 pp. 16 × 24 cm. Price, $7.50.

This rather small volume attempts to cover a large subject. According to the authors, the book is aimed at the honours' student of Biochemistry, biochemists unfamiliar

with the usefulness of the thermodynamic approach (if such exist), and the physical chemist unfamiliar with the more biochemical applications of his science. It is this third category for whom the book is most useful.

Obviously, a book this size could not present a thorough development of the fundamentals of physical chemistry *and* a thorough coverage of the biochemical applications. The sections dealing with fundamental physical chemistry are foreshortened and "telescoped." This leads to statements which, without proper qualification and explanation, are not strictly true. For example, here are a few: "the activity coefficient varies between the limits 0 and 1" and "ions are found to have minimal values of f . . . of the order of 0.5," p. 83; "activity coefficients are the same in solutions of the same ionic strength," p. 87; (from Debye–Hückel equation) "r" is termed "average" ionic radius p. 88, etc. For these reasons, the reader should have his physical chemistry well in hand *before* starting this book.

Despite this major shortcoming (it would require a monumental volume to give adequate coverage), the book serves a useful purpose. The style is easy to read though verbose in spots, the examples are well chosen, and the book provides a handy summary for a large specialized field in which such summaries are few. As a text, the book would require supplemental reading. It is best suited as a desk copy providing a quick review or a springboard to more detailed, comprehensive literature.

PHARMACOLOGY AND BIOCHEMISTRY
SCHOOL OF MEDICINE
UNIVERSITY OF ROCHESTER WILLIAM F. NEUMAN
ROCHESTER, NEW YORK

Thermodynamics. An Advanced Treatment for Chemists and Physicists. Third Edition. By E. A. GUGGENHEIM, M.A., Sc.D., F.R.S., Professor of Chemistry in the University of Reading. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y., 1957. xxii + 476 pp. 16 × 23 cm. Price, $9.75.

Thermodynamics can be approached from two widely different points of view. The first point of view, that typically used in instruction in American Chemistry Departments, conceives thermodynamics to be a means of explaining some very interesting physical phenomena. The other point of view, that typified by this book, conceives thermodynamics more as an end in itself, a kind of mathematical game in which the object is to derive as many equations as possible from as limited a set of postulates as possible—the quantitative answers that may be derivable from these equations are treated as of secondary interest.

Professor Guggenheim's objective is a clean cut exposition of the mathematical principles and relationships in the field of thermodynamics, and he is interested in the physical phenomena mainly in that they provide a test for his equations. Usually he loses interest as soon as the final equation is presented and goes on to a new subject to him more exciting than exploring the physical implications of the equation. As one of many examples of this attitude may be cited the last section of the chapter on Solutions of Electrolytes. A set of equations is derived from which may be obtained the concentration of a base in a solution relative to the concentration in the surface layer. The equations are not applied to any specific examples. No comment is made about whether or not the equations have ever been applied or even about whether the data suggest that a lower or higher relative concentration of base is to be expected in the surface.

The value of the book lies in the excellence of its presentation of thermodynamic theory. The book is not mathematically difficult. Development of each step of an argument from the preceding step is very carefully presented so that the reader should have no more difficulty with the mathematics than with that in more elementary texts in thermodynamics. The two long chapters, 1 and 3, constitute in fact an exceptionally clear summary of the fundamental principles of thermodynamics and of the mathematical relationships used in analysis of thermodynamic problems.

Professor Guggenheim's presentation of thermodynamic theory leaves the reader with an impression of tremendous authority. Part of this sense of authority stems from his obvious familiarity at first hand with all the major contributions to thermodynamic thought. Part of it stems from his manner of presentation. He clearly is never content to accept the work of others without thinking through in his own way the entire question under consideration, and in the end he never hesitates to present his own view without apology.

The third edition of the book differs from the first two mainly in that a final short chapter on Onsager's Reciprocal Relations has been added, and in that the material on solutions has been reorganized. The discussion of Onsager's Relations is restricted to isothermal systems and illustrated mainly by application to electrokinetic effects. In the first of the chapters on solutions, a quantity called the *excess molar Gibbs function* is introduced and discussed. Discussions of mixtures whose fugacities f are related to mole fraction x by $RT \ln f_1 = x_2^2 w$ has been made more general by treatment of w as a function of temperature and pressure.

The organization and scope of the book can probably best be illustrated by citing the chapter headings in order: Introduction and Fundamental Principles; Digression on Statistical Thermodynamics; Some Relations of General Validity; Systems of a Single Component; Gaseous, Liquid and Solid Mixtures; Solutions, Especially Dilute Solutions; Systems of Chemically Reacting Species; Solutions of Electrolytes; Electrochemical Systems; Gravitational Field; Electrostatic Systems; Magnetic Systems; Radiation; and Onsager's Reciprocal Relations. The book is clearly and attractively printed and is nearly free from typographical errors.

Professor Guggenheim's book is, as its subtitle states, an advanced treatise and would not be suitable for the usual introductory chemical thermodynamics course. The work should serve, however, as an excellent reference book for the serious student who desires to acquire depth and perspective. Any chemist who plans to work in the field of thermodynamics should read the book with attention.

UNIVERSITY OF CALIFORNIA
DIVISION OF MINERAL TECHNOLOGY ALAN W. SEARCY
BERKELEY 4, CALIFORNIA

Methods in Enzymology. Volume IV. Special Techniques for the Enzymologist. Edited by SIDNEY P. COLOWICK and NATHAN O. KAPLAN, McCollum–Pratt Institute, The Johns Hopkins University, Baltimore, Maryland. Academic Press, Inc., 111 Fifth Avenue, New York 3, N. Y. 1957. xii + 979 pp. 16 × 23.5 cm. Price, $24.00.

The phenomenal progress which enzyme chemistry has made in recent years may be ascribed to the development of refined techniques and the application of modern equipment. This volume deals with such special techniques which have been employed in enzyme studies. The following listing of the subject matter will illustrate the nature of this volume.

In Section I physical methods for characterization of proteins include: electrophoresis; paper electrophoresis; ultracentrifugation, diffusion and viscometry; infrared spectrophotometry; X-ray diffraction; light-scattering measurements; flow birefringence; fluorescence techniques; solubility criterion; and essential groups in enzymes.

In Section II there are techniques used in metabolic studies: assay of respiratory enzymes; artificial electron acceptors; perfusion techniques used in soil metabolism; the Hill reaction; nitrogen-fixation; certain micromethods used in enzyme assays; histochemical methods, and electron microscopy.

In Section III the following techniques for isotope studies are described: measurement; synthesis and degradation of isotopically labeled carbohydrates and carbohydrate intermediates; isotopic carbon patterns in bacterial fermentations; experiments with the tricarboxylic acid cycle; purines and pyrimidines; biosynthesis of protoporphyrin; amino acids and proteins (synthesis, isolation and degradation); labeled steroids; methyl groups (biosynthesis and transfer); labeled sulfur; labeled fatty acids; labeled compounds in phospholipid metabolism; labeled coenzymes; and I^{131}-labeled compounds.

The authors of these contributions are prominent representatives of their respective fields. Because most of these procedures have appeared widely-scattered in a large num-