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
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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. Osdene; 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; fluorescyanine, F. Korte; fluorescyanine B, M. Polonovski, R.-G. Busnel, H. Jérome 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. Jérome 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 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 microörganisms, 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
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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 coworkers 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 electroösmosis. 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. Especially, 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-