

entropy are exactly defined only for the equilibrium case, it is then clear that the De Donder theory is an inexact theory which includes an exact one as a special case. If one loves generality enough to purchase it at such a price, one has afterwards to contend with the fact that it is by no means always obvious whether a given result obtained within the exposition of the general theory belongs to the inexact or the exact category. This is particularly true of the theory of stability as expounded in Chapter XV, most of the results of which are deducible without ever attributing temperature and entropy to systems not in equilibrium. The alternative to De Donder's procedure is first to develop the exact theory of equilibrium in full, and then, as an annex, the less exact one of irreversible processes in general, in which the De Donder method would have the place of honor when it comes to chemical reactions. I may add that in the book under review almost all of the experimental illustrations pertain to equilibrium, and that this is still perfectly representative of the present relation of theory to data in thermodynamics. We are thus far from having in this book or anywhere else a proof of the intrinsic superiority of the De Donder view. Which view is better bids fair to remain for some time a matter of taste.

DEPARTMENT OF CHEMISTRY
STANFORD UNIVERSITY
STANFORD, CALIF.

FREDERICK O. KOENIG

in man, R. H. Girdwood, hepatic fibrosis in children with acute leukemia treated with folic acid antagonists, J. Colsky), folic acid analogs (effect on growth and cell-division of microorganisms, M. Webb; effect on embryonic development, R. Bellairs; mode of action of folic acid antagonists and the function of the *Leuconostoc citrovorum* factor, W. Jacobson), antimetabolites related to folic acid (certain 2,4-diaminopteridines, H. O. J. Collier; derivatives of condensed pyrimidine systems, G. H. Hitchings, G. B. Elion and S. Singer), pteridine metabolism (D. J. Hutchison and J. H. Burchenal), and the yellow pigment of the argentaffine cells of mammalian gastro-intestinal tract (W. Jacobson).

The papers presented contain some original work as well as reviews of previously published material. This book will be of great value to all investigators interested in pteridine chemistry and biochemistry from the various disciplines, organic chemistry, biological chemistry, cell physiology, microbiology, pharmacology, insect physiology and leukemia research, and contains authoritative viewpoints of the history and future of pteridine research. A debt of gratitude is due the Ciba Foundation for making this symposium and its record possible.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF TEXAS
AUSTIN 12, TEXAS

WILLIAM SHIVE

Ciba Foundation Symposium on Chemistry and Biology of Pteridines. By G. E. W. WOLSTENHOLME, O.B.E., M.A., M.B., B.Ch., and MARGARET P. CAMERON, M.A., A.B.L.S. Editors for the Ciba Foundation for the Promotion of International Co-operation in Medical and Chemical Research, 41 Portland Place, London, W. 1, England. Little, Brown and Company, Publishers, Boston 6, Massachusetts. 1954. xiv + 425 pp. 14.5 × 21 cm. Price, \$8.00.

The papers presented at the Ciba Foundation sponsored international conference on the chemistry and biological aspects of pteridines are combined into a single volume with transcriptions of the general discussions of the conference. The discussions in a free conversational manner are very stimulating and allow more insight and speculation into the problems and difficulties of pteridine research than would be possible in formal papers.

The initial part of the symposium was devoted to chemistry of pteridines and includes topics concerning various reactions of pteridines (ring-opening, E. C. Taylor, Jr.; alkylation, H. C. S. Wood; reduction and reoxidation, G. B. Elion), synthesis of pteridines (monosubstituted pteridines, D. J. Brown; use of *o*-aminonitroso compounds in pteridine synthesis, G. M. Timmis, D. G. I. Felton and T. S. Osdone; recent developments, E. C. Taylor, Jr., J. A. Carbon, R. B. Garland, D. R. Hoff, C. F. Howell and W. R. Sherman; sulfonamide derivatives of pteridines, M. J. Fahrenbach, K. H. Collins, M. E. Hultquist and J. M. Smith, Jr.; pyrimidopteridines, E. A. Falco and G. H. Hitchings), isolation and constitution of pteridines (urothione, R. Tschesche; pteridines of *Drosophila melanogaster*, H. S. Forrest and H. K. Mitchell; fluoresceyanine, F. Korte; fluoresceyanine B, M. Polonovski, R.-G. Busnel, H. Jérôme and M. Martinet; structural studies on pyrimidopteridines, E. C. Taylor, Jr., C. K. Cain and H. M. Loux), physical properties (ultraviolet absorption spectra, S. F. Mason; chromatographic and electrophoretic studies, M. Polonovski, H. Jérôme and P. Gonnard) and some unresolved problems (A. Albert). These excellent papers on chemistry of pteridines will assist rapidly developing research in this very important class of compounds which includes pigments of many insects and fish, vitamins and growth factors, growth-regulating agents and other biologically active substances.

The second part of the symposium was devoted to biological aspects which include topics such as the biological functions and activities of essential metabolites related to pteridines (metabolic relations between *p*-aminobenzoic acid and folic acid, D. D. Woods; function of folic acid in purine and pyrimidine biosynthesis, R. H. Nimmo-Smith; activity of folic acid and substituted pteridines for *Tetrahymena*, G. W. Kidder), clinical aspects of folic acid and related compounds (disordered folic acid metabolism

Ionography. Electrophoresis in Stabilized Media. By HUGH J. McDONALD, D.Sc., Professor of Biochemistry, Stritch School of Medicine of Loyola University, Chicago, Ill. In collaboration with ROBERT J. LAPPE, M.S., Research Assistant, Department of Biochemistry, Loyola University, EDWARD P. MARBACH, Ph.D., Associate Chemist, American Meat Institute Foundation and Research Associate (Instructor), Department of Biochemistry, University of Chicago, ROBERT H. SPITZER, M.S., Research Assistant, Department of Biochemistry, Loyola University, and MATTHEW C. URBIN, Ph.D., Associate Chemist, Chemical Division, Corn Products Refining Company, Argo, Ill. The Year Book Publishers, Inc., 200 East Illinois Street, Chicago 11, Illinois. 1955. x + 268 pp. 14.5 × 22 cm. Price, \$6.50.

The subject of this book is electrophoresis under conditions where the solvent is stabilized, *i.e.*, supported in some sort of solid medium for the purpose of preventing convection. The word *ionography* is not the universally accepted term for this kind of electrophoresis. Since filter paper is the commonest supporting medium in use, the term *paper electrophoresis* is frequently employed; Tiselius and co-workers have used the term *zone electrophoresis*; and several other terms with essentially the same meaning are in the literature. One of the purposes of the authors of this book is undoubtedly to establish the term *ionography* and several pages are devoted to its defense.

The contents of the book may be divided into three parts, as follows: (1) Description of apparatus and experimental methods. This section includes a discussion of the various ways which have been used to suspend filter paper strips with particular emphasis on the authors' own method, in which the paper strips are held in a taut horizontal position in a controlled atmosphere.

(2) Determination of mobilities and their relation to mobilities measured by the moving boundary method. In this section much of the space is devoted to theory, *e.g.*, to the effect of electroosmosis. There is lengthy criticism of the "tortuous path" theory of Kunkel and Tiselius, and a preference for the authors' own "barrier" theory.

(3) A survey of the recorded applications of the method, divided into chapters on proteins, peptides and amino acids; carbohydrates and related compounds; lipoproteins and related substances; enzymes, hormones and vitamins; inorganic substances; miscellaneous applications. The survey of the literature is very complete: the bibliography comprises 865 papers, of which only 93 are dated earlier than 1950.

The book can be criticized on a number of counts. Evidently, the "barrier" theory is of dubious validity, as is evident from the summary on page 88 which states that "... the paper can be thought of as interposing obstacles or barriers in the migration path of the migrant. As a con-

sequence of this barrier effect, the thermodynamic activity of the migrant is decreased, thus causing a decrease in its mobility." The most charitable view of this sentence and the equations which derive the relation based on it is that the term "thermodynamic activity" slipped into the text by accident, and that the authors really intend it to represent some quite different empirical quantity.

Nevertheless, "Tonography" should be a book of great utility to all those interested in the separation of natural products or in their characterization by the electrophoretic method. The field is a very new one, as the dates of the references clearly show, and the authors have reviewed it completely. Even though, as they themselves admit, their own point of view is stressed, other points of view are given full airing. No other source of reference to the complete literature of electrophoresis in supported media is available.

DEPARTMENT OF CHEMISTRY
STATE UNIVERSITY OF IOWA
IOWA CITY, IOWA

CHARLES TANFORD

The Chemistry of Petroleum Hydrocarbons. Volume I. Edited by BENJAMIN T. BROOKS, CECIL E. BOORD, STEWART S. KURTZ, and LOUIS SCHMERLING. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1955. viii + 664 pp. 16 X 23 cm. Price, \$18.00. **Volume II.** vi + 448 pp. 16 X 23 cm. Price, \$13.50. **Volume III.** vii + 690 pp. 16 X 23 cm. Price, \$18.00.

This compendium is very appropriately dedicated to Vladimir N. Ipatieff and Frank C. Whitmore who contributed so voluminously to the development of this subject. The set of books represents a tremendous undertaking and the reviewer is reminded of two reviews of "Textbook of Physical Chemistry" by Glasstone, which appeared in *Trans. Faraday Soc.*, **38**, 120, 214 (1942). The first causti-

cally criticizes the attempt to cover all of physical chemistry in a single work. The second views it as a noble and well deserved effort, stating that it is a guide book to the subject. This reviewer feels that the present work is of the latter nature and that Dr. Brooks and his co-editors are deserving of high compliment. They have brought together a large number of contributing experts who have done on the whole a splendid job.

Volume I is concerned primarily with the physical chemistry and the physical processes of petroleum and petroleum fractions, although it also embraces some synthetic work and the Fischer-Tropsch reaction. The latter two subjects might have been more appropriately included in Volume II (the smallest of the three) and in their stead to have presented discussions of the thermodynamic properties of hydrocarbons, such as free energies of formation, equilibria, heats of hydrogenation and bond energies.

Volumes II and III deal with chemical reactions of petroleum hydrocarbons and, hence, are probably of the greater interest to most chemists. Space here does not permit a definite description of the volumes' contents. The omission of a discussion of the phenomenon of "knock" and its relation to chemical composition is regrettable. Likewise it is unfortunate that the current studies on low pressure ethylene polymerization (such as "Ziegler chemistry" and the Phillips Company's work) have been reported so recently as to have precluded inclusion of them in the chapter on this subject. Another field which is virtually ignored is that of both "normal" (ionic) and "abnormal" (free radical) additions to olefins.

The Publishers have done an excellent job in preparing this work and only a few minor errors have been found. The prices may seem high but, under the circumstances, are probably justified, as such a large amount of material is covered. The set is recommended to those chemists who are interested in petroleum.

SHELL DEVELOPMENT COMPANY
EMERYVILLE 8, CALIFORNIA

WILLIAM E. VAUGHAN