

There are, even accepting the limits and approach defined by the author, a number of omissions of importance. It would be inappropriate to list these, but a few instances must be quoted to substantiate the statement. The fact that carvone hydrobromide gives eucarvone (p. 73) is stated without any mention of carenone and the work of van Tamelen. The biosynthesis of terpenoids is discussed with markedly undue stress on senecioic acid and no mention of the work of Lynen. One of the most impressive results accrued from triterpenoid studies is the discovery of the beautiful biogenetic relationship of all the triterpenoids. This earns nine words and the single representation, the cyclization of squalene to lanosterol (page 211), is misleading. The chemistry of caryophyllene is presented with no mention of the work of Barton. The migration of double bonds under the influence of ozone (pp. 16 and 29) is a dubious phenomenon in the extreme whilst the radical cyclization of large rings (p. 215) has little justification. Although some space is devoted (and rightly) to physical methods, the words nuclear magnetic resonance do not appear. The Auwers-Skita rules are given but not their conformational significance as expressed by Allinger and others.

The above and other flaws and lacunae, regrettable though they may be, might not detract seriously from the value of a book which, if it were in other respects, instructive and, most important for students, stimulating. However, herein lies in the Reviewer's opinion, the major deficiency in the book. The author in practically no place makes any attempt to increase the students understanding of how or why reactions take place, even in a very general sense. Indeed, although recent material is referred to, the style and approach of the book is that of some twenty years ago. This is a serious charge, but one, regrettably, justified.

Thus, one of the really important things forthcoming from terpenoid chemistry was the study of the Wagner-Meerwein change. This earns about two pages (the same, for instance, as does humulene) and little indication of its considerable generality is given. Starting materials and products are, in general, abruptly presented with no indication of the processes involved (the avoidance of the use of arrows appears studied). Time and time again the alert student must be troubled. How are the camphor sulfonic acids formed, how does lupene become converted into δ -amyrene, how does dihydrocarvone hydrobromide give carone, how does thujone give "isothujone" and caryophyllene give β -caryophyllene alcohol or clovene? . . .

The avowed and specific purpose of this volume is to instruct students, but instruction is surely not the same as a bald statement of starting material and product. The student is entitled to some sort of explanation for it is these explanations which lead eventually to a general understanding of organic chemistry. Without such a basis terpenoid chemistry (and organic chemistry as a whole) becomes an undigested jumble and, rather worse, a bore.

Apart from some conformational diagrams the book is very well produced and appears free of errors. The price, since the book is intended for students, is high.

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NMR and EPR Spectroscopy. Papers presented at Varian's Third Annual Workshop on Nuclear Magnetic Resonance and Electron Paramagnetic Resonance, held at Palo Alto, California. By the NMR-EPR Staff of Varian Associates. Pergamon Press, Inc., 122 East 55th Street, New York 22, N.Y. 1960. viii + 288 pp. 16 × 23.5 cm. Price, \$12.00.

The majority of research workers in chemistry who have applied magnetic resonance techniques to solve their problems have done so with some kind of Varian Spectrometer. The appearance of this collection of papers given at the annual workshop at Palo Alto will be of interest especially to those people who have recently obtained Varian Instruments. The book is of an introductory nature to the fields of n.m.r. and e.p.r. with a strong bias toward instrumentation.

Although I have not attended these summer schools presented by Varian Associates it is apparent that the material presented in the book differs very little from that

given in the lectures. It is unfortunate that the authors did not take more care in modifying the presentation in book form. The introductory articles have several repetitive sections with duplication of figures and plates. The same photograph of a high resolution spectrometer appears twice in the first 57 pages of the book. There is in general a lack of adequate references as well as inconsistencies in the referencing system from chapter to chapter.

Many of the articles read like a spectrometer manual and neglect approaches to magnetic resonance spectroscopy that have been made by independent workers. There is little or no discussion, for instance, of high resolution spectrometers using proton resonance stabilized circuits. Another general criticism is that a book on magnetic resonance for the chemist should contain sections devoted to nuclear magnetic resonance in solids.

The introduction to analysis of high resolution n.m.r. spectra, although limited in scope by the space available, gives the essentials concisely. Rempel's chapters 18 and 22 on e.p.r. are correspondingly well presented in the space available. It is a pity that these quantitative aspects of the theory were not expanded at the expense of some introductory material.

The organic chemist will look for material on proofs of molecular structure. Some interesting examples of this will be found in Shoolery's chapter on "High resolution N.M.R. as a structure determining tool." The spectra of several large molecules are presented and the use of integrated intensities illustrated in structure proofs. The difficulties of working with such large molecules as $\Delta^5,16$ -pregnadiene-20-one-3 β -ol in dilute solution seem to have been satisfactorily mastered using standard Varian equipment. The following chapter, which describes the use of high resolution n.m.r. as a quantitative analytical tool, points out the high precision available. The illustration of the intensity ratio of the two toluene proton resonance signals as a function of r.f. power shows the striking influence of dissolved oxygen on quantitative work.

The title "N.M.R. for the physical chemist" which appears at the head of chapter 9 would indicate more than a study of chemical kinetics. The contribution of n.m.r. to our knowledge of intermolecular forces, a general account of nuclear shielding, and nuclear magnetic resonance in crystals would seem to fall into this division and in my opinion should have been included. The treatment of proton exchange and hindered internal rotation, however, is the most up to date which has appeared in book form.

Those people interested in modifying their Varian spectrometers to measure H_1 and relaxation times will find the instructions in two short chapters by Anderson.

The last third of the book is devoted entirely to e.p.r. spectroscopy. These chapters consist of descriptions of apparatus and the over-all scope of e.p.r. spectroscopy is presented. The sensitivity and specificity in identification of species associated with unpaired electron spins is illustrated.

It is apparent that what was probably very successful as a workshop has suffered considerably when reported without adequate change between the formal covers of a book. The lack of editing has allowed such phrases as "color centre magnetic resonance spectroscopy" to appear in the text.

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Wave Mechanics and Valency. By J. W. LINNETT, F.R.S., Fellow of the Queen's College, Oxford. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1960. xii + 184 pp. 12.5 × 19 cm. Price, \$3.00.

This book is another in the Methuen monograph series. The author states in the Preface that his object is "to try to explain to the experimental chemist the processes and techniques that are involved in the application of wave mechanics to the electronic structures of atoms and molecules." The book is not intended for the professional worker in the field of molecular quantum mechanics, and he probably would find some of the discussion not suited to his taste. Examples are the mathematical limitations on ψ on page 4 (where incidentally the limitations are incorrect, e.g., the δ -function), and the section on *normalisation* and *orthogonality* on pages 10-13.

In the reviewer's opinion, the nicest feature of the book is its emphasis on the effects of electron correlation in many-electron systems, a topic which often is glossed over in most books of this type. After a section devoted to zero-potential problems, the hydrogen atom and the standard approximation methods, the author takes up the problem of the helium atom in some detail. The various methods of introducing radial and angular correlation in He are clearly discussed and numerical comparisons are made. The method of configuration interaction is touched upon from this point on throughout the book.

A section on H_2^+ and H_2 introduces the reader to molecular quantum mechanics, with emphasis mainly upon the older methods of handling the H_2 problem. (The diagrammatic representation of H_2 orbitals on page 109, although correctly emphasizing the inner node of the 2s-functions, is otherwise very rough and a little misleading.) Determinantal eigenfunctions for the many-electron problem are introduced at the beginning of Chapter VIII. Perhaps it would have been more natural to present this formalism in the discussion of the excited states of He, but this may be a matter of taste.

The last 32 pages of the book give a generally good, but very brief, description of the quantum theory of polyatomic molecules. The organic molecules, acetylene, ethylene, butadiene, benzene and pyridine, and some simple inorganic molecules, notably H_2O and B_2H_6 , are discussed. Ligand field theory and the nature of van der Waals forces are also briefly mentioned in the last few pages of the book.

Two further criticisms of the book should be made for the record. The first concerns the bibliography, which seems to the reviewer always to be virtually non-existent in most British monographs. This book carries on the tradition quite well. The second concerns the cover of the book, which apparently has a tendency to warp badly, at least in a dry climate.

Since much of the book is of a descriptive, qualitative nature, and yet touches on most of the modern aspects of quantum chemistry, it should serve well its intended purpose as an introduction on the undergraduate or first-year graduate student level to this important field.

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Steric Aspects of the Chemistry and Biochemistry of Natural Products. Biochemical Society Symposium No. 19 held at Senate House, University of London on 30 June, 1959. Edited by J. K. GRANT and W. KLYNE. Organized by J. K. Grant. Cambridge University Press, 32 East 57th Street, New York 22, N. Y. 1960. 16 × 25 cm. Price, \$5.50.

The first paper of this Symposium is an excellent summary by Klyne of the methods available for correlating configurations of organic compounds and establishing absolute configurations. The examples are chosen from naturally occurring compounds or synthetic biologically active materials.

The second paper by Arigoni discusses some stereochemical aspects of the biosynthesis of polyisoprenoids, including a demonstration of the absolute configuration of mevalonic acid. Some of the discussion parallels that which has already appeared in the Ciba Symposium on biosynthesis of terpenes and sterols.

The remaining six papers deal with stereochemical effects in enzyme systems or pharmacological preparations, which are more complex and less well-known than the purely chemical systems in Klyne's paper. A consideration of these papers underlines the comments of Professor Peat, in summing up the Symposium, that although the definition of enzyme structure and function in chemical terms is one of the most fundamental and challenging problems facing chemists and biochemists, our exact knowledge is still very vague, and has not advanced far beyond the pictorial notions of Emil Fischer and Paul Ehrlich. If research is allowed to continue at its present pace, we may expect that by 1975 a symposium similar to this one should be able to show us the complete structure of several enzymes, and to give us a complete explanation of their steric specificities and mechanisms of action.

The chapter by Barlow discusses steric effects of drug action, considering mainly compounds which are imitators of acetylcholine. Pitt and Morton discuss the importance of *cis-trans* isomerization of retinene in the visual process. Webb reviews briefly the steric specificities of hydrolytic enzymes—esterases, glycosidases, peptidases and some miscellaneous types. The classical work by Westheimer and Vennesland on DPN mediated hydrogen transfers furnishes the most important part of Slater's paper on steric factors in oxidation-reduction processes. The last paper by Barker discusses the mechanism of the enzymatic processes involved in the biosynthesis of the pentose sugars, the nucleotides and polynucleotides.

Organic chemists with any interest in the biochemical implications of their science will find the papers in this collection stimulating and rewarding.

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Organic Analysis. Volume IV. Editorial Board: JOHN MITCHELL, JR., I. M. KOLTHOFF, E. S. PROSKAUER and A. WEISSBERGER. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1960. vii + 429 pp. 16 × 23.5 cm. Price, \$13.50.

This volume, like the earlier offerings in this series, concerns itself with a number of entirely separate areas of interest to the analytical chemist. There are chapters on: Determination of Organic Peroxides, by A. J. Martin; Enzyme Analytical Reactions, by John B. Neilands; Gas Chromatography, by Stephen Dal Nogare and Leo W. Safranski; Applications of Nuclear Magnetic Resonance Spectroscopy to Organic Analysis, by Harlan Foster; Crystallographic Methods of Analysis: X-ray Diffraction and Microscopy, by John Krc, Jr.; and Applications of Differential Thermal Analysis to High Polymers by Bacon Ke.

Like the earlier members of the series, the contents of this volume represent a mixture of subjects chosen on the basis of sample composition on the one hand and analytical technique on the other. There is also a more subtle heterogeneity of subject matter in terms of the probable rate at which the various chapters will become obsolete. The chapters on Gas Chromatography and Nuclear Magnetic Resonance particularly will require early revision owing to the rapidity of new developments in these fields. In contrast, the thorough and generally excellent treatment of the Determination of Organic Peroxides will endure for a much longer period.

John Neilands' brief treatment of Enzyme Analytical Reactions will find many interested readers, although most analytical chemists would have preferred a more detailed and complete discussion of the subject. An extensive listing of commercially available enzymes, however, is given as well as a three-page table of known enzymic reactions. The chapter will adequately serve as an introduction to the subject and perhaps as a stimulus to further reading.

The chapter on Gas Chromatography by Dal Nogare and Safranski fills 136 pages without padding or digression. The authors probably have found approximately the right balance between theory and practice for most of their audience. The chapter is well written and provides a clear and comprehensive view of the field. Interest in Gas Chromatography crosses many of the scientific disciplines and this chapter will appeal to a broad cross section of the scientific community.

Harlan Foster clearly has not represented n.m.r. as the universal solution to the organic chemists' structural problems. He has been careful to avoid such a posture and indeed may have presented a somewhat pessimistic view. His final paragraphs are entitled "Appraisal of the Method" which seems entirely appropriate in a discussion of a technique as new as this. He has attempted to describe a complicated field in relatively few pages (about 60) and has succeeded very well. Organic and analytical chemists particularly will find this discussion an easy way to become informed concerning the potentialities of an important new technique.

The chapter on Crystallographic Methods of Analysis presents a great deal of information in highly concentrated