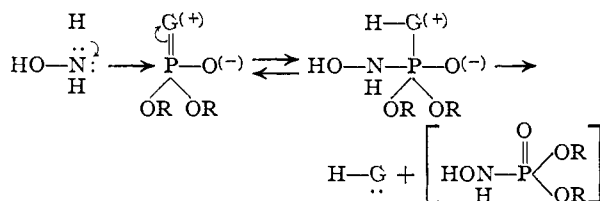


regenerate the enzyme the phosphorylated enzyme reacts only very slowly with water. It is the slowness of this reaction which makes these compounds inhibitors rather than substrates.⁴

Theory predicts that nucleophilic reagents should dephosphorylate the enzyme and thus restore its activity. When R = ethyl (inhibitor = tetraethyl pyrophosphate or diethyl fluorophosphate) reactivation is readily accomplished by a large number of compounds containing amino, hydroxyl, mercaptyl, guanidino, amidino, pyridyl or hydroxylamine groups.⁴ When R = isopropyl (inhibitor = diisopropyl fluorophosphate) reactivation is far more difficult.

The reactivation process occurs as follows (illustrated with hydroxylamine)



Acetylcholinesterase contains an activation anionic site which binds alkylated cationic amino groups. Experiments show that this site survives the inhibition of the enzyme and can contribute to the reactivation process. It is, therefore, to be expected that a very good reactivator could be produced by combining an intrinsically good

reactivating group such as hydroxylamine with a suitably placed quaternary nitrogen structure in the same molecule. We have therefore synthesized nicotinydroxamic acid methiodide and compared it to hydroxylamine as a reactivating agent.

R	Inhibitor	Reactivator at 24° 0.1 M	Time in hours	% reactivation
Ethyl	Tetraethylpyrophosphate (24-48 hrs. exposure)	Hydroxylamine	0.5	40 ^a
		Nicotinydroxamic acid methiodide	0.25	63
Isopropyl	Diisopropyl fluorophosphate (1 hr. exposure)	Hydroxylamine	4	17
		Nicotinydroxamic acid methiodide	24	19
		Nicotinydroxamic acid methiodide	4	50
		Nicotinydroxamic acid methiodide	24	96

^a Taken from ref. 5.

With this new compound we have for the first time obtained large and indeed even complete reactivations of diisopropyl fluorophosphate inhibition. The practical significance of this theory and of the new compound are self-evident.

DEPARTMENT OF NEUROLOGY
COLLEGE OF PHYSICIANS AND SURGEONS
COLUMBIA UNIVERSITY
NEW YORK, N. Y.

IRWIN B. WILSON
ESTELLE K. MEISLICH

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BOOK REVIEWS

Non-Aqueous Solvents—Applications as Media for Chemical Reactions. By LUDWIG F. AUDRIETH, Professor of Chemistry, University of Illinois, and JACOB KLEINBERG, Professor of Chemistry, University of Kansas. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1953. xii + 284 pp. 16 × 23.5 cm. Price \$6.75.

The present volume on "Non-Aqueous Solvents" is devoted to a topic which should be much more widely studied and understood by organic, inorganic and analytical chemists. The subject is vitally important to the industrial chemist who is constantly seeking more rapid and cheaper methods for the production of his products. Our students are all taught about metathetical and solvation reactions where water is the solvent, but little is said about the same reactions when solvents such as ammonia, alcohol, etc., are used. The universal availability and use of water as a solvent has thus at times partially blinded us and restricted our perspective.

Very appropriately the volume is dedicated to Edward Curtis Franklin, Charles A. Kraus, and Paul Walden, pioneers in the field of "Non-Aqueous Solvent Chemistry." The first chapter is devoted to the properties of solvents, starting with the special characteristics which have been largely responsible for the outstanding position which water occupies. This is followed by a discussion of the nature of differentiating and leveling solvents and type reactions in non-aqueous solvents.

The second chapter is devoted to the historical development of acid-base concepts, stressing the solvent system of Franklin-Kraus, the protonic concept of Brønsted-Lowry, and the electronic theory of Lewis. Succeeding chapters

deal with liquid ammonia as a dispersion medium, the nitrogen system of compounds, reactions in liquid ammonia, metal-ammonia solutions, and nitrogen-containing solvents. Special chapters are devoted to acetic acid, sulfuric acid, hydrogen fluoride and liquid sulfur dioxide. A separate chapter devoted to acid chlorides deals with selenium(IV) oxychloride, carbonyl chloride (phosgene), nitrosyl chloride and phosphorus(V) oxychloride. The use of halogens and interhalogens as solvents is summarized with tables showing the preparation of nitrosyl and nitronium complexes in bromine trifluoride, the behavior of elements in the solvents I₂, ICl and IBr and the solubility of halides in I₂, ICl, IBr and BrF₃.

A concluding chapter takes up the very interesting, but much less explored field of high temperature solvent systems. These include phenomena involved in ceramics and geochemical phenomena such as no doubt occurred in nature in the formation and deposition of our minerals and ore deposits.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF COLORADO
BOULDER, COLORADO

FRANK E. E. GERMANN

Cytochemistry—A Critical Approach. By J. F. DANIELLI, Professor of Zoology, King's College, London, W. C. 2. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1953. v + 139 pp. 14.5 × 22 cm. Price, \$4.00.

Danielli presents in seven chapters the subject matter of a series of lectures designed to guide workers entering the "almost undeveloped" field of cytochemistry. He gives

techniques and facts and hypotheses; the emphasis is on techniques (more than half the book by page count); the findings are used as illustrations, and Danielli has a gift for selecting dramatic illustrations to highlight a point. The author is at his best, however, in the skill with which he sketches the outlines of plausible and ingenious hypotheses and then, having established an orientation, carefully describes the pitfalls, obvious as well as subtle (*e.g.*, 7 pp. are devoted to "the requirements of a system which will permit quantitative studies"). Danielli finds the cytochemist bedeviled by physical problems, *e.g.*, diffusion and adsorption artefacts, effects of molecular orientation and light scattering; by chemical problems, *e.g.*, specificity and accuracy; and by biological problems, *e.g.*, age and state of activity of the cell.

Cytochemistry, a field of intense activity during the past 10 years, is described as having exceptional power but is to be viewed as a rigorous technique in the hands of an adequately trained team. Developments in the localization and identification of phosphatases, aldehydes and proteins-nucleic acids are given a chapter each. Techniques are discussed: 10-20 pages in each chapter. Some of the topics may be listed: for phosphatase—the presence in cell nuclei, the relation to protein synthesis, to bone formation, to secretion (Danielli pictures a most ingenious contractile protein that drags a molecule through a membrane.); for aldehydes—the role in fat transport, synthesis and metabolism; for proteins and nucleic acids—the problem of protein synthesis (nucleic acid participation may be (a) direct, (b) as a folding agent or (c) as a trapping agent); the selective distribution of cytoplasmic PNA and nuclear DNA, the effects of radiation.

The book is blessed with a readability reminiscent of the informal discursive scientific writing of half a century ago. Certain criticisms can be stated. The most important neglected field is the biochemical characterization of *isolated* cellular components, such as nuclei, and mitochondria. More specific referencing would have been helpful. Magnifications were not indicated in the legends of the carefully selected and beautifully reproduced figures. Little mention was made of some potentially helpful tools, *e.g.*, phase microscopy, dispersion staining and electron micrography. These are minor matters. The impact of the imaginative discussions is better gauged by such provocative suggestions as this one to the pharmacologist—can he design "a drug to fit the enzymic pattern of a tumor"? and this challenge to the chemist—cytochemistry is "throwing almost the whole of the living world open to study by the chemist."

DIVISION OF PHARMACOLOGY
UNIVERSITY OF ROCHESTER
SCHOOL OF MEDICINE AND DENTISTRY
ROCHESTER, NEW YORK

HAROLD C. HODGE

Kalorisch-Chemische Rechenaufgaben. By Dr. M. v. STACKELBERG, Apl. Professor für Physikalische Chemie an der Universität Bonn A. RH. Springer-Verlag, Reichpietschufer 20, Berlin W 35, Germany. 1952. ii + 71 pp. 13.5 × 21 cm. Price, DM 5.80.

The aim of this booklet is to make students familiar with the concepts of the enthalpy, affinity and entropy of chemical reactions and to give them practice in the use of tables of thermochemical data, more particularly those contained in a handbook prepared by D'Ans and Lax. Half of the book is devoted to problems, half to the solution of these problems.

It is highly probable that a student who should work his way through this collection of problems would emerge with a deeper understanding of thermodynamics and more skill in its application to many types of chemical processes. However, I do not think this booklet would be very useful to American students. In the first place, they would run into symbols quite different in many cases from those they have been learning to use. For example, the author uses the symbols W and ΔS for the affinity, the change in the enthalpy and the change in the entropy, respectively, and these same symbols in heavier lettering for what we in the United States would designate as their standard values. I think this notation would be a stumbling block in the way of the inexperienced student.

In the second place, the data used in the solution of the problems are taken exclusively from the German handbook previously mentioned. Although I think this is a minor objection, nevertheless the student in this country would be

obliged to accumulate his data from other handbooks and then compare his solutions of a problem with that given in the booklet, based on different data. This might be good training for the student but it wouldn't increase his affection for Dr. von Stackelberg's booklet.

PENNSYLVANIA COLLEGE FOR WOMEN F. H. MACDOUGALL
PITTSBURGH, PENNSYLVANIA

Synthetic Organic Chemistry. By ROMEO B. WAGNER, Former Assistant Professor of Chemistry, The Pennsylvania State College; and HARRY D. ZOOK, Assistant Professor of Chemistry, The Pennsylvania State College. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1953. xii + 887 pp. 16 × 23.5 cm. Price, \$11.50.

This work is a comprehensive treatment in a single volume of methods for the synthesis of mono- and difunctional organic compounds. It covers the more important chemical literature published in English, French and German from 1919 through 1950. The number of references to the literature varies from 15 for sulfinic acids to 801 for hydroxy compounds, and the total number is over 7000. The number of citations is considerably more since many of the references list more than one citation.

Each of the thirty-nine chapters deals with a single functional group, or in a few instances with several closely related groups. Within each chapter the examples are listed according to the method of preparation. For each method the text covers the scope, conditions and limitations of the reaction and the particular behavior of individual compounds. One or more tables at the end of each chapter list specific compounds, their method of preparation, yield, reference to the literature, physical properties and the properties of derivatives. These compounds were selected on the basis of adequate description of the method of preparation. The classification of the compounds is such that the method of preparation is not necessarily one of those considered in the chapter where the table appears. Although the tables contain only a selected list of relatively simple compounds, the fact that they cover twenty or more years of literature not yet included in Beilstein ensures their frequent use for ready reference purposes.

The arrangement of the material is such that more use will be made of the tables of contents at the beginning of the book and at the beginning of each chapter than of the index. In fact the index occupies only twenty-six pages and is supplementary to the tables of contents and tables of compounds and does not duplicate them. The index has entries only under the type of compound and under the name reactions. Although one can appreciate the desire to keep the size of the index at a minimum, the inclusion of entries for types of reaction would not have increased greatly the size of the index and would have added to the convenience in using the book. A further expansion to include the more specific reagents and catalysts would have been welcome.

The two other works with which this volume may be compared are "Synthetic Methods of Organic Chemistry" by W. Theilheimer and "Organic Reactions" edited by R. Adams and others. This book is easier to use and at present covers a greater period of years than the surveys by Theilheimer, although the latter include more complex compounds and always will cover more recent literature. "Organic Reactions" is more definitive, but this book covers a greater variety of reactions. It has an advantage over both of the other publications in that all of the material is in a single volume. A possible adverse criticism that the literature previous to 1919 is not cited is less important than it might be, because references are given to previous compilations in review articles and books.

The publishers have been highly successful in producing by the use of off-set printing a book of this type which can be marketed at a comparatively low price. The type face is familiar and readable, the material appears to be free of typographical errors, and the quality of paper and binding is excellent. The book should prove to be a valuable and much used tool of the chemist engaged in the laboratory synthesis of organic compounds.

DEPARTMENT OF CHEMISTRY
STANFORD UNIVERSITY
STANFORD, CALIF.

CARL R. NOLLER