

TABLE I
SYNTHESIS OF ANTHRANILIC ACID FROM SHIKIMIC-5-P AND L-GLUTAMINE

Cell-free extracts were prepared by subjecting cells of freshly harvested *E. coli* mutant B-37 to sonic vibration.¹¹ The incubation mixtures contained 0.2 ml. of extract (4 mg. of protein), 5 μ moles of $MgCl_2$, 40 μ moles of Tris buffer pH 8.2, 1.0 μ mole of shikimic-5-P or 5 μ moles of glutamine (as indicated), + additions in a final volume of 1 ml. Following incubation at 37° for 2 hours aliquots were removed for the assay of anthranilic acid.^{12,13}

Substrates and additions	Yield of anthranilic acid, μ moles
Shikimic acid-5-phosphate (1.0 μ mole)	0
+ 5.0 μ moles L-aspartic acid	0.10
+ 5.0 μ moles L-glutamic acid	0.20
+ 5.0 μ moles L-glutamine	0.86
+ 5.0 μ moles L-asparagine	0.17
+ 5.0 μ moles NH_4Cl	0.18
L-glutamine (5.0 μ moles)	0
+ 1.0 μ mole SA	0
+ 1.0 μ mole SA + 1.0 μ mole ATP	0.18
+ 1.0 μ mole shikimic-5-P	0.80
+ 1.0 μ mole Z1	0

(11) The organism was grown for 24 hours with aeration at 30° in minimal medium A (B. D. Davis and E. S. Mingioli, *J. Bact.*, **60**, 17 (1950)) supplemented with 0.2% Difco yeast extract and 0.2% Difco Casamino acids.

(12) A. C. Bratton and E. K. Marshall, *J. Biol. Chem.*, **128**, 537 (1939).

(13) H. W. Eckert, *ibid.*, **148**, 197 (1943).

ably the 5-enolpyruvate of shikimic acid^{14,15}), and the two isomers of 6-amino-3,4,5-trihydroxycyclohexane carboxylic acid,¹⁶ could not replace shikimic-5-P.

The formation of anthranilic acid also requires the oxidized form of pyridine nucleotide (DPN⁺ or TPN⁺). Treatment with charcoal destroys the capacity to form anthranilic acid from shikimic-5-P and L-glutamine. The addition of DPN⁺, TPN⁺, or DPNH,¹⁷ restores the activity. Furthermore, the addition of DPNase¹⁸ completely abolishes anthranilate formation.¹⁹

It is a pleasure to acknowledge my indebtedness to Professor J. S. Gots for the mutant strain, and to Professor B. D. Davis for the shikimic-5-P and Z1.

(14) B. D. Davis and E. S. Mingioli, *J. Bact.*, **66**, 129 (1953).

(15) C. Gilvarg and B. D. Davis, unpublished observations.

(16) The two isomers were kindly supplied by Professor H. Plieninger, University of Heidelberg.

(17) These extracts contain an active DPNH oxidase.

(18) The Neurospora DPNase was a kind gift of Professor N. O. Kaplan.

(19) Some extracts were found to be inactive unless they were fortified with yeast extract. DPN⁺ alone was unable to substitute for the yeast extract, suggesting a possible requirement for another cofactor.

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BOOK REVIEWS

Annual Reports on the Progress of Chemistry for 1957. Volume LIV. R. S. CAHN, Editor. The Chemical Society, Burlington House, London, W. 1, England. 1958. xx + 445 pp. 14.5 × 22 cm. Price, £2.

The authors of *Annual Reports* face a huge task in their effort to summarize the significant advances in chemistry reported during a year. They acquit themselves of this task very well.

To the specialist within an area the reports provide a perspective to the year's progress which is difficult to achieve from the reading of individual papers. For workers interested in undertaking more intensive study on a topic, the Reports provide an outstanding source of references both to original papers and to recent reviews. For those wishing to survey recent developments in areas outside their own special interests, the Reports serve as an authoritative up-to-date summary which is, for the most part, readable without reference to the original work and without special knowledge in the field.

There are twelve topics in the table of contents which were reviewed last year as well. When, due to space limitations, a topic is covered only after a two or three year accumulation of work, the result is an especially useful review. Such topics in the 1957 Reports and the years since their last appearance are: Radiofrequency Spectroscopy (2), Electrochemistry (3), Thermochemistry (3), and Amino Acids, Peptides and Proteins (2). Other topics appear to be simply summaries of the current status of work and are not restricted to a particular time span. These include: Dielectric Measurements, Stereochemistry, The Mechanism of Enzyme Action Studied with Isotopes, Neuramic Acid, The Biosynthesis of the Purine and Pyrimidine Ring Systems, and the Biosynthesis of Penicillin and Some Other Antibiotics.

The text is adequately, but not abundantly, illustrated with structural formulae. This reviewer particularly ap-

preciated the frequent use of Arabic, rather than the time honored but unwieldy Roman, numerals to refer to the structural formulae. This speeds reading comprehension to a marked degree.

This volume continues the excellent tradition established by the series of *Annual Reports* and is recommended to the attention of every chemist.

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Reaktionmechanismen. Erste Folge. BY VOLKER FRANZEN, Privatdozent an der Universität Heidelberg. Dr. Alfred Hüthig Verlag, Wilckensstrasse 3, Heidelberg, Germany. 1958. 160 pp. 16 × 23.5 cm. Price, DM 18,—.

This book is a collection of papers on reaction mechanisms which appeared in *Chemiker-Zeitung*, 1955-1957. Titles of the chapters are: Hydride Shifts (Carbinol-Carbonyl Equilibrium, Meerwein-Oppenauer Reduction-Oxidation, Cannizzaro Reaction, Quinone Dehydrogenation, Sommelet Reaction, Leuckart-Wallach Reaction, Reduction with Carbonium Ions, Stereochemistry of Hydride Reductions); Electron-deficient Rearrangements (Wolff, Hofmann, Lossen, Curtius, Schmidt and Baeyer-Villiger Rearrangements and Ozone Cleavage); Carbonyl Reactions (Addition Reactions, Aldol, Perkin and Grignard Reactions); Friedel-Crafts Reaction (Alkylation and Acylation); Ester Pyrolysis; Prius Reaction; Wolff-Kishner Reaction; Silver Salt-Bromine Reaction and Decarboxylation. Many of the original papers have been revised and all of the older ones have been brought up to date. The literature is covered through 1956 and in some cases (such as the Grignard equilibrium), where particu-

larly pertinent recent papers have appeared, into 1957. Introductory chapters (not very comprehensive) on transition states, isotope effects and acid-base catalysis have been added. Each section is followed by a well-selected bibliography.

This is not, and according to the preface is not meant to be, a textbook on reaction mechanisms. Such fundamental concepts as the H_0 -function and the Hammett σ - ρ treatment are not dealt with (although the Brønsted catalysis law is mentioned), and such basic reactions as aliphatic nucleophilic substitution, aromatic substitution, olefin addition and ionic elimination are not covered in a general way. However, the reader who takes this book for what it is—namely, a collection of essays—will be delighted by the lucidity and conciseness of the author's exposition. Each essay starts out with a brief statement of the scope and history of the reaction in question and its mechanistically more interesting aspects. Studies concerned specifically with mechanism are then presented. Reasonable mechanisms are discussed and employed to account for the course of the reaction in a number of special cases. For example, it is shown how the carbanion mechanism of the Wolff-Kishner reaction may account for double-bond shifts in α,β -unsaturated aldehydes and for concomitant elimination reactions in α -substituted carbonyl compounds. Little space is given to a critical discussion of alternative mechanisms. Thus in the silver salt-bromine reaction, only the likely radical mechanism is presented; the controversy regarding Kenyon's electrophilic displacement mechanism is not mentioned.

This book is recommended to the preparative organic chemist who wishes to use mechanistic ideas to improve his batting average in the design of syntheses, since practical applications of mechanistic considerations are stressed throughout the presentation. It will also be a welcome summary to those interested in the area of physical organic chemistry who have not managed to keep up with all the studies on the mechanisms of specific reactions (and who can keep up with all of them nowadays!), especially since the author has himself made contributions to a number of the fields he discusses. Finally, the book should be of value to the student of organic chemistry who already has a sound background in the field of physical organic chemistry and who, at the same time, wishes to improve his German (the book is not difficult linguistically) and wants to learn about the mechanism of reactions some of which are not covered in standard textbooks.

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Fortschritte der Hochpolymeren-Forschung (Advances in Polymer Science). Band 1, Heft 1. Edited by J. D. FERRY, Madison, C. G. OVERBERGER, New York, G. V. SCHULZ, Mainz, J. STAVERMAN, Leiden, and H. A. STUART, Mainz. Springer-Verlag, Reichpietschauer 20, Berlin W 35, Germany. 1958. 158 pp. 16.5 × 24.5 cm. Price, DM 29.80.

This is the first issue of a new series of reviews on current polymer chemistry and physics; it evidently is designed to supplement and keep up to date "Die Physik der Hochpolymeren," edited by H. A. Stuart and also published by Springer-Verlag. Included in Heft 1 are the following: Specific Ion Binding, pp. 1-34, by H. Morawetz (Polytechnic Institute of Brooklyn); The Study of High Polymers by Nuclear Magnetic Resonance, pp. 35-74, by W. P. Schlichter (Bell Telephone Laboratories, Inc.); Fluorine-Containing Polymers. I. Fluorinated Vinyl Polymers with Functional Groups, Condensation Polymers and Styrene Polymers, pp. 75-113, by W. Postelnek, L. E. Coleman and A. M. Lovelace (Wright Air Development Center); and The Dynamic Mechanical Properties of High Polymers at Low Temperatures, pp. 114-158, by A. E. Woodward and J. A. Sauer (Pennsylvania State University).

The monographs have been carefully planned. Each starts with an outline, which simultaneously serves as a topical index. Then the introduction gives the historical and theoretical background which the general reader will need in order to follow the subsequent development of the special subject. Thus Morawetz includes a review of simple complexes and chelates before discussing the binding of ions

to proteins and to synthetic polyelectrolytes; Schlichter begins with a presentation of theory and a compact description of experimental methods before presenting the results on nuclear magnetic resonance for polymers. The chapter on fluorine-containing polymers requires only a short introduction; the authors then systematically cover the recent work on the polymers listed in their title. Especially useful in this chapter is the inclusion of preparation of monomers in addition to descriptions of polymerization methods and properties of products. The fourth chapter opens with a review of the theory of the mechanical behavior of viscoelastic systems, which is followed by a brief outline of the experimental methods. One of the most valuable features of all of the monographs is their extensive bibliographies, which average to about a hundred references dated 1950 or later for each chapter. This series promises to become the Chemical Reviews for the special field of polymers; it is recommended to all research workers in the field as a means of keeping in contact with the pyramiding literature on polymers.

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Spot Tests in Inorganic Analysis. Fifth, enlarged and revised English Edition. By FRITZ FEIGL, Eng., D.Sc., Laboratório da Produção Mineral, Ministério da Agricultura, Rio de Janeiro; Professor at the University of Brazil; Member of the Austrian and Brazilian Academies of Sciences. Translated by RALPH E. OESPER, Ph.D., Professor Emeritus, University of Cincinnati. D. Van Nostrand Company, Inc., 126 Alexander Street, Princeton, N. J. 1958. xiii + 600 pp. 16 × 23.5 cm. Price, \$13.25.

This volume is the successor to "Spot Tests, Vol. I, Inorganic Applications," which appeared in its fourth edition in 1954. This fifth edition contains some twenty per cent. more tests than the predecessor. Five methods for detecting acids (cyanic, hypohalogenous, perchloric, hyposulfurous and sulfamic) have been added, as have about twenty-five tests on technical materials and minerals. As explained in the Foreword, much of the new material has not been previously published.

The general format of the book is unchanged from the previous edition. Printing and paper are good, and the book is attractively bound. Professor Oesper's translation has rendered the German into smooth and readable English.

In the Foreword to the 1954 Edition, the author states that "the advanced students will find here many important and significant facts of experimental chemistry, and they will gain an insight into the relation between analytical problems and other provinces of chemistry." This statement aptly characterizes the numerous writings of Dr. Feigl on spot tests. In a day when much of chemical analysis is done with a black box, it is well to be reminded of these simple and often subtle methods based on direct observation. Not only will the student, but also the practising analyst, find much of value in this massive yet orderly compilation of significant facts of experimental chemistry.

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Fundamentals of High Polymers. By O. A. BATTISTA, Research and Development Division, American Viscose Corporation, Marcus Hook, Pennsylvania. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1958. ix + 140 pp. 16 × 23.5 cm. Price, \$5.50.

Adhesives, Coatings, Fibers, Plastics and Rubbers—all belong to the large and very important class of high polymeric materials which find an ever increasing number of applications in household, agriculture and industry and which start to open very promising approaches to problems of biology and medicine. As a consequence, many people—physicians, government officials, company executives and lawyers are interested in achieving a certain basic knowledge on the synthesis, structure and application of representative high polymers. The purpose of this book is to provide such information in a simple and attractive manner.