

$[\alpha]_{270}^{27D}$ 0.0°, $[\alpha]_{270}^{27D}$ 0.0° (*c* 0.70, CHCl₃); nmr (CDCl₃) δ 7.9–7.4 (m, 10 H), 2.4–1.6 (m, 8 H), 1.4–0.7 (m, 6 H). The residue from evaporation of the mother liquor was twice recrystallized (acetone–heptane) to furnish 0.85 g (34%) of analytically pure, hygroscopic (*S,S*)-**1**, mp 126–127°, $[\alpha]_{270}^{27D}$ –18°, $[\alpha]_{270}^{27D}$ –67° (*c* 0.33, CHCl₃);¹² nmr (CDCl₃) δ 7.8–7.2 (m, 10 H), 2.6–1.5 (m, 8 H), 1.4–0.7 (m, 6 H). The coupling reaction was also applied to optically pure (–)-(*S*)-methylphenyl-*p*-tolylphosphine oxide,¹³ resulting in a 50% yield of (*S,S*)-1,2-bis(phenyl-*p*-tolylphosphinyl)ethane (**2**), mp 247–248°; $[\alpha]_{270}^{27D}$ +6.9° (*c* 0.98, CHCl₃); nmr (CDCl₃) δ 8.0–7.1 (m, 18 H), 2.52 (apparent d, 4 H, separation 2.5 Hz), 2.38 (s, 6 H). Although we have been unsuccessful in measuring the enantiomeric purity of (*S,S*)-**1** or (*S,S*)-**2**, the small amounts of meso diastereomer conveniently confine the enantiomeric purity to ≥90%.

Enantiomerically pure (+)-(*R*)-methyl *p*-tolyl sulfide¹⁴ was coupled using the above procedure, except for the necessary replacement of *n*-butyllithium by lithium diethylamide,⁴ to afford (*R,R*)-1,2-bis(*p*-tolylsulfanyl)ethane (**3**) in 45% yield, after chromatography. The ¹H nmr spectrum was identical with that for authentic¹⁵ *dl*-**3** and demonstrated the absence of any *meso*-**3**. Recrystallization (heptane–CHCl₃) sup-

(12) The specific rotation of (*S,S*)-**1** is sensitive to moisture, and highly concentration and solvent dependent.

(13) R. D. Baechler and K. Mislow, *J. Amer. Chem. Soc.*, **92**, 3090 (1970).

(14) (a) K. Mislow, M. M. Green, P. Laur, J. T. Melillo, T. Simmons, and A. L. Ternay, Jr., *ibid.*, **87**, 1958 (1965). (b) The enantiomeric purity of this compound has been demonstrated by the use of a chiral shift reagent: H. Nozaki, K. Yoshino, K. Oshima, and Y. Yamamoto, *Bull. Chem. Soc. Jap.*, **45**, 3495 (1972).

(15) E. V. Bell and G. M. Bennett, *J. Chem. Soc.*, 3189 (1928).

plied colorless needles (25%), mp 132–133°, $[\alpha]_{270}^{27D}$ +278° (*c* 0.044, CH₃OH). The enantiomeric purity of (*R,R*)-**3** was confirmed at ≥97% through the use of the chiral shift reagent tris(3-heptafluoropropylhydroxymethylene-(+)-camphorato)europium(III).¹⁶

The CD spectrum (CH₃OH) of (+)-(*R,R*)-**3** displays two Cotton effects centered at 242 nm, $[\theta]_{\max}$ +194,000°, and at 219 nm, $[\theta]_{\max}$ –218,000°. These optically active transitions closely resemble corresponding Cotton effects for (+)-(*R*)-methyl *p*-tolyl sulfoxide (CH₃OH), $[\theta]_{\max}$ +69,000° at 238 nm and $[\theta]_{\max}$ –95,000° at 215 nm. Consequently, there is no compelling evidence for intramolecular chromophoric coupling and hence no reason to suspect significant intramolecular association.^{18,19}

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(16) For racemic **3** in the presence of the chiral shift reagent¹⁷ (0.5 mol equiv), one set of aromatic protons (presumably ortho) appeared as a pair of doublets centered at δ 9.67 ($\Delta\nu$ = 13.5 Hz, both ³J_{HH} = 8 Hz), and the other set (presumably meta) appeared as an overlapping pair of doublets centered at δ 7.80 ($\Delta\nu$ = 2.5 Hz, both ³J_{HH} = 8 Hz). Under the same conditions, the synthesized (+)-(*R,R*)-**3** exhibited only the high-field pairs of ortho and meta protons.

(17) R. R. Fraser, M. A. Petit, and M. Miskow, *J. Amer. Chem. Soc.*, **94**, 3253 (1972).

(18) Monosulfoxides have been reported to exhibit a tendency to self-associate (ref 14a and references cited therein).

(19) ¹H nmr spectral information on 1,2-ethano bis sulfoxides also suggests a lack of intramolecular association.^{5a,7b,20}

(20) F. Taddei, *Boll. Sci. Fac. Chim. Ind. Bologna*, **26**, 107 (1968).

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Book Reviews*

Carbon-13 NMR Spectra. By L. F. JOHNSON and W. C. JANKOWSKI (Varian Associates). Wiley-Interscience, New York, N. Y. 1972. Unnumbered pp. \$24.95.

This oversized volume consists principally of the nmr spectra of 500 selected compounds, displayed one to a page, with assignments of the signals. A name index and a code index allow one to find either a specific compound or a compound having specific structural features easily. The text consists of a seven-page preface that is primarily concerned with explaining the use of the code index. This is a useful reference work and a valuable adjunct to a textbook for those who are seriously engaged in learning about ¹³C nmr.

Chemical Technology. An Encyclopedic Treatment. Volume 4. Petroleum and Organic Chemicals. Edited by L. W. CODD, K. DIJKHOFF, J. H. FEARON, C. J. VAN OSS, H. G. ROEBERSON, and E. G. STANFORD. Barnes and Noble, New York, N. Y. 1973. xxxi + 792 pp. \$42.50 (\$35.00 by series subscription).

This volume reminds one of a text on strictly "classical" organic chemistry, but brought up to date. Only four of its twenty chapters are closely connected with petroleum; the bulk of the book covers organic chemistry in systematic organization according to functional type or use (*e.g.*, dyes, explosives). The approach is strongly descriptive, with little concern for mechanism, structure, or correlations of reactivity. Specific compounds of industrial importance are emphasized, and their various uses, present and

past sources or methods of production, and statistical data on manufacture and use are given in addition to succinct presentations of the general reactions of and synthetic routes to the various classes. Short bibliographies, consisting largely of books, are given for each chapter. A substantial index increases the reference value of this volume independent of the others in the series.

Apart from its obvious utility to industrial chemists, Volume 4 could be a valuable source book for teachers of organic chemistry who wish to enrich their lectures by relating academic chemistry to the technology and society that support it.

Cooperative Phenomena near Phase Transitions. A Bibliography with Selected Readings. Edited by H. EUGENE STANLEY. MIT Press, Cambridge, Mass. 1973. xviii + 308 pp. \$14.95.

This large-size (8½ × 11 in.), soft-bound, photo-offset volume consists of a bibliography of about 2500 articles current to June 1972, and reprints of 35 short experimental articles and the abstracts of 65 theoretical articles. It is intended to serve as a "companion" to the author's book "Introduction to Phase Transitions and Critical Phenomena" (Oxford University Press, 1971). Features of the bibliography that should make it especially useful are a list of the 61 journals utilized and a list of 50 relatively recent conference proceedings dealing with critical phenomena.

Developments in Inorganic Nitrogen Chemistry. Volume 2. Edited by C. B. COLBURN (Auburn University). Elsevier Scientific Publishing Co., Amsterdam/London/New York. 1973. x + 228 pp.

The first volume of this work was published seven years ago.

* Unsigned book reviews are by the Book Review Editor.

The aim of the editor is not clearly apparent, for the present volume has no preface (which also means that there is no statement as to how up to date the coverage is, or how far back in time it goes). The references date from 1802 (*sic!*) to 1970—at least, I could find none more recent. The 1937 edition of Sidgwick's "Organic Chemistry of Nitrogen" is cited, in apparent ignorance of the appearance of a revised edition in 1966. This book is thus not at all up to date.

There are three chapters: Reactions of Nitrogen(II) Oxide (R. O. Ragsdale); The Chemistry of Dinitrogen Pentoxide (C. C. Addison and N. Logan), and Nitrogen Compounds of Chlorine, Bromine, and Iodine (J. Jander and U. Engelhardt). Each is comprehensive, with extensive lists of references (1151 citations in Chapter III). They are valuable monographs, and it is unfortunate that their appearance is not more timely. The absence of running headings makes it more difficult to use the book than need have been, but the absence of an index is really frustrating ("Index" is the last entry in the table of contents, but apparently it never materialized). This book is a credit to the contributors, but not to the publishers.

Metabolic Compartmentation in the Brain. Edited by R. BALAZS and J. E. CREMER. Halsted/Wiley, New York, N. Y. 1973. xiii + 383 pp. \$29.50.

At a symposium held in Italy in 1971, an interdisciplinary group of investigators met to discuss metabolic heterogeneity in the brain. An introduction, a summary, the texts of 24 papers, and a subject index make up this volume which will be of particular interest to neurochemists.

Mössbauer Effect Data Index 1971. Edited by J. G. STEVENS and V. E. STEVENS (University of North Carolina at Asheville). Plenum Publishing Corp., New York, N. Y. 1972. x + 430 pp. \$32.50.

This work, as specialists in the field know well, is the third annual volume of a comprehensive bibliography with an index arranged according to element and isotope. The number of references is said to have increased from 700 in 1970 to 940 in 1971. In addition, there are short reviews on aspects of methodology, an addendum of 1969 and 1970 references, an author index, and a partial list of 1972 references. This volume has appeared with commendable promptness (the Foreword is dated July 1972).

Polymerization in Biological Systems. CIBA Foundation. American Elsevier, New York, N. Y. 1973. viii + 314 pp. \$15.50.

The fourteen papers given at CIBA Foundation's Symposium 7 (New Series), held in London in 1972 under the chairmanship of E. Katchalski, are reproduced in this volume, together with the ensuing discussions. They are concerned with the assembly of nucleic acids, carbohydrates, and proteins (emphasis on the last) in living systems. There are references, many good illustrations, and a subject index.

Thermal Analysis. ICTA 1971. Edited by H. G. WEIDMANN (Mettler Instruments AG). Berkhäuser Verlag, Basel and Stuttgart. 1973. Volume 1: xv + 631 pp. SF74. Volume 2: xv + 800 pp. SF94. Volume 3: xv + 711 pp. SF84 (SF 224 per set).

Thermal analysis, which includes DTA (differential thermal analysis) and DSC (differential scanning calorimetry), was the subject of a six-day Third International Conference held in Switzerland in 1971. The sheer mass of these three volumes is impressive evidence of how this relatively young technique has developed into a tool of major importance in analysis and research. The preface states that 360 scientists from 30 countries participated, and that 190 lectures were delivered. All of these are included in these volumes, which are composed of photo-offset reproductions of the authors' typescripts (including figures and references). The great majority of papers are in English, although some are in French or German. Volume 1 covers Advances in Instrumentation; Volume 2, Inorganic Chemistry; and Volume 3, Organic and Macromolecular Chemistry, Ceramics, and Earth Sciences. Each volume is separately indexed.

Recent Advances in Gas Chromatography. Edited by I. I. DOMSKY (Armour-Dial, Chicago) and J. A. PERRY (Consultant, Instrumental Analytical Chemistry, Chicago). Marcel Dekker, Inc., New York, N. Y. 1971. xi + 414 pp. \$19.50.

The seventeen papers in this collection were originally given as lectures before the Chicago Gas Chromatography Discussion Group during the 1968-1969 academic year. As is common with such collections, the papers are extremely uneven in their content, length,

and depth. Some read as if they were direct transcriptions of the lecture; others read as if they were standard research papers or reviews. The book is reproduced photographically from typescripts which are also quite uneven in their organization and layout.

Roughly, the papers cover four areas: fundamentals, 137 pages (column technology, flow patterns in gc columns, glass as a chromatographic support, use of Rohrschneider constants, electron capture detector response, and a comparison of the flame ionization and electron capture detectors); special techniques, 60 pages (the development of new silylation reagents, silylation in the presence of water, small-scale preparative gc, and the use of large computers in gc); applications, 124 pages (food packaging, lipid analysis, pesticides, metabolic profiles, and electron capture detection of halogenated derivatives of organics); and gel permeation, 78 pages (calibration and quantation, and trouble shooting). The reason for the inclusion of the papers on gel permeation is unclear; neither seems significant or relevant. This reviewer found the material on fundamentals and applications to be the most interesting and potentially useful.

Arleigh Hartkopf, *Wayne State University*

Molecular Wave Functions and Properties: Tabulated from SCF Calculations in a Gaussian Basis Set. By LAWRENCE C. SNYDER (Bell Telephone Laboratories) and HAROLD BASCH (Ford Motor Company). Wiley-Interscience, New York, N. Y. 1972. x + 42 pp + 386 pp of tables. \$14.95.

The efficiency of present-day computer programs for generating molecular self-consistent field (SCF) wave functions has made possible the many comprehensive theoretical studies now appearing in the research literature. Yet this very efficiency has made it more difficult for other chemists to draw upon the results of such studies, as it has become commonplace for quantum chemists not to publish their wave functions, but rather to confine their papers to tabulations of energies, other expectation values, and various measures of molecular charge distributions. The present volume fills a major need by presenting in an easy-to-use tabular format SCF wave functions for 56 different molecules ranging from hydrogen with two electrons to tetrafluoroethylene with 48 electrons. Only molecules containing hydrogen, boron, carbon, nitrogen, oxygen, and fluorine are included, with the same moderate sized but flexible Gaussian basis set of double-zeta quality used for a given element in any compound in which it appears. Only one calculation is reported for each molecule, with that being for the experimental equilibrium geometry. The bulk of the volume is taken up with the tables, with the entry for each molecule consisting of atomic coordinates, a figure showing the orientation of the molecule, a list of molecular orbital (MO) symmetry types and occupation numbers, energy expectation values, nonvanishing moments of the total charge distribution through the fourth power, expectation values at atomic centers for various operators, Mulliken charges, overlap populations by MO, orbital energies and coefficients for occupied MO's and *some* virtual orbitals, and finally the overlap matrix. Having available wave functions of comparable quality for so many small but important molecules should stimulate a large number of comparative studies both of the properties tabulated in the book and of those which can be calculated from the functions. It is expected that this volume will play an important role in molecular quantum chemistry for a number of years to come.

Lawrence L. Lohr, Jr., *University of Michigan*

The Radiation Chemistry of Macromolecules. Volume II. Edited by MALCOLM DOLE (Baylor University). Academic Press, New York and London. 1972. xvii + 406 pp. \$25.00.

This is the second volume of a two-volume collection of articles dealing with the effects of high-energy radiation on materials, primarily polymers. Whereas the first volume stressed theoretical concepts, the present volume emphasizes the details of the radiation chemistry of a variety of specific systems.

These systems include polypropylene, poly(propylene oxide), poly(vinyl chloride), poly(vinyl acetate), polystyrene, poly(methyl methacrylate), polyisobutylene, poly(ethylene terephthalate), polyoxymethylene, *cis*-1,4-polybutadiene and polyisoprene, and various polyamides, polysiloxanes, fluoropolymers, nucleic acids and related compounds, proteins, and polysaccharides. The information given on the radiation chemistry of these substances includes the production of polymer networks through cross-linking, the occurrence of chain scission and unsaturation, the evolution of gaseous products, the spectroscopic characteristics of the irradiation products, the mechanisms of the radiation-induced processes and the

effects of additives on these processes, and the chemical grafting of one substance onto another by means of radiation.

In addition, there are four, more general, chapters on the oxidation and mechanical properties of irradiated polymers and the effects of radiation on single crystals of polymers and polymer fibers.

As was concluded in the review of Volume I [*J. Amer. Chem. Soc.*, **95**, 2756 (1973)], this collection of articles will be extremely useful to anyone interested in the radiation chemistry of high-molecular-weight materials.

J. E. Mark, *University of Michigan*

Fast Reactions. By DAVID N. HAGUE (University of Kent). Wiley-Interscience, London. 1971. viii + 159 pp. \$8.50.

The primary aim of this book is to bring to the attention of the general chemist or biochemist the exciting possibilities of fast reaction techniques as applied to chemical and biochemical kinetics, primarily in solution. Thus the first half of the text deals with the various techniques available, the principles of their operation, and their limitations. Techniques covered include molecular beams, flow methods, flash photolysis, pulse radiolysis, shock tubes, chemical relaxation techniques (a general treatment of step and periodic forcing functions), several variations of nmr, epr, fluorescence quenching, and electrochemical methods. The depth of treatment in each case is obviously limited, with no serious attempt to discuss instrumentation, and readers wishing to delve seriously into a particular technique would undoubtedly wish to consult a more thorough treatise. However, the inclusion of short appendices on the mathematical treatment of relaxation equations (Appendix C) and the Bloch equations applicable to nmr spectra (Appendix D) should aid the nonexpert in the interpretation of literature in these areas.

The second half of the text is devoted to an overview of the more interesting results which have been obtained using the fast reaction techniques. These include information on proton transfer, hydrated electron reactions, metal complex formation (including both inorganic and biological systems), enzyme-substrate reactions, and nucleic acid systems (including base pairing and helix-coil transformations).

Inevitably this book must be compared to the earlier text by Caldin ("Fast Reactions in Solution," Blackwell, Oxford, 1964) who is Hague's colleague at the University of Kent. Several similarities between the two books do exist, but the current work may be characterized as a more popularized treatment, more concerned with basic concepts than with operational details, and more likely to be read by individuals who do not wish to become experts in the area but desire a broad survey of the field.

David B. Rorabacher, *Wayne State University*

Carbohydrate Chemistry. Volume 5. By J. S. BRIMACOMBE (University of Dundee). The Chemical Society, London. 1972. xii + 434 pp. £8.00.

This volume, which is the fifth in this annual review series published as a Specialist Periodical Report by the Chemical Society, London, covers the literature published in 1971. It is divided into two parts. Part I, compiled by J. S. Brimacombe, R. J. Ferrier, R. D. Guthrie and T. D. Inch, consists of 180 pages (829 references) and is subdivided into 27 chapters dealing with the chemistry of mono-, di-, and trisaccharides and their derivatives. Included are chapters on antibiotics, nucleosides (rather too abbreviated), oxidation and reduction, nmr spectroscopy and conformational features of carbohydrates, other physical methods, and separatory and analytical methods. Part II, by J. F. Kennedy and R. J. Sturgeon, is subdivided into eight chapters (1438 references) dealing with the literature of macromolecules published in 1970 and 1971 in the following fields: general methods, plant and algal polysaccharides, and microbial polysaccharides. Physicochemical properties are integrated into appropriate chapters. The remaining chapters of Part II covers the literature published during 1971 of glycoproteins, glycopeptides, and animal polysaccharides, enzymes, glycolipids, and gangliosides, and chemical synthesis and modification of oligosaccharides, polysaccharides, glycoproteins, enzymes, and glycolipids. Abstracts of the American Chemical Society Meetings, Dissertation Abstracts, and the patent literature have not been abstracted.

The treatment of subject matter in this volume, while necessarily brief, is very well organized, remarkably complete, and very readable by the specialist. Significant contributions in the monosaccharides are well illustrated by appropriate schemes of formulas. Placement of literature references at the page bottoms, rather than at the end of each chapter, is very helpful. A clear and very well-organ-

nized table of contents and a complete author index aid in the use of this volume.

The coverage in all chapters is thorough and indicates the prodigious effort which must have been expended by each reporter.

This volume and the previous ones are indispensable to the specialist. The beginning graduate students of carbohydrate chemistry will not find the very succinct abstraction of many papers of much help in their studies. Undoubtedly, this volume will be of help to a large cross section of carbohydrate chemists.

Alex Rosenthal, *The University of British Columbia*

The Chemistry of Enamines. By S. F. DYKE (University of Bath). Cambridge University Press, London. 1973. vii + 93 pp. \$4.95 (paper), \$10.95 (cloth).

This is a short review intended to illustrate the basic principles involved in enamine chemistry. Discussion of dienamines and enamines is not included.

References to the original literature have been omitted. The bibliography page indicates eight reviews on the subject.

The book is aimed as an introduction to enamine chemistry. For more exhaustive coverage of the subject and literature references the reader is referred to the already available reviews.

J. Szmuszkowicz, *The Upjohn Company*

Symposium on Antibiotics—Ste. Marguerite, Canada, 1971. Edited by S. RAKHIT (Ayerst Laboratories). Butterworth and Co., London. 1971. vii + 304 pp. \$23.25.

The symposium was cosponsored by the IUPAC, the Chemical Institute of Canada, and the Canadian Society for Microbiologists. The papers were published promptly in *Pure and Applied Chemistry*, Vol. 28, No. 4 (1971). Chemists and microbiologists were brought together in this status report of antibiotic research. Chemically oriented treatments, together with pertinent biological discussion, are included on penicillins and cephalosporins, aminoglycosides, nucleoside antibiotics, macrolides, hydroxamic acids, chemically modified coumermycins, bleomycins, and antiviral agents. Additionally presented are discussions on mode of action, cell-free synthesis, microbial transformations, biosynthesis of polypeptide antibiotics, and a good presentation of resistance factors.

The reviews are stimulating, and can be useful to the research worker. For example, the section on aminoglycosides contains some results which are not published elsewhere.

Roger D. Westland, *Parke, Davis & Company*

The Constitution of Inorganic Compounds. Volume I. Atomic Quantum Mechanics: Metals and Intermetallic Compounds. By JOHN T. WAUGH (University of Hawaii). Wiley-Interscience, New York, N. Y. 1972. xv + 797 pp. \$29.95.

This present book is the first volume of a two-volume set which is intended as a presentation of the principles of structure theory and quantum mechanics necessary for a discussion of the constitution of a compound. The latter phrase is defined by the author as "a knowledge of the type and spatial arrangement of its interatomic bonds, the ground-state energy of the compound, and the manner in which it interacts with electromagnetic radiation and other reagents to give rise to excited states or to the formation of other substances." The level of the presentation is meant to be suitable for senior undergraduates or beginning graduate students.

The book is divided into two independent parts. The first part (375 pages) is a rigorous and fully documented development of the quantum theory of atomic structure. Here much of the necessary mathematics is developed when needed, and most of the intermediate steps in the derivations are worked out in detail. For example, the transformation of the Laplacian operator from Cartesian coordinates to spherical polar coordinates is given in a footnote which is somewhat over three pages long. After laying the foundation for atomic theory and quantum mechanics, the motion of a particle in a central force field is presented, followed by a discussion of approximate techniques, spin wave functions, and the electronic structure of atoms.

The second part of the book (397 pages) deals with metals and intermetallic compounds. Here the metallic state is characterized and the properties of metals and intermetallic compounds are interpreted in terms of electronic theories. The second part is concluded by applications of the theories which have been developed to the properties of the alkali metals, the coinage metals, the group IIa and IIb metals, the transition metals, and aluminum and its alloys.

This is an unusual book with the contents of the section on metals departing considerably from what one expects to find in chemistry books. Perhaps after Volume II becomes available it will be pos-

sible to understand the basis for the title. It is unlikely that this book would be used as the primary textbook in a contemporary undergraduate curriculum, but it surely will serve as a useful source book for a wide range of studies in chemistry.

William E. Hatfield, *University of North Carolina*

Laboratory Manual on Crystal Growth. By I. TARJÁN and M. MÁTRAI. Akadémiai Kiadó, Budapest. 1972. 250 pp. \$10.40.

This book is a worthwhile attempt to present clearly and concisely various crystal growth techniques and, despite some weaknesses, can prove to be extremely useful to all those devoted to teaching or research. It appears very clear to the reader that the center of gravity of the material covered is in the area of ionic crystals, and this is done detrimentally to the development of other important areas, such as metallic crystal growth from the melt. There is complete silence on the growth of "composite" crystals of eutectic or off-eutectic composition from the melt, a subject of ever increasing importance in modern technology, both for mechanical and physical applications.

The presentation of basic phenomena in Part One is an accumulation of interesting information that is done in a coherent, systematic fashion. However, the reader notices a poor documentation on dendritic or faceted dendritic structures and on interface instability during growth. Important phenomena such as coarsening or coalescence that accompany growth are completely by-passed.

Favorable comments may be made on the presentation of Part Two on techniques of crystal growth. The material is presented systematically and thoroughly in a way that makes reading and assimilation easy and pleasant.

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Molecular Reality. By MARY JO NYE (The University of Oklahoma). Macdonald, London, and American Elsevier, Inc., New York, N. Y. 1972. xi + 193 pp. \$5.50.

This scholarly volume subtitled, "A perspective on the scientific work of Jean Perrin," is the story of the philosophical and scientific debate among nineteenth century chemists and physicists about the physical reality of atoms and molecules. After giving the reader the background of this debate, which began after the publication of John Dalton's work in 1808, the author discusses the career and publications of the French physical chemist Jean Perrin (1870-1942). Perrin's work, *Les Atomes*, published in 1913, one of the most influential scientific books ever written, was the reason molecular reality abruptly ceased being a burning issue.

I hesitate to recommend Dr. Nye's book to chemists whose avocation is reading chemical biography, unless they are specifically interested in Jean Perrin. Nonetheless, the author has done the English-speaking chemical community a great service by telling this interesting and important story.

David H. Kenny, *Michigan Technological University*

Biochemical Applications of Mass Spectrometry. By GEORGE R. WALLER (Oklahoma State University). Wiley-Interscience, New York, N. Y. 1972. xiv + 872 pp. \$49.95.

This book serves well to introduce students to the intricacies of mass spectrometry and its biochemical applications. It is a very useful and comprehensive compilation of technical information on nearly every type of compound encountered in biochemistry. In some regards it is also a heroic epic story recounting a wide range of adventures. Readers fond of Don Quixote (or even Cyrano de Bergerac) may appreciate a definite (but not overblown) romanticism underlying the design of the book. It surprised me by its somewhat unique introduction to the human aspects in developing this increasingly vast and potentially mechanized and impersonal field. Dr. Waller has provided the selected contributors with an opportunity for them and their priorities to become known. From the dedicatory beginning to David Rittenberg, whose personal inspiratory contributions on the use of stable isotopes are noted, to the later sections, there was a consistent orientation toward personalization. I enjoyed the historical perspectives of Ratner and Stenhagen whose presentations inevitably note that individual humans assembled the machines and methods; not the reverse. The mental image of Stenhagen and Ryhage scavenging equipment for those early models in Stockholm sets a mood for the following Section I, which is more of an annotated Cook's tour of certain laboratories around the world developed and maintained by recognized contributors to the technology. Unfortunately, some of those individuals provided too brief a comment to illustrate their hopes and plans for developing the full potential of the method,

whereas others indulged in minutiae that may not be educational to the beginner nor needed by the expert. Each introduces his assembly to the reader a bit in the style of Quixote describing his Dulcinea: "I see her as I would have her be." In the process the reader learns not only of instruments and measurements, but organization of systems and strategies for data handling.

Mass spectra can easily confuse beginning students, and the clustering of illustrative results and procedures in the many small chapters of Section III according to possible areas of motivating interests is a valuable tactic. Eighteen different classes of natural products are treated in individual chapters. Thus, one can delve in detail on fragmentations of selected antibiotics and, if needed, still refer back to one of the earlier, more fundamental chapters to clarify some aspects of methodology. Often the individual chapters contain detailed interpretation of selected fragmentations; however, four chapters principally describing methods (27, 28, 30, and 31) are unfortunately placed at the end of the book rather than in Section II which has general methodologic concepts. It seemed ironic that the chapter (27) on methodology with stable isotopes (so effectively used by Rittenberg to signal metabolic events) occurred after a brief description of semiochemicals. It was also not easy to see the advantage of putting methodological aspects of O₂ and CO₂ measurement in clinical uses of mass spectrometry between tetrapyrroles (21) and pesticides (23).

Some of these organizational features may reflect the difficulty of securing contributions from so many different busy investigators. The shortage of references to work after 1970 is not too serious since the reader can use this authoritative text to search forward for developments by using Citation Index or a similar tool. The chapter by C. Hignite does not go into the details of fragmentation as some do, but provides a particularly orderly and efficient referencing of mass spectra of pyrimidines, purines, and nucleosides. Overall, the 31 chapters provide 2,219 references—a formidably authoritative treatise! Appendices provide statements of policy or philosophy concerning support for mass spectrometry centers, and extensive lists of instruments commercially available, two topics that may already be modified by recent developments of fiscal policy and instrumentation. Computer-assisted methodology for data reduction has developed very rapidly, and new features of ionization of samples may provoke a desirable revised second edition of even greater value to those of us who wish to understand the ways by which this almost magical tool can serve our needs in investigating natural products.

The editor, George R. Waller, is to be congratulated on orchestrating the offerings of the many individuals in an open forum that clearly displays the range of the method, respects their individuality, and properly responds to the dedicatory challenge "...for if the trumpet give an uncertain sound, who shall prepare himself for battle?"

William E. M. Lands, *The University of Michigan*

Introduction to Molecular Photochemistry. By C. H. J. WELL. (Kingston Polytechnic). Wiley-Halsted, New York, N. Y. 1973. xii + 146 pp. \$5.25.

Any text with "Molecular Photochemistry" in the title is almost sure to excite the fond attention of this reviewer. The author of this particular text proposes that it presents the principles of molecular photochemistry in a form which will be attractive to undergraduates who have had no formal courses in photochemistry or in electronic spectroscopy. It is hoped that postgraduates and research workers seeking a concise introduction to photochemistry might also find this book useful.

The paperback text of 139 pages contains six chapters, a brief general bibliography, and subject index.

Chapter I discusses the properties of light in terms of the electromagnetic radiation model, and the relationship between absorption of radiation, molecular absorption spectra, and photochemistry. The energy units of kilojoules per mole (kJ/mole) are introduced here. Regrettably, kilocalories/mole are still the units employed by most photochemists in this country. It would have been useful, to ease the pain of constant conversions, if energies were given in both kJ/mole and kcal/mole. (Since no conversion tables are given in the text, the reader might note that kJ/mole \times 0.24 = kcal/mole.) This chapter gives a brief description of quantum yields, shows how to calculate state energies from absorption spectra, and discusses experimental factors in photochemistry.

Chapter II considers electronic transitions and electronic spectra. A brief outline is given of orbital types and shows how electronic states can be classified by orbital transitions, spin differentiation, and transition energies. Selection rules which determine band

intensities are presented without much comment on the physical basis for the rules. A brief but lucid description of the reasons for vibrational structure in absorption and emission spectra according to the Franck-Condon principle (as deduced from the spectra of diatomic molecules) then concludes the chapter.

Chapter III is a good one which covers the important features of electronically excited states, especially their dynamics. The notions of intramolecular and intermolecular excitation transfer and deactivations are put forth, and examples of the efficiencies and rates of deactivation of a number of selected molecules are used effectively to demonstrate the principles.

Chapter IV, on the kinetics of photochemical processes, I feel, is the best chapter in the text. The measurement of excited-state lifetimes, the use of fluorescence and phosphorescence in evaluating rate constants, and the notions of Stern-Volmer quenching kinetics are clearly presented, along with numerous examples and data to reinforce these important ideas and methods.

In Chapter V a number of general types of photochemical reactions, such as photoreductions, photocycloadditions, and photorearrangements are considered, whereas, in Chapter VI, the mechanism of some dissociative and elimination processes (*e.g.*, photodecarbonylation, type II cleavage, the Barton reaction) are presented.

Overall, the book covers a fair amount of material in a relatively brief span. The first two chapters are probably too brief to allow a student much insight into the important topics covered. Chapters III and IV, on the other hand, are of sufficient depth to be quite useful and informative to a beginning student. The last two chapters give the student a necessarily selected glimpse of the synthetic power of photoreactions and the fascinating aspects of photochemical reaction mechanisms. The selection and presentation of material in a book intended to be a brief introduction to a topic like photochemistry is a difficult problem for any author. I feel that in the case of the present text, the choices have been felicitous and effective. The author has been successful in meeting his expressed purpose of writing a good book for undergraduates who have had no former courses in photochemistry.

Nicholas J. Turro, *Columbia University*

Progress in Organic Chemistry. Volume 8. Edited by W. CARRUTHERS (University of Exeter) and J. K. SUTHERLAND (University of Manchester). John Wiley (Halsted Press), New York and Toronto. 1973. vii + 343 pp. \$32.50.

The present volume in this well-established series will be of particular interest to natural products chemists, though it also contains reviews in other areas. The first chapter, on prostaglandin synthesis, by R. Clarkson, approaches the syntheses in a usefully comparative manner. The fascination of biomimetic synthesis in the terpenoid field is well conveyed in Chapter 2 (T. Money), while in Chapters 3 and 4 recent developments in the active fields of cannabinoids (R. K. Razdan) and penicillin-cephalosporin chemistry (R. J. Stoodley) are summarized. A broad yet thorough coverage of structural, synthetic, stereochemical, and biological aspects of cyclic peptides (P. M. Hardy and B. Ridge) follows. The two succeeding chapters are of mechanistic interest; F. McCapra surveys chemiluminescence of organic compounds, and S. R. Hartshorn and K. Scholfield discuss recent studies in the classic field of nitration reactions, especially as they bear upon aromatic reactivity. Finally, F. J. McQuillin discusses mechanisms and applications of homogeneously catalyzed hydrogenation, with emphasis on the selective reductions possible using these methods.

The chapters are quite long and well and tightly written, so that a great deal of information is summarized. I would find my reading to flow more easily if the publishers chose Arabic formula numbers instead of Roman ones, especially in rigorous, condensed surveys of up to CCCXI compounds!

P. W. Le Quesne, *University of Michigan*

Organometallic Chemistry. Volume 1. Reported by E. W. ABEL (University of Exeter) and F. G. A. STONE (University of Bristol). The Chemical Society, London. 1972. xvi + 571 pp. \$9.00.

The specialist reports of the Chemical Society have become a standard quick review series for a wide range of topics. The current series covers the 1971 literature on organometallic chemistry

and again provides this service in a new area. The review is complementary to the annual surveys of Organometallic Chemistry published in the *Journal of Organometallic Chemistry* and provides a different organization of the material. In general, the treatment of transition element organometallic chemistry is somewhat better than that of the main group elements, but in all cases the main purpose of the work is to provide an organized annual bibliography to the literature. It does this very nicely and is recommended for that purpose. It also provides a convenient listing of all the structures determined for organometallic compounds during the year organized by chemical formula.

Each chapter represents a review by a different author and often a paper will be referenced in two or more chapters. This overlap is certainly preferred to exclusion of material and makes the work more useful. The chapters cover the following topics: the alkali and coinage metals; the alkaline earths and zinc and its congeners; boron, aluminum, gallium, indium, and thallium; carboranes; the silicon group; metal carbonyls; organometallic compounds containing metal-metal bonds; substitution reactions of metal and organometal carbonyls with group V and VI donor ligands; carbene, nitrene, and related complexes; complexes containing metal-carbon bonds; hydrocarbon-metal complexes; π -allylic complexes; π -cyclopentadienyl, arene, and related compounds; substitution reactions of hydrocarbon-metal π complexes; oxidative-addition and related reactions; homogeneous catalysis; and X-ray and electron diffraction studies of organometallic compounds.

John P. Oliver, *Wayne State University*

The Bond to Halogen and Halogenoids. Parts I and II (Organometallic Compounds of the Group IV Elements. Volume 2). Edited by ALAN G. MACDIARMID (University of Pennsylvania). Marcel Dekker, Inc., New York, N. Y. 1972. viii + 374 and viii + 232 pp. \$34.50.

This is the second volume of a series dealing with the organometallic compounds of the group IV elements. The present volume, which consists of two parts, is concerned with the chemistry of the element-halogen and pseudohalogen bond. A uniform format for the presentation of the material is followed throughout the book. First, the synthesis of the element-halogen (halogenoid) bond is described, followed by a discussion of reactions leading to a cleavage of the element-halogen (halogenoid) bond. The final portion of each chapter consists of a presentation of physical properties of group IV-element halogenides. The chapters are concluded by a list of references, and at the end of each part of the volume a list of authors and a subject index is provided, thus making the contents of the book very accessible to the reader.

Charles H. Van Dyke wrote the chapter on silicon-halogen (halogenoid) compounds, which is by far the largest contribution, making up the entirety of Part I of Volume 2. In Part II, J. J. Zuckerman contributed the review on the germanium-halogen (halogenoid) compounds. H. C. Clark and R. J. Puddephat are the authors for the tin-halogen (halogenoid) section of the book. The final chapter, concerned with the description of corresponding lead analogs, is authored by S. E. Cook, F. W. Frey, and H. Shapiro.

The chemical and physical aspects of the subject are covered critically and generally are very much up to date. Very useful are the many tables presenting spectroscopical data including nmr, uv, ir, and Mössbauer spectra of these compounds.

Brief sections of the tin and lead chapters give toxicological data on triorganotin and triorganolead halogen compounds. Though there exist considerable data on pharmacological and toxicological effects of even triorganogermanium compounds, including the halogenides covered in this volume, none of these findings are mentioned. With the present emphasis on the potential hazards of chemicals on the environment, this reviewer regrets the omission of such data on the germanium and silicon sections. The editor might consider to devote a more comprehensive chapter dealing with this subject in the concluding volume of this series. With the rapidly increasing literature concerned with organometallic chemistry, a person active in this field will find this volume helpful and could use it often and beneficially as a trustworthy companion in his research efforts. It is indispensable for libraries of universities and research institutes.

Hans Zimmer, *University of Cincinnati*