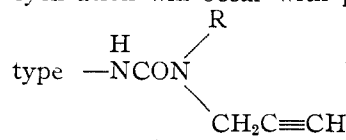
groups of isopropyl), a second doublet at 8.06 τ (CH_3 attached to a double bond) a quartet at 4.00 τ (single proton attached to olefin); the single proton of the middle carbon of isopropyl at 5.69 τ and the aromatic protons at 2.61 τ.

The fully saturated 2-imidazolidone V is obtained on hydrogenating III with platinum oxide in acetic acid as small colorless granules, m.p. 67.8–68.2°. *Anal.* Calcd. for $C_{13}H_{16}Cl_2N_2O$: C, 54.50; H, 5.58; Cl, 24.75; N, 9.77. Found: C, 54.10; H, 5.62; Cl, 24.80; N, 9.40. The infrared spectrum no longer shows the C=C band at 6.15 μ.

V is identified unequivocally by synthesis with the urea IV. IV is prepared following conventional procedures: 2-propanolamine → isopropyl-2-hydroxypropylamine → isopropyl-2-chloropropylamine → IV. IV is cyclized by treatment with sodium hydroxide in acetone to V, m.p. 67.7–68.2°. Mixed m.p. with hydrogenated III, (IV) is not depressed and infrared spectra are identical. All elemental analyses are correct as required by theory.

The results of our investigation indicate that cyclization will occur with propynyl ureas of the type  When R = H, the parent urea is regenerated on treatment with water or base presumably through formation of a carbodiimide. The reaction offers a simple and facile route to 1,3-disubstituted imidazolones. A discussion of the mechanism and scope of the reaction will be published shortly.

AGRICULTURAL RESEARCH DEPARTMENT
AGRICULTURAL CHEMICALS DIVISION
MONSANTO CHEMICAL COMPANY P. J. STOFFEL
ST. LOUIS 66, MISSOURI A. J. SPEZIALE

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BOOK REVIEWS

Azo and Diazo Chemistry. Aliphatic and Aromatic Compounds. By HEINRICH ZOLLINGER, Professor in the Eigenössische Technische Hochschule, Zurich, Switzerland. Translated by HARRY E. NURSTEN, Lecturer in the University of Leeds, Great Britain. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1961. 444 pp. 17.5 × 24.5 cm. Price, $16.50.

This book bears a close relationship to the German-language book by the same author, "Chemie der Azofarbstoffe," Birkhäuser Verlag, Basel, Switzerland, 1958; but the relationship is not the simple one of translation from German to English, or even of second edition to first with translation as an extra flourish.

"Chemie der Azofarbstoffe" dealt exclusively with the chemistry of aromatic diazonium and azo compounds. Throughout, its point-of-view was that of reaction mechanisms and physical chemistry as it treated the major phenomena of interest to the organic chemist or the dyeworks chemist dealing with these compounds. Important aspects of the dyeing process received their share of attention.

About three-quarters of the content of the original book has been transferred, with modifications to keep it up-to-date and with translation, to form the main substance of "Azo and Diazo Chemistry." Those chapters devoted to technical aspects of azo dyes and dyeing were not carried over. In the new book their place, so to speak, is taken by several chapters or sections on *aliphatic* azo compounds which, altogether, comprise about a quarter of the work.

The new book is about 30% longer than its predecessor.

Professor Zollinger writes of aromatic diazonium and azo chemistry with the confidence and command that one would expect from the world's leading investigator in that area. Though respectful of the worthwhile contributions of earlier decades, he discards much of the older systematization and nomenclature in favor of a presentation organized largely according to the precepts of modern physical organic chemistry. His lucid presentation clears away the clutter of outmoded views which had made the area of pure chemistry to which azo dye technology is related as unfashionable as Whist. The many fascinating phenomena and challenging problems which Zollinger has revealed offer a stirring opportunity to the investigator willing to suffer the slights of the style-conscious for the rewards of discovery in an exciting but neglected field.

In presenting aliphatic azo chemistry, Zollinger is more the competent critic than the practicing master. Nevertheless, what he writes is authoritative and valuable.

It is inevitable that any general treatment of a fast-moving field should be partially out of date on the day of publication. The absence of Schmitz' work on cyclodiazomethane and of Huisgen's interpretation of the cycloaddition of diazomethane to olefinic bonds (as a concerted 1,3-dipolar addition) are cases in point.

The translation from German into English seems faithful. Indeed, it is occasionally too much so. Traces of German word order or idiom now and then show through.

The book is beautifully printed and produced, and errors are not obvious. However, the reviewer got a bit of peevish satisfaction out of seeing (p. 409) Burnett misspelled "Bunnet" for a change.

METCALF CHEMICAL LABORATORIES
BROWN UNIVERSITY JOSEPH F. BUNNETT
PROVIDENCE 12, RHODE ISLAND

Industrial Organic Nitrogen Compounds, ACS Monograph No. 150. By MELVIN J. ASTLE, Professor of Organic Chemistry, Case Institute of Technology, Cleveland, Ohio. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1961. vii + 392 pp. 16 × 23.5 cm. Price, $14.00.

"This book has been written in an attempt to summarize the chemistry of most of the types of organic nitrogen compounds. No single book has appeared in recent years which has accomplished this goal. Many very excellent treatises are available describing the chemistry of amino acids and proteins, alkaloids and heterocyclic nitrogen compounds. Accordingly these compounds are not discussed extensively in this monograph. In order to present a comprehensive survey of nitrogen chemistry it has been necessary to discuss the simple heterocyclic nitrogen ring systems in some detail.

"Considerable attention has been given to the patent literature in order to present developments from the indus-

trial laboratories as well as those from other institutions. Reaction mechanisms are discussed whenever they appear useful in understanding the chemistry involved but no attempt is made to make this work an approach to the theory of reactions."

The above quotation from Professor Astle's Preface explains quite well the purpose and scope of this ACS Monograph. Generally speaking, perusal of the book indicates that the author has done an excellent job within the framework he has set for himself.

The book should find wide value as a quick reference tool, not only in industrial research organizations but in academic institutions as well. It probably will be of greatest use to persons not expert in the chemistry and technology of organic nitrogen compounds who from time to time need authoritative and up-to-date answers to specific questions. By the same token, it will surely be a worthwhile addition to the bookshelf of the research chemist who has frequent occasion to work with nitrogen derivatives yet is not a primary investigator in the field.

As one might expect, the author has organized his subject matter according to functional classes. Chapter headings are as follows: 1, Aliphatic Amines, 2, Arylamines, 3, Heterocyclic Amines, 4, Hydrazines, Azo Compounds, Diazonium Salts, and Oximes, 5, Nitriles, Amides and Amino Acids, 6, Isocyanates, Ureas, Thioureas, 7, Aromatic Nitro and Nitroso Compounds, 8, Aliphatic Nitro Compounds. For each class of compound, the discussion covers (a) general properties and characteristics, (b) methods of preparation, (c) reactions and (d) industrial utilization. A list of references to literature and patents is appended to each chapter.

Emphasis is on the chemistry of organic nitrogen compounds rather than on commercial aspects. This is as it should be, nevertheless trade names and approximate production figures for important products are mentioned, and the references, which appear to have been carefully selected, include many patents. Most of the references carry dates within the past two decades up to and including 1958.

In discussing methods of preparation and reactions of a given class, the author gives a good deal of moderately detailed information, *e.g.*, yields, melting and boiling points, reaction conditions, work-up procedures, and so on. On occasion, brief discussions of reaction mechanisms are presented. The result is a good compromise between breadth and depth, both from the standpoint of the laboratory chemist and from that of the research director.

"Industrial Organic Nitrogen Compounds" is not a book one can sit and read comfortably from cover to cover. It is rather a ready reference volume packed with well chosen information which will provide partial, if not complete, answers to the questions most likely to be asked in this area of science and technology.

CENTRAL RESEARCH DIVISION
AMERICAN CYANAMID COMPANY JOHN H. FLETCHER
STAMFORD, CONNECTICUT

Chemical Crystallography. An Introduction to Optical and X-Ray Methods. Second Edition. By C. W. BUNN. Oxford University Press, 417 Fifth Avenue, New York 16, N. Y. 1961. xiii × 509 pp. 16.5 × 24 cm. Price, $12.00.

When the first edition of this book appeared in 1945, the field of X-ray crystallography was expanding rapidly both in this country and abroad. Textbooks were needed to link the ancient subjects of crystal morphology, lattice geometry and crystal chemistry with the theory and techniques of X-ray diffraction and crystal structure analysis. Treatises were needed to develop systematically the formal theory and the experimental state of X-ray crystallography in order to prepare the way for the rapid advances to come. In time even additional compendia would be required to encompass the ever-growing literature.

Among the many books written in the past twenty years to meet these needs, "Chemical Crystallography" has occupied a unique position. Neither a textbook nor a treatise, the book has nevertheless maintained a substantial following over the years because it merits so well its subtitle, "An Introduction to Optical and X-Ray Methods." The author undertook the difficult task of writing a descriptive survey integrating a variety of crystallographic fields. He succeeded in providing an interesting and intelligent introduction suitable for readers with diverse backgrounds. The organization was such that he was able to bring the work up to date in the recent Second Edition by making minor revisions and modest additions.

The most striking feature of this book is the lack of the formal mathematical development so characteristic of other books in this field. Indeed, one is led to feel that those few mathematical formulas which do appear were recorded reluctantly for the want of a better mode of expression. The burden of each argument therefore falls upon exposition and, fortunately, this is the strong point of the book. The author writes with charm and style and, in an unhurried way, carefully builds each argument with the aid of numerous examples and excellent illustrations. For this reason, many students encountering crystallography for the first time have found this book a useful adjunct to more formal presentations.

The first part of the book is concerned with the identification of crystalline substances. Crystal morphology and symmetry are treated at length to provide the basis for later discussions of identification procedures involving crystal optics and X-ray powder diffraction analysis.

The second, and larger, part of the book deals with crystal structure analysis. The geometric principles involved in the determination of unit cells are treated in terms of the reciprocal lattice for a variety of experimental methods. This is followed by a short treatment of the relationship of structure to diffraction intensities and the determination and use of space group symmetry. A number of well chosen examples of structure determinations are then discussed in detail to illustrate the principles involved in trial and error methods.

The last two chapters have been considerably expanded in this new edition. The first of these provides an introduction to modern methods of structure determination and refinement. A variety of Fourier syntheses, vector syntheses, Fourier transforms and statistical intensity relationships are qualitatively discussed and illustrated with examples. The last chapter briefly notes the effects of crystal size, texture and disorder on diffraction intensities.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF PENNSYLVANIA ROBERT E. HUGHES
PHILADELPHIA, PENNSYLVANIA

Reference Electrodes. Theory and Practice. Edited by DAVID J. G. IVES, Birkbeck College, London, and GEORGE J. JANZ, Rensselaer Polytechnic Institute, Troy, New York. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1961. xi + 651 pp. 16 × 23.5 cm. Price, $20.00.

The title covers only a part of the contents of this book. It is really a summary, in unsystematic form, of a large part of electrochemistry. It will probably be of most use in directing research workers to the literature of the subject. In this respect it is admirable, as the authors have searched out even obscure references to the use and preparation of the most utilized electrodes. However, the text will serve in many cases without resort to the original papers.

One criticism that can be made is that the authors are not clear as to what they mean by the term "electrode." It appears as metal–electrolyte, as in most galvanic cells; as semiconductor–electrolyte when utilizing glass surfaces; as membrane surface–electrolyte; and as liquid–liquid junctions in most of the biological applications. It is probably only in the last case that real misunderstandings can arise in the interpretation of measurements, but such false interpretations can occur particularly with data on colloidal materials.

The book should be especially useful to active workers in electrochemistry and in fields utilizing electrochemical methods. The care that is necessary if precision is to be obtained is emphasized and illustrated by excellent diagrams and illustrative data. It should prevent novices from plunging into research involving electrodes without realizing their limitations, but this is probably too much to expect.

The reviewer is pleased to observe the rather belated recognition in this volume of the utility of simple galvanic cells with one type of electrode as sources of precision