be found essential for the reader who is either measuring or using partial molal properties, but it may be omitted by the more general reader without loss." The section in question is printed in smaller type, thus reinforcing the student's impression that partial molal properties have only a few special applications.

Contrast this with the calculation of thermodynamic functions from spectroscopic data, a subject close to the heart of the senior author (and to mine). It is possible to take the position that atoms and molecules have energy levels which are determined by physicists and published in journals such as "Physical Review." Treatment can then be limited to derivation of the desired functions. No such course has been taken. Discussion of energy levels begins with wave equations and ends with selection rules.

The wide scope of the text, combined with the use of mathematical methods with which the student is not expected to be familiar, creates problems in exposition. For example, in deriving Mulholland-type expressions for rotational partition functions, it is never mentioned that these are asymptotic expansions, with a specialized type of convergence. The skeptical student who attempts numerical verification with a minimum of arithmetic by using a very low temperature will have to seek elsewhere for explanation of his failure. To take another example, it is difficult to believe that any student who first sees a wave equation at the top of page 253 can have even a faint understanding, by the middle of the page, of the way in which this equation gives discrete energy levels.

There is no reason to doubt that the content and organization of this course has been satisfactory at Penn State. I feel that it is generally better for the student (and surely more comfortable for the professor) to have quantum mechanics taught by the Physics Department. Granted, it is good to abolish barriers between the sciences. Good for the organic chemist to learn thermodynamics. Good for the physical chemist to learn quantum mechanics. Good for the physicist to learn higher mathematics, and good for the organic chemist too, no doubt. Yet must all who set foot on a good road follow it to the end? May not the organic chemist (even the biologist) study thermodynamics without quantum mechanics, while physical chemists in the same class learn quantum mechanics with physicists? Since I would teach the course with such a philosophy, this volume could not be my basic text, but it would be heavily used for supplemental assignments.

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DES PLAINES, ILLINOIS LOUIS S. KASSEL

The Enzymes. Volume 1. Kinetics. Thermodynamics. Mechanism. Basic Properties. Second Edition, Completely Revised. Edited by PAUL D. BOYER, Department of Physiological Chemistry, University of Minnesota, Minneapolis, Minnesota; HENRY LARDY, Institute for Enzyme Research, University of Wisconsin, Madison, Wisconsin; and KARL MYRBÄCK, Institute for Organic Chemistry and Biochemistry, University of Stockholm, Stockholm, Sweden. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1959. xiii + 785 pp. 16 × 23 cm. Price, $24.00.

The statement that the second edition is completely revised is certainly correct. The first edition barely touched on the primary problem of enzyme chemistry—why are enzymes such good catalysts? A good portion of the volume is devoted to this problem, either directly or through topics which are likely to throw light on this problem.

The first chapter on the development of enzyme kinetics, by H. L. Segal, gives an excellent account of the many erroneous ideas and rate equations proposed for enzyme reactions. It is instructive to see the length of time taken for the idea of the enzyme–substrate complex to be proposed, an idea now considered so simple and obvious. The development of equations for inhibition and integrated rate equations are also discussed.

The second chapters by Hearon, Bernhard, Friess, Botts and Morales examines enzyme kinetics in exhaustive detail. Steady state equations for several substrates, different types of inhibition, several reactions in succession are discussed for all possible cases. Transient kinetics also are examined, and published data are compared with the theory for several enzymes. The treatment is very involved, and it is doubtful whether the equations will be of much help to those doing detailed kinetic studies. However, the discussion should be helpful in avoiding numerous pitfalls when working out one's own equations.

A short third chapter by R. A. Alberty discusses the rate equation for an enzyme reaction. There is considerable duplication of the material in the second chapter, but the discussion is clear, to the point, and should be useful to workers who plan to investigate the kinetics of an enzyme in detail.

The fourth chapter on some aspects of thermodynamics and mechanisms of enzymic catalysis by R. Lumry is superb. A discussion of the thermodynamics of binding and reaction of substrate molecules is followed by a discussion of how the protein may interact with the substrate, and finally there is a discussion of the various hypotheses for mechanisms of enzyme action. The reviewer knows of no better treatment of these problems, and all enzymologists will obtain helpful ideas from this chapter.

The fifth chapter by H. Gutfreund discusses structure and stereospecificity of enzymes. The discussion centers on the specificity of enzymes for metals, coenzymes, "identical groups" (as in citric acid), and group transfer reactions. Unfortunately, few data are presented on the different degrees of specificity in different enzymes, nor is there any discussion of the specificities of antibodies for haptens, for which there are many data and which is probably a similar problem.

The sixth chapter by F. H. Westheimer gives an ex ellent treatment of enzyme models. The models for coenzymes and derivatives, ester hydrolysis, concerted reactions, metal ion catalysis and decarboxylation are examined. Both the usefulness and limitations of model reactions in understanding enzyme mechanisms are clearly and critically discussed. The presentation and discussion of the data in Westheimer's excellent style makes this chapter one of the best in the volume.

The seventh chapter by D. E. Koshland, Jr., takes up the mechanisms of transfer enzymes. The specificity, the stereochemistry of the substrate and product, the mechanisms and nature of the active site of transfer enzymes are discussed. There is also some treatment of general mechanisms of enzyme action.

The eighth chapter by P. George and J. S. Griffith is on electron transfer and enzyme catalysis. Detailed discussion is given of electron exchange between inorganic cations, especially the Fe(II)–Fe(III) exchange, the oxidation of Fe(II) by O_2, and the thermodynamics of all possible intermediates in the reaction of O_2 to H_2O. A shorter discussion of these topics would have permitted the authors to take up other systems such as $SO_4^=$ to H_2S, NO_3^- to NH_3, etc., which are important in certain bacteria. Much of the discussion probably is not applicable to biological systems; for example, the Fe(II)–Fe(III) electron transfer would not apply to oxidative phosphorylation since there appear to be coenzyme intermediates between the different cytochromes.

The ninth chapter by R. J. P. Williams deals with coordination, chelation and catalysis. The stability, spectra, oxidation–reduction potentials and catalytic activity of transition metal complexes are discussed. There is an excellent treatment of the porphyrin complexes. The facts and ideas presented in this chapter should be helpful to those who work with enzymes containing transition metals.

The tenth chapter by Linderstrøm-Lang and J. A. Schellman on protein structure and enzyme activity takes up the primary, secondary and tertiary structure of proteins and the types of bonding that may be involved in maintaining these structures. Optical rotation, entropy and enthalpy changes in folding are discussed, as well as the sequences of amino acids in several enzymes. The treatment is excellent, but limited by the small amount of data in the field.

The eleventh chapter by P. D. Boyer on sulfhydryl and disulfide groups of enzymes gives a good discussion of this chemistry both in enzymes and in model compounds. Useful tables of SS and SH content of various enzymes are given. Enzymes in which SH groups probably form part of the active site are examined in some detail.

The twelfth chapter by H. Fraenkel-Conrat discusses other reactive groups of enzymes besides SH groups. The reactions of the amino, carboxyl and aliphatic hydroxyl groups in proteins are reviewed, as well as iodination, oxidation and the reactions of active sites of enzymes.

The thirteenth chapter by M. R. Pollock is on the induced formation of enzymes. This chapter gives an excellent summary of the kinetics and specificity of induction of enzymes. A critical discussion of the facts, theories and speculations on induced enzyme formation is helpful in understanding the present status of this difficult field.

The last chapter on the control of enzymatic activity by A. B. Pardee discusses the various methods of control such as enzyme induction, activation and inactivation, the role of substrates, coenzymes and specific inhibitors and activators. The discussion enumerates many facts and hypotheses and is not critical, but this is indicative of the small degree to which this field has advanced.

Chapters on enzyme synthesis and on the comparative biochemistry of enzymes might well have been included in this volume, and it is to be hoped that they will be included in one of the succeeding volumes. Because of its general nature, this volume probably will be the most valuable of the series. It will be advantageous for all enzymologists to have their own copy, but graduate students will, for the obvious reason, have to make use of the library copy.

DEPARTMENT OF BIOCHEMISTRY
COLLEGE OF PHYSICIANS AND SURGEONS
COLUMBIA UNIVERSITY STANLEY L. MILLER
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BOOKS RECEIVED

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J. B. BIRKS, General Editor. J. H. SCHULMAN, American Editor. "Progress in Dielectrics." Volume I. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1960. 312 pp. $11.00.

EDWARD A. BRUGES. "Available Energy and the Second Law Analysis." Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1959. 124 pp. $5.50.

E. M. CROOK, Organized and Edited by. "Glutathione." Biochemical Society Symposium No. 17 held at Senate House, University of London, on 15 February 1958. Cambridge University Press, 32 East 57th Street, New York 22, N. Y. 1959. 115 pp. $4.50.

R. M. C. DAWSON, DAPHNE C. ELLIOTT, W. H. ELLIOTT AND K. M. JONES, Edited by. "Data for Biochemical Research." Oxford University Press, 417 Fifth Avenue, New York 16, N. Y. 1959. 299 pp. $10.10.

I. L. FINAR. "Organic Chemistry." Volume Two. "Stereochemistry and the Chemistry of Natural Products." Second Edition. Longmans, Green and Co., Inc., 119 West 40th Street, New York 18, N. Y. 1959. 834 pp. $9.50.

DAVID GINSBURG, Edited by. "Non-Benzenoid Aromatic Compounds." Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1959. 543 pp. $18.00.

DONALD J. HANAHAN. With Contributing Chapters by FRANK R. N. GURD AND IRVING ZABIN. "Lipide Chemistry." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1960. 330 pp. $10.00.

RUDOLF KAISER. "Gas-Chromatographie." Akademische Verlagsgesellschaft, Geest und Portig, K.-G., Sternwartenstrasse 8, Leipzig C 1, Germany. 1960. 223 pp. DM. 32.—.

E. LEDERER. "Chromatographie en Chimie Organique et Biologique." Volume I. "Généralités. Applications en Chimie Organique." Masson et Cie., 120, Boulevard Saint-Germain, Paris 6, France. 1959. 672 pp. Broché, 9.000 fr.; cartonné toile, 10.000 fr.

R. H. F. MANSKE, Edited by. "The Alkaloids, Chemistry and Physiology." Volume VI. Supplement to Volumes I and II. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1960. 442 pp. $14.00.

HENRI MAURAS. "Tables pour le Calcul Direct des Constantes D'équilibre des Systèmes Chimiques aux Hautes Températures. Graphiques de Conversion en Composition a L'équilibre. Exemples de Calculs." Masson et Cie., 120, Boulevard Saint-German, Paris 6, France. 1959. 149 pp. Broché, 1.650 fr.; cartonné toile, 2.450 fr.

C. A. NEUGEBAUER, J. B. NEWKIRK AND D. A. VERMILYEA, Edited by. "Structure and Properties of Thin Films. Proceedings of an International Conference held at Bolton Landing, New York, on September 9–11, 1959." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1959. 561 pp. $15.00.

PAUL PASCAL, EDITOR. "Nouveau Traité de Chimie Minérale." Tome XVI. "Fluor, Chlore, Brome, Iode, Astate, Manganèse, Technétium, Rhénium." Masson et Cie., 120, Boulevard Saint-Germain, Paris 6, France. 1960. 1195 pp. Broché (2 vol.), 170 NF; cartonné toil (1 vol)., 185 NF.

F. L. M. PATTISON. "Toxic Aliphatic Fluorine Compounds." D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, New Jersey. 1959. 227 pp. $3.50.

LINUS PAULING. "The Nature of the Chemical Bond and the Structure of Molecules and Crystals: An Introduction to Modern Structural Chemistry." Third Edition. Cornell University Press, 124 Roberts Place, Ithaca, New York. 1960. 644 pp. $8.85.

E. H. ERICH PIETSCH, Edited by. "Gmelins Handbuch der Anorganischen Chemie." Achte Völlig Neu Bearbeitete Auflage. "Cadmium." Ergänzungsband. System-Number 33. Verlag Chemie, G. m. b. H. Pappelalle 3, Weinheim/Berstr., Germany. 1959. 802 pp. Kart., DM. 508.—; Gazl., DM. 513.—.

GEORGE C. PIMENTEL AND AUBREY L. MCCLELLAN. "The Hydrogen Bond." W. H. Freeman and Company, 660 Market Street, San Francisco 4, California. 1960. 475 pp. $9.50 (Text edition); $11.40 (Trade edition).

A. J. C. WILSON, General Editor. N. C. BAENZIGER (Metals), J. WYART (Inorganic Compounds), and J. MONTEATH ROBERTSON (Organic Compounds), Section Editors. DUBRAVKA HAVRANEK, Assistant Editor. "Structure Reports for 1952." Volume 16. N. V. A. Oosthoek's Uitgevers Mij., Domstraat 1–3, Utrecht, The Netherlands. 1959. 651 pp. $32.00.