The reviewer is gratified to read in the preface that, in subsequent editions, more specialized assistance will be obtained for detailed revision of particular sections and chapters. This set of volumes is so interesting and useful, and contains such a wealth of information that one is reluctant to mention any specific points of minor criticism. The section on a "radioactivity room" is written entirely in terms of radium, although a later chapter mentions in detail numerous radioisotopes. The excellent chapter on vitreous silica does not mention silica spring balances. The reviewer is particularly astounded to find in Volume I, page 477, that gas heated thermostats are still described in detail. It is noted that the electron microscope is not mentioned. The section on X-ray analysis is hopelessly out of date, and the subject of electron diffraction is not included. However a paragraph of 7 lines on the subject of neutron diffraction has been added at the end of Chapter VII. A more comprehensive index would make the volumes more useful. Despite these and other minor matters of omission and commission, the reviewer believes that every student of physical chemistry should be familiar with these volumes, and it is strongly recommended that they should be on the shelves of every library. The excessive cost will doubtless deter individual ownership.

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The Kinetic Basis of Molecular Biology. By FRANK H. JOHNSON, Department of Biology, Princeton University, HENRY EYRING, Department of Chemistry and the Graduate School, University of Utah, and MILTON J. POLISSAR, Department of Chemistry, City College of San Francisco and Biomechanics Group, University of California Medical School, San Francisco. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N.Y. 1954. vii + 874 pp. 16 × 23.5 cm. Price, $15.00.

The reviewer's first contact with the subject matter of this book occurred some twenty years ago when, while taking an advanced course in physical chemistry, he first heard of the exciting advances being made by Eyring, Morse, London and others toward reaching the goal of theoretical chemistry: *to predict from first principles the absolute rate of chemical reactions*. At that time both students and staff were particularly stimulated by the success these workers were having in the analysis and estimation of specific reaction rates for such relatively simple processes as the decomposition of gases (HCl, HBr) and the ortho → para hydrogen conversion. Since Farrington Daniels was in charge of the course, inevitably, speculation turned on whether application ever would be made to biological systems. In view of the complexity of such systems, most of us thought not—at least in our lifetime. Yet, in less than a decade, Eyring and Stearn could publish not merely a paper but a *review* on the application of the theory of reaction rates to proteins, and a few years later Johnson, Eyring and their collaborators were furnishing a series of contributions that dealt with absolute reaction rates as applied to such a definite biological process as bioluminescence. Why were we so mistaken in our doubts?

Aside from the operation of what a colleague terms the fourth law of thermodynamics—given two alternatives, one is more likely to choose the false one—it seems that the unexpected application by the authors and others in attacking biological reactions rests on the philosophy of their approach. Since in a sense this philosophy is the *raison d'etre* of this book, it might be informative to consider it as they have phrased it: "In theory at least, all the chemical and physical processes which molecules enter into are now calculable from first principles. Processes in living organisms seem to be no exception. . . . In applying absolute rate theory to specific reactions, using established values for the properties of the reactants, the calculations necessary to predict the rate of even the simplest reactions are extensive and complicated. In biological reactions the rate is ultimately controlled by enzymes and other proteins having such complex structure and high molecular weight that it is not feasible to calculate the absolute rates from first principles. The same theory applies, however, to complicated as well as to simple reactions and can be used to gain a clearer insight into the mechanism of biological processes. In many cases, for example, it is profitable to visualize the biological process in terms of potential energy surfaces. In any case the quantitative variation in rate with such factors as temperature and pressure is to be interpreted on the basis of the modern theory."

To illustrate and document such a point of view is the purpose of this book; to accomplish this, the authors have collected and organized most of the significant studies. In spite of their regret that limitations in space and time did not allow inclusion of separate chapters on such topics as photosynthesis and ionizing radiations (not entirely neglected, however), the result is a voluminous monograph of 762 pages of text (including about 250 illustrations), 84 pages of bibliography (over 1000 references) and 18 pages of subject index. Since it is not practical, even if one were competent, to comment on more than a fraction of the specific items discussed in this volume, consideration of its general organization appears to be more useful.

Of the 14 chapters, the initial one, simply called Introduction, is to me the most valuable and impressive. In the short space of 42 pages the authors have supplied an excellent abstract of the rest of the book. The theory of reaction rates with particular emphasis on the concept of the "activated complex" (intermediate compound, transition state) is developed, and the necessary mathematical aspects briefly indicated. Application of the theory to typical biological processes is then explored. The remainder of the volume is essentially a documentation and extension in depth of the material outlined in this introduction. First, the theory is rigorously defined and details supplied in a series of chapters dealing with thermodynamics (12 pages), classical mechanics (7 pages), quantum mechanics (27 pages), statistical mechanics (13 pages), culminating in the exposition of the calculation of absolute rates (22 pages). These chapters may well prove to be the most attractive feature of the book for the chemist as they present in condensed form some of the more abstruse aspects of chemical theory. They provide a welcome review for those who studied this material some time ago and should be helpful for the present-day student seeking a simplified presentation. The biochemist, and certainly the specialist in other branches of biology, is likely to find this section tough. Dr. Eyring, who, I suppose, is responsible for this material, has done an excellent job of logical presentation of complicated matters, but there are limits to what can be done in this direction. Most biologists would do well to concentrate on the chapter dealing with thermodynamics (as this is the minimum essential) and skip the others, secure in the knowledge that the mathematical and other manipulations necessary for obtaining the final equations have been adequately handled by competent practitioners.

The remaining chapters are devoted to biological applications. Merely to enumerate representative examples will suffice to illustrate the scope of the treatment: bioluminescence; effect of temperature and pressure on enzymes and other proteins; reversible and irreversible protein denaturation; respiratory processes in bacteria; cell division; action of inhibitors on enzyme systems; action of drugs; narcosis; disinfection; diffusion through membranes; and at the end, two stimulating chapters by Pollisar that deal with the physical chemistry of cell irritability, of nerve impulse and of muscle contraction. To single out any of these for special mention would reveal only the bias of the reviewer; obviously, this one would like particularly those dealing with bioluminescence and enzyme theory.

What, then, can be concluded as to the effectiveness of this somewhat awe-inspiring volume? First, it is certainly the definitive work in the field; the authors have been leaders in providing both theory and experiment for its development. Second, a real service has been supplied by collecting together between two covers the diverse contributions that necessarily have appeared in all types of physical and biological journals. Whether this collective effort with its vast expenditure of time and energy will convince the skeptics or reach those hitherto unfamiliar with these developments is not so clear. The reviewer is well aware of the unfairness to both author and publisher of criticizing a book on the grounds that this is not what he would have written had he been the author. These authors evidently wanted an encyclopedic volume, and they have provided it. It probably will be a valuable addition to both chemical and biological libraries and will serve for many years as a useful account of the development of this branch of biophysics and as a reference book for those that need detailed discussion of

both the mathematics and the experimental findings. But its size and cost will severely curtail its circulation among the very group that should have ready access to it—namely, present-day students who might thus be attracted to the field and provide the research for its continued development. With this comprehensive treatise available for consultation what is now needed is a volume modest in size and price as a text or a usable reference book for courses in chemistry, physics, biochemistry, bacteriology, and other biological specialties. It is suggested that chapter 1 (Introduction), chapter 2 (Thermodynamics) plus not more than 100 pages of varied biological applications abstracted from the last 640 pages of the present volume would make such a book. True, this condensation would lack the detail and completeness of the present work, but one does not need to count all the swallows to be sure of summer.

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Advances in Enzymology and Related Subjects of Biochemistry. Volume XV. Edited by F. F. NORD, Fordham University, New York, N. Y. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1954. x + 547 pp. 16 × 23.5. Price, $11.00.

This book is an excellent addition to this distinguished series of reviews. In addition to articles on various individual enzyme systems, this volume contains two general reviews on the mechanism of enzymatic reactions. The first of these "The Mechanism of Oxidoreduction" by S. J. Leach is concerned with the manner in which electrons, ions and radicals participate in the reaction between substrate, enzyme and coenzyme. Among the topics discussed in this article are heterogeneous catalysis, the role of the protein moiety as an electron or photon semiconductor, and studies with isotopes, enzymes and enzyme models. The second review, "Mechanism of Action of Hydrolytic Enzymes" by H. Lindley deals in a critical fashion with present theories of enzyme action, the evidence for them, and the limitations of available experimental methods. A third article by Rene Wurmser is entitled "Thermodynamics of Immunological Reactions." Three articles dealing with carbohydrate metabolism also are presented. These include "Alternate Pathways of Glucose and Fructose Metabolism" by E. Racker, "Enzymatic Mechanisms in the Citric Acid Cycle" by S. Ochoa, and "Enzymatic Synthesis of Polysaccharides" by M. Stacey. The second of this group of reviews includes a discussion of fumarase, the condensing enzyme for the formation of citrate, and the oxidation of α-ketoglutarate. Closely allied to these articles on carbohydrates is a review "Chemistry and Metabolism and Scope of Action of Pyridine Nucleotide Coenzymes" by Singer and Kearney. Other chapters in this book are "Urea Synthesis and Metabolism of Arginine and Citrulline" by S. Ratner, "Thiaminase" by A. Fujita, "Rennin and the Clotting of Milk" by N. J. Berridge, and "Structure of the Tobacco Mosaic Virus and Its Mutants" by G. Schramm. The book contains a complete author and subject index of the present volume and a cumulative index of authors of reviews and titles of reviews. The format and printing of this book are excellent, and it contains only a few typographical errors.

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BOOKS RECEIVED

January 10, 1955–February 10, 1955

M. L. ANSON, KENNETH BAILEY, AND JOHN T. EDSALL (edited by). "Advances in Protein Chemistry," Volume IX. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1954. 542 pp. $10.50.

J. O'M. BOCKRIS AND B. E. CONWAY (edited by). "Modern Aspects of Electrochemistry." Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1954. 344 pp. $6.80.

HARRY J. DEUEL, JR. "The Lipids. Their Chemistry and Biochemistry." Volume II: "Biochemistry. Digestion, Absorption, Transport, and Storage." Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1954. 919 pp. $25.00.

PAUL H. EMMETT (edited by). "Catalysis." Volume II. "Fundamental Principles" (Part 2). Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1955. 473 pp. $12.00.

HELLMUTH FISCHER. "Elektrolytische Abscheidung und Elektrokristallisation von Metallen." Springer-Verlag, Reichpietschufer 20, Berlin W 35, (West-Berlin), Germany. 1954. 717 pp. Ganzleinen DM 72.—.

FRIEDRICH HECHT AND MICHAEL K. ZACHERL (editors). "Handbuch der Mikrochemischen Methoden." Volume I, Part 1. "Präparative Mikromethoden in der Organischen Chemie." H. LIEB AND W. SCHÖNIGER. "Mikroskopische Methoden." L. KOFLER AND A. KOFLER. Springer-Verlag, Mölkerbastei 5, Wien 1, Austria. 1954. 236 pp. Ganzleinen, $11.30. Subscribers to Handbuch, $9.30.

ERICH HECKER AND ADOLF BUTENANDT. "Verteilungsverfahren im Laboratorium." Nr. 67. Monographien, Zu., Angewandte Chemie und Chemie Ingenieur-Technik. Verlag Chemie, G.m.b.H., Weinheim/Bergstrasse, Germany. 1955. 229 pp. $4.75.

OTTO HOFFMANN-OSTENHOF. "Enzymologie. Eine Darstellung für Chemiker, Biologen und Mediziner." Springer-Verlag, Mölkerbastei 5, Wien 1, Austria. 1954. 772 pp. Ganzleinen, $26.65.

H. H. G. JELLINEK. "Degradation of Vinyl Polymers." Volume III. Physical Chemistry. A Series of Monographs. Edited by Eric Hutchinson. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1955. 329 pp. $8.50.

W. KLYNE. "Progress in Stereochemistry." Volume I. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1954. 378 pp. $8.00.

J. A. LOVERN. "The Chemistry of Lipids of Biochemical Significance." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1955. 132 pp. $1.75.

J. B. NEILANDS, PAUL K. STUMPF AND ROGER Y. STAINIER. "Outlines of Enzyme Chemistry." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1955. 315 pp. $6.50.

J. R. PARTINGTON. "An Advanced Treatise on Physical Chemistry." Volume V. "Molecular Spectra and Structure. Dielectrics and Dipole Moments." Longmans, Green and Co., 55 Fifth Avenue, New York 3, N. Y. 1955. 565 pp. $15.50.

KENNETH M. SMITH AND MAX A. LAUFFER (edited by). "Advances in Virus Reseach." Volume II. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1954. 313 pp. $7.00.

P. C. L. THORNE AND E. R. ROBERTS (edited by). "Ephraim's Inorganic Chemistry." Sixth Edition—Revised and Enlarged. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1954. 956 pp. $6.25.

MELVILLE L. WOLFROM, Editor, R. STUART TIPSON, Assistant Editor, and E. L. HIRST, Associate Editor for the British Isles. "Advances in Carbohydrate Chemistry." Volume 9. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1954. 426 pp. $10.50.