standardized official nomenclature now adopted by "Chemical Abstracts" and leading scientific journals.

The authors have chosen to present their exposition without "footnotes, tables or other distracting ancillary material," and to append a list of 774 references, classified as to general subjects, from which the majority of the information presumably is derived. Although this absence of specific documentation may facilitate reading for the beginner, it constitutes a serious limitation of the usefulness of the book for the worker in the field. Not only is one unable to take full advantage of the many novel and interesting facts presented, but in the few instances where statements in the text are at variance with the impression of this reviewer (for example, that 2α-methylcortisone is an active corticoid in any species or that androstenedione is reduced to dehydroepiandrosterone by *Pseudomonas testosteroni*), it is difficult to check the source to resolve the discrepancy.

In presenting an orientation for beginners, this reviewer has some reservation about the pedagogical tactics of the authors. The text often does not provide the neophyte with a clear picture of the more important points. For example, Chapter 5 begins with the statement that certain plants contain glycosides of C_{23}-steroids with potent "cardiac activity," but, except for scattered mention of toxicity, the meaning of cardiac activity is buried late in the chapter in a paragraph beginning "Cardiac glycosides have a bitter taste." In the chapter on estrogens, a definitive initial impression of the biological importance of these hormones is obscured by an immediate discussion of the non-steroidal substances with estrogenic activity found in certain plants. The important mammalian hormone, estradiol-17β, is not included among the examples of estrogens given nor even mentioned until the sixth chart of the chapter where it is merely shown to be in metabolic equilibrium with estrone. In Chapter 4 one finds statements that "another interesting sapogenin is digitogenin" and that "the glycoside digitonin contains 2 glucose, 2 galactose and 1 xylose units," but, unless he consults another text, the reader does not know for sure that digitonin contains digitogenin as its aglycone.

In spite of these points of criticism, and no attempt to condense steroid biochemistry into 169 pages could possibly please everyone in every detail, "Biochemistry of Steroids" is a valuable contribution to the steroid literature.

BEN MAY LABORATORY
UNIVERSITY OF CHICAGO — ELWOOD V. JENSEN
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Comparative Biochemistry. A Comprehensive Treatise. Volume I. Sources of Free Energy. Edited by MARCEL FLORKIN, Department of Biochemistry, University of Liège, Liège, Belgium, and HOWARD S. MASON, University of Oregon Medical School, Portland, Oregon. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1960. xxv + 590 pp. 16 × 23 cm. Price, $18.00.

Volume I of this series initiates a long needed integration of the vast store of facts and theories that have been derived from a multitude of investigations on diverse biochemical systems in the past few decades. The historical role and contemporary importance of a comparative approach to biology and biochemistry is presented very elegantly in an introductory chapter. The theme that thermodynamics constitutes a common denominator for biochemical reactions is developed in the first chapter. General concepts are explained with great clarity. The thermodynamical analysis of open systems is especially welcome since few biologists or biochemists have access to a readable account of this recently developed branch of science. The reviewer would have welcomed also some additional applications to specific biochemical systems as well as a more extensive treatment of entropy changes in chemical reactions and the relationship between entropy and information content. In subsequent chapters considerable attention is given to the energy-yielding reactions which are ubiquitous in nature. These are grouped into chapters on glycolysis, terminal electron transport, fatty acid oxidation and oxidation of inorganic substrates. The complex metabolic pathways are thoroughly analyzed and integrated into the scope of a comparative treatise. The photosynthetic reactions obviously belong here too but these are to appear in a subsequent volume. The chapters on energy-rich and onium compounds are exceptionally thorough and lucid and complement the pathway analyses perfectly. The remaining material of the book diverges from the main theme. Although superbly discussed, the subjects of phototropism and phototaxis, vision and thermal energy utilization seem rather unrelated to free energy sources. The reactions involved in these phenomena would more appropriately be considered as triggering or control devices rather than as sources or transformers of free energy.

The reviewer feels that this volume is one of the most valuable additions to the review bookshelf and strongly recommends it to all students, teachers and research workers in biology and biochemistry.

DEPARTMENT OF BIOCHEMISTRY
DARTMOUTH MEDICAL SCHOOL — EARL E. JACOBS
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Field Emission and Field Ionization. Harvard Monographs in Applied Science Number 9. By ROBERT GOMER. Harvard University Press, Cambridge, Mass. 1961. 195 pp. 14.5 × 21 cm. Price, $6.75.

A glance through the references in this monograph quickly indicates that the relevant literature is widely scattered throughout the journals of physics, chemistry and metallurgy. It seems therefore appropriate that a review be published and, according to the dust jacket, this monograph is "believed to be the first book in English" on the subjects named in its title. The first chapter is devoted to the theory of field emission, comparable in level to but considerably more detailed than treatments found in standard solid state physics texts. Chapter 2 deals with characteristics of field emission microscopes and especially the experimental aspects of attaining suitable emission tips; this useful lore for the practicing microscopist is supplemented by an appendix on the technical details of screens, tip assemblies, vacuum systems, and electronic equipment. Chapter 3 contains a discussion of field ionization (". . . field emission in reverse, . . . the tunneling of electrons from molecules into the tip . . ."), field desorption, and their applications, such as in microscopy, investigation of potential curves in adsorption processes, and tip cleaning. Chapters 4 and 5 return to field emission for a fairly thorough discussion of the following applications: gas–solid adsorption; surface diffusion; properties of dielectric layers; molecular images; whisker growth and structure. The book closes with a second appendix on "recent work," a list of footnote references, and a complete index. It is well supplied with photographs of emission patterns, tables of relevant data, and useful working equations, and appears to be a book useful to workers involved in, or contemplating, research in the areas of field emission and ionization.

DEPARTMENT OF PHYSICS
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The Chemistry of the Terpenes. By A. R. PINDER, B.Sc., Ph.D., D. Phil., Senior Lecturer in Organic Chemistry, University College, Cardiff, University of Wales. John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1960. vii + 223 pp. 16 × 25 cm. Price, $8.25.

The decision as what to include in a single volume devoted to the chemistry of terpenoids must, to a certain extent, be arbitrary. The present volume devotes 27 pages to essential oils and the general determination of structure, 86 to monoterpenoids, 33 to sesquiterpenoids, with 29, 39 and 11 pages for the di , tri and tetraterpenoids, respectively. There are two final smaller sections on rubber and the biogenesis of terpenoids. This seems, on the whole, an acceptable balance.

The date of the preface is May, 1960, but no reference later than 1958 appears and those of 1956 and later constitute a very small proportion (about 4%) of the whole. In the space at his disposal the author covers adequately what may be described as classical terpenoid chemistry. The structural determination of the simpler, and some of the more complex members, and their related syntheses are clearly presented. The determination of stereochemistry receives, except with the monoterpenoids, a smaller place,

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-carophyllene 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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CHEMISTRY DEPARTMENT P. DE MAYO
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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 repetitious 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-3β-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.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF BRITISH COLUMBIA LEONARD W. REEVES
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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.