

In parallel reactions comparing catalysis of alkylation by  $\text{AlCl}_3$  and  $\text{ArMo}(\text{CO})_6$ , generally similar reaction times produced similar yields. However, the arenetri-carbonylmetal compounds show distinct advantages over  $\text{AlCl}_3$  in promoting Friedel-Crafts reactions, particularly in storing and handling of the catalysts, and also in reaction work-up where  $\text{AlCl}_3$  functions as a homogeneous catalyst. In reactions involving  $\text{ArM}$ -

(2) W. Strohmeier, *Chem. Ber.*, **94**, 3337 (1961).

(3) R. P. M. Werner and T. H. Coffield, *Chem. Ind. (London)*, 936 (1960).

$(\text{CO})_6$ , the decomposed catalyst can simply be filtered from the solution, yielding the relatively uncontaminated reaction mixture.

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Michael F. Farona,\* James F. White

Department of Chemistry, The University of Akron  
Akron, Ohio 44304

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## Book Reviews

**Art in Organic Synthesis.** By NITYA ANAND, JASJIT S. BINDRA (Central Drug Research Institute, Lucknow), and SUBRAMANIA RANGANATHAN (Indian Institute of Technology, Kampur). Holden-Day, Inc., San Francisco, Calif. 1970. xiv + 414 pp. \$8.95.

The explosive development of synthetic organic chemistry in the last 30 years has left a great legacy in our understanding of selective reaction and stereochemical control. The authors of this book have sought to prepare a reference for rapid access to this information and have been spectacularly successful.

The strong point of this book and its most unique feature is the extensive use of flow charts. There are approximately 3000 structural formulas, many in full stereochemical projection, giving a tremendous pictorial impact to even a brief perusal of the pages. Somewhat more than 100 syntheses have been outlined with frequent reference to alternative and parallel approaches.

The text has been extensively cross-referenced by reaction name, reaction type, reagent, author, and subject. The alphabetical arrangement of the syntheses is particularly convenient to someone generally familiar with the work, but arrangement by compound type might be more sensible for readers less versed in the field. Perhaps the most interesting way to use this book is merely to open to a random page. The authors have dealt with a wide variety of organic compounds with considerable attention to steroids and alkaloids, polypeptides and polynucleosides, and strained and unusual compounds.

Technically the book has been well done. The formulas have been carefully and correctly reproduced. Editorial comments are short and pertinent. At its relatively modest price, the book will undoubtedly find its way onto the shelves of most chemists interested in synthesis, students, teachers, and researchers alike.

John T. Groves, *University of Michigan*

**The Irreducible Representations of Space Groups.** J. ZAK, Editor, A. CASHER, M. GLUCK, and Y. GUR. W. A. Benjamin, Inc., New York, N. Y. 1969. x + 271 pp.

This book is essentially a list of tables with directions of usage. They have been derived by a method (solubility) different from that used originally by Kovalev (ray representations, also called weighted or loaded representations) in his pioneering work giving the first complete compilation of space group representations. Obviously the results should be equivalent, and those by Zak, *et al.*, do not presuppose a working knowledge of ray representations. They are also tabulated in a more convenient way (from this reviewer's stand point) and printed in a more pleasing format.

The tables have hopefully been checked by the authors against Kovalev's. This reviewer has only made a few spot checks and found them accurate (except the "international" symbol of  $C_{3h}$ , page 30). As usual, the reader is advised to pay attention to the particular notation convention used, which is fairly agreeable to this reviewer.

As the expert would only consult these tables for special points on the boundaries of the Brillouin zone, and even then only for nonsymmorphic space groups, the tempting question is: How many chemists will ever need to consult these tables? However, past experience may indicate that this reviewer may want to eat these words in a few years. Thirty years ago Bouckaert, Smo-

luchowski, and Wigner felt that physicists would hardly ever need them, which obviously is not the case now. When Zak, *et al.*, state (p 19) that "for representations... of basic importance in solids, it is sufficient to know the character tables in order to take into account the time reversal symmetry," they may also turn out to be overoptimistic. Like many other "representation" tables, these here (in contrast to Kovalev's) are actually only character tables.

Raoul Kopelman, *University of Michigan*

**The Chemistry of the Isoquinoline Alkaloids.** By TETSUJI KAMETANI (Tohoku University, Japan). American Elsevier Publishing Co., New York, N. Y. 1969. viii + 266 pp. \$21.00.

This, the authoritative monograph in this area, has been written by one of the leading workers in the field. It is indispensable for libraries and a valuable book of reference for alkaloid chemists. The literature is covered exhaustively through about 1966. There are subject and alkaloid name indexes. The value of this book would be enhanced with time if supplemental volumes could be prepared.

**Fortschritte der Chemie organischer Naturstoffe. Volume XXVII.** Edited by L. ZECHMEISTER (California Institute of Technology). Springer-Verlag, Vienna and New York. 1969. viii + 412 pp. \$33.00.

This volume in the series contains reviews of cellulose ultrastructure and biogenesis (A. Frey-Wyssling), ethylene in nature (M. Spencer), spectroscopic studies of carotenoids (B. C. L. Weedon), stereochemistry in the vitamin D series (G. M. Sanders, J. Pot, and E. Havinga), flavonoids (K. Weinges, W. Bähr, W. Ebert, K. Goritz, and H.-D. Marx), constituents of *Amanita muscaria* (C. H. Eugster), marine toxins (P. J. Scheuer), and lysozyme (M. A. Raftery and F. W. Dahlquist). The literature is covered up to about 1968, although some 1969 references have been cited. There are good author and subject indexes.

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

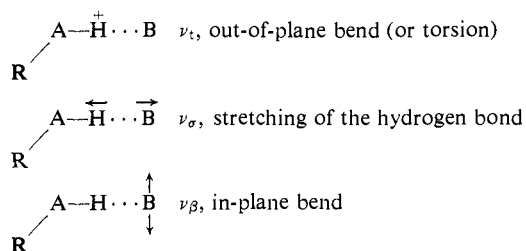
**Chemical Applications of Far Infrared Spectroscopy.** By ARTHUR FINCH, P. N. GATES, K. RADCLIFFE (Royal Holloway College), F. E. DICKSON (Gulf Research and Development Co.), and F. F. BENTLEY (Wright-Patterson Air Force Base). Academic Press, London and New York. 1970. vii + 277 pp. \$14.50.

The introductory chapter sets the stage for the sequential sections of the book. The authors, rightly so, realize that drums don't sound, bugles don't blow, and firecrackers don't ignite when you cross the  $200\text{-cm}^{-1}$  point into the far-infrared; therefore, they have backed up this limit a bit to include the many torsional modes, bendings, and lattice vibrations which are found in the region below  $400\text{ cm}^{-1}$ . Wisely included in the first chapter is a plot of the Boltzmann distribution of molecules in the various energy levels present in this low-frequency region to acquaint the reader with the possibilities of molecules existing with reasonable population in higher energy levels as well as the ground state. Amplifying this degree of disorder in the energy levels is a plot of entropy, given in Figure 5, as a function of frequency. From this figure, one can easily appreciate the contribution of low-frequency vibrations to molecular thermodynamic properties.

Chapter Two, instrumentation, is very adequate in describing the instrumental problems found in far-infrared research. Following a logical order, Chapter Three describes the techniques used in far-infrared research. For the most part, these techniques are similar to those applied in the mid-infrared, yet there is enough difference in such things as window material, sample thickness, etc., to necessitate mention.

Chapter Four is concerned with the torsional vibrations about single bonds which may be found in the far-infrared. The authors provide the basic details and examples of calculations which relate the observed torsional frequencies to barriers to internal rotation. This chapter is very good in providing both the theory as well as tables of measured barriers to internal rotation for many molecules.

The three modes of the hydrogen bond



are found in the region below  $400\text{ cm}^{-1}$ . Chapter Five discusses the observation of these frequencies.

Chapter Six presents the intense interest of the structural inorganic chemist in the far-infrared. Adequate information is presented in this chapter to acquaint the reader with the importance of far-infrared studies when applied to inorganic chemistry. Chapter Seven expands the interest of this technique to the structural investigation of metal-organic and organic compounds. One now realizes the synthetic use of the terms mid- and far-infrared, since both regions are inseparable and necessary in the studies of molecular structures.

The authors, in Chapter Eight, fulfill the final need of a text on this subject by discussing lattice vibrations. This chapter treats this subject very satisfactorily. One very minor point of criticism is found here. The authors first present a method of determining the selection rules for crystals in detail without mentioning the difficulties encountered in selecting the proper Bravais cell. They follow this with a brief description of Halford's correlation method which circumvents the above selection problem. I wish they had emphasized Halford's correlation method.

The references are excellent, accurate, and up to date. The book does not take the appearance of being compiled by five unconnected authors, but demonstrates a touch of juxtaposition so rare in multiauthored books. The book will serve both the neophyte and the "ole sweat" spectroscopist and is a welcome addition to our libraries.

William G. Fateley, *Carnegie-Mellon University*

**Essentials of Molecular Pharmacology.** By ANDREJUS KOROLKOVAS (University of São Paulo, Brazil). John Wiley & Sons, Inc., New York, N. Y. 1970. xv + 339 pp. \$16.50.

The author has presented a well-illustrated and referenced supplementary text in a clear, easy-to-read style for students of biochemistry, medicine, and pharmacy. It comprehensively covers the theories and concepts of the pharmacological action of drugs. Drug-receptor interaction theories which form the fundamental basis for biological response are covered and those that describe drug action such as induced fit, occupancy, and molecular

perturbation theories. A thorough discussion is given of the physicochemical properties that influence the absorption and transport of drug to the site of action such as solubility, partition coefficients, degree of ionization, resonance, inductive and steric effects, as well as molecular spatial conformation. While the molecular modification of a promising chemotherapeutic agent remains as a rule of action for the medicinal chemist in his search for new drugs, the chapter on the pharmacological effects of specific moieties should be of considerable aid in drug design. Subsequent chapters discuss the nature and structure of receptors and the binding forces involved during the interaction of drug and receptor, such as covalent, ionic, dipole-dipole, and hydrogen bonds and van der Waals forces. Chapter 8 has an extensive and engrossing account of attempts to determine receptor topography for a variety of pharmacological responses, covering analgetics, antiinflammatory agents, cholinergic-adrenergic and histamine receptors, and the receptors of monoamine oxidase inhibitors. As additional information accumulates on the interaction of drug and receptor, it appears less likely that a general theory on drug mechanism will evolve.

This basic text should interest the student of chemistry and biology who desires an acquaintance with the interrelationship of medicinal chemistry and pharmacology.

V. H. Maddox, *Parke, Davis & Company*

**Nuclear Magnetic Resonance Spectroscopy.** By FRANK A. BOVEY (Bell Telephone Laboratories). Academic Press Inc., New York, N. Y. 1971. ix + 396 pp. \$16.50.

This volume is not a textbook in the usual sense of the word inasmuch as it contains only a cursory and qualitative discussion of the principles underlying nuclear magnetic resonance phenomena. The book is intended rather as a practical guide or handbook for chemists who desire a working knowledge of nmr spectral analysis and of the principles of operation of modern commercial spectrometers. Emphasis is placed consistently on the empirical and semi-empirical relations which have proved useful for correlating spectra with molecular structure. Descriptions of the mechanisms of chemical shifts and spin-spin coupling are qualitative, but they are clear and concise and should aid the intuition of those unfamiliar with magnetic resonance. In keeping with the emphasis on practical spectroscopy, an extended chapter on experimental methods is included. Flux stabilizers, shimming, cycling, modulation and side bands, field-frequency locking, and signal averaging are just a few of the topics carefully explained in this chapter. This discussion is confined, however, to techniques available on commercial analytical spectrometers. Magnetic relaxation is described only to the extent that it affects the appearance of high resolution spectra through line broadening, while decoupling, spin-tickling, and liquid crystal spectroscopy are surveyed specifically as techniques for the determination of signs of proton-proton coupling constants.

Although the development of basic concepts is brief and usually qualitative throughout the book, readers are compensated by a systematic account of spectral phenomena in a variety of interesting chemical systems. For example, the effects of chemical exchange on line widths are derived from the modified Bloch equations, and the results are applied to analyses of ring inversions, hindered rotation, proton exchange, and conformations of fluxional molecules. Similarly, the discussion of proton-proton coupling constants is largely empirical and emphasizes applications in conformational analysis. One of the more useful features of the book is the 125 pages of appendices, which include tabulated proton chemical shifts and coupling constants, calculated spectra, and computed shielding effects due to phenyl ring currents. Dr. Bovey's book covers quite lucidly many applications of high resolution nmr spectroscopy in chemistry, and it can be recommended to the many chemists who seek a practical guide of this scope.

Robert R. Sharp, *University of Michigan*