

fined and laboratory tests for assessing the potential utility of these drugs are outlined. The actions, uses, and side-effects of the clinically useful agents are also described. The chemical aspects of neuromuscular blockade are not discussed here but will be the subject of a chapter in Volume 3 of the series.

The chemistry, pharmacology, mode of action, and clinical applications of the 2-halogenoalkylamine class of adrenergic blocking agents are fully and lucidly treated in Chapter 4. Although the clinical utility of these drugs has been limited, the relationship of their unique chemical properties to their pharmacological actions continues to intrigue the chemist and biologist. Thus the discussion of structure-activity relationships in this chapter, which up-dates earlier reviews of this topic, is particularly worthwhile.

The last chapter presents a concise account of the complex subject of anaphylactic reactions and the relationship of these laboratory phenomena to allergies. Very little chemistry is discussed here for, apart from the antihistamines and bronchodilators which are used with limited success, effective drug therapy of allergies is almost entirely lacking. This chapter is written in a way that permits the chemist who is unfamiliar with the subject to gain some knowledge of the principles and problems involved in a field where further research on several fronts is sorely needed.

All chapters are uniformly well written and, although the subjects are not treated in the exhaustive manner of the Progress in Drug Research series, provide thorough summaries of the status of these fields. The literature through 1960 appears to be well covered and some 1961 references are included. The printing and appearance of the book are excellent, although a disconcertingly large number of minor typographical errors are found in Chapter 4.

This volume is highly recommended not only to those chemists and biologists directly interested or active in the fields under discussion but to all workers who maintain a general interest in synthetic drugs and their modes of action.

RESEARCH AND DEVELOPMENT DIVISION CHARLES L. ZIRKLE  
SMITH KLINE AND FRENCH LABORATORIES  
PHILADELPHIA 1, PENNSYLVANIA

**Chemical Carcinogenesis.** By DAVID B. CLAYSON, M.A., Ph.D., Lecturer in the Department of Experimental Pathology and Cancer Research, the University, Leeds. Medical Book Department, Little, Brown and Co., Boston 6, Mass. 1962. 16 × 24 cm. 467 pp. Price, \$15.00.

This careful and critical review of chemical carcinogenesis will be of much use to all interested in the field. The collation of data alone in this field would be very worthwhile, and the thoughtful evaluation further increases the worth. The author's association with the group at the University of Leeds, long working with chemical carcinogenesis, adds much to the practical worth.

The problem of chemical carcinogenesis is covered under four general headings: its relevance to cancer in man, the experimental methods available, types of chemical shown to be carcinogenic, and the theories that have been advanced. An additional service which the author provides is to give a number of structural formulas, particularly when multiple names have been given to the same substance. This work is of material help to all those interested in carcinogenesis and is an almost essential companion to the catalog of chemical carcinogens of Shubik and Hartwell.

CANCER RESEARCH INSTITUTE SHIELDS WARREN  
NEW ENGLAND DEACONESS HOSPITAL  
BOSTON 15, MASSACHUSETTS

**Brookhaven Symposia in Biology. Number 15. Enzyme Models and Enzyme Structure.** By Biology Department, Brookhaven National Laboratory, Brookhaven National Laboratory, Associated Universities, Inc., Upton, L. I., N. Y. 1962. ix + 337 pp. 17.5 × 25.5 cm. Price, \$3.50.

This volume contains the proceedings of a symposium held at Brookhaven in June, 1962. There are 17 papers, contributed by invited speakers, transcripts of the discussion which followed each paper, and two pages of good photographs of participants in informal poses.

The papers cover a wide range of subjects. Some of them deal with basic chemical and physical studies which affect the enzymologist's thinking, though they do not deal with enzymes directly or even with enzyme models. Among these are a paper on side-chain interactions in myoglobin crystals, by J. C. Kendrew, and a paper on general aspects of electron transfer in solution, by H. Taube.

A second category comprises papers which are progress reports on the work being done to elucidate the structure of specific enzymes. For example, there is a paper by B. S. Hartley which

gives a partial amino acid sequence of chymotrypsinogen, in which 224 of the 242 amino acid residues are at least tentatively located.

A third category of papers deals with studies of organic reactions (in the absence of any enzyme) which might serve as models for enzymic processes. An example is provided by a paper by W. P. Jencks on phosphate ester cleavage.

Finally, there are, of course, papers which deal directly with studies of enzyme catalysis. These include, for example, a general paper by R. A. Alberty on the interpretation of steady state kinetic data, one by D. E. Koshland, *et al.*, on the mechanism of action of chymotrypsin, one by H. Beinert, *et al.*, on the application of low temperature optical and electron paramagnetic resonance spectroscopy to the study of oxidative enzymes, etc.

The book as a whole can be recommended not only to enzymologists, but also to "outsiders," who are not themselves active in research in enzymology, for it represents an up-to-date cross section of what the modern enzymologist does and what he is interested in learning from others. The price is only \$3.50, and it is worth that much for the photographs alone.

DEPARTMENT OF BIOCHEMISTRY CHARLES TANFORD  
DUKE UNIVERSITY MEDICAL CENTER  
DURHAM, NORTH CAROLINA

**The Thermochemical Properties of Uranium Compounds.**

M. H. RAND, M. R., D. Phil., Senior Scientific Officer at the Atomic Energy Research Establishment, Harwell, and O. KUBASCHEWSKI, Dr. phil. not., Dr. phil. habil., Senior Principal Scientific Officer at the National Physical Laboratory, Teddington. Oliver and Boyd Ltd., Tweeddale, 14 High Street, Edinburgh 1, England. 1963. 19 × 25 cm. 96 pp. Price, 30s.

This useful book has collected under one cover a wealth of information on the thermodynamic properties of uranium compounds (including alloys). It will be useful for libraries and for research groups involved in uranium and heavy element technology. The data are well referenced and tabulated and easy to locate. The authors have done more than merely to record existing data, but have used various chemical observations to help estimate new thermochemical functions where none now exist. Finally, there is a section illustrating a variety of uses to which such data can be applied.

Unfortunately there are some curious omissions and oversights. Very little complex ion (including hydrolysis) data are included, and in general aqueous species get rather poor coverage. In this respect, the volume is not as useful as previous summaries of the chemistry of uranium and the actinides. On page 12, a statement is made that there are no heat data available for the  $UO_2^{2+}(aq)$  ion. Yet both Latimer and the Bureau of Standards list a heat of formation (involving an estimated entropy). Still another oversight has resulted from apparently not noticing the latest values on the heats and free energies of formation of  $U^{+4}(aq)$  and  $UCl_4(c)$  from this reviewer's own laboratories. These kinds of oversights are perhaps a little too numerous throughout the book, and tend to detract somewhat from an otherwise satisfactory endeavor.

DEPARTMENT OF CHEMISTRY JAMES W. COBBLE  
PURDUE UNIVERSITY  
LAFAYETTE, INDIANA

**Theory and Applications of Ultraviolet Spectroscopy.** By H. H.

JAFFÉ and MILTON ORCHIN, Professors of Chemistry, University of Cincinnati. John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1962. xv + 624 pp. 15.5 × 23.5 cm. Price, \$15.00.

The authors have set for themselves the task of writing a book which begins as a primer in valence theory and which works its way up to interpretation of electronic spectra of complex molecules, both organic and inorganic. No particular background is assumed for the reader, the first three chapters (70 pages) treating such topics as light absorption laws, classification of the electromagnetic spectrum, elementary description of atomic orbitals, and Hückel MO description of simple molecules. The views in these first three chapters are more or less standard.

The next six chapters (125 pages) represent an introduction to the fundamentals of molecular electronic absorption spectra including a very elementary account of character tables and symmetry representations, promotion schemes, and term levels for several key molecules ( $H_2$ , ethylene, butadiene, benzene, and formaldehyde), intensity theory, Franck-Condon principle, transition polarizations, excited state geometry, MO and VB descriptions of excited states, chromophore theory, and theory of substitution and solvent effect. Some of these topics are covered in quite some detail; *e.g.*, intensities, Franck-Condon

principle, MO and VB descriptions of H<sub>2</sub>, and theory of chromophores.

These six chapters provide a coherent and useful introduction to qualitative aspects of molecular spectroscopy and should make the subject intelligible to the neophyte. The main criticism is that on the whole the development could be more physically based. For example, the important example of splitting of states in benzene is attributed in a mysterious way (to the beginner) to symmetry instead of placing the blame squarely where it belongs—on electron repulsion interactions. Similarly, the treatment of intensities is too involved in MO computation of dipole transition moments instead of bringing out more forcefully the basic local selection rules at the atomic level, and how these tie in with the total symmetry properties. The discussion of chromophores and substitution effects are good and will go a long way to make wave length shifts between related compounds understandable to the beginner.

The next eight chapters (312 pages) deal with the spectra of complex organic molecules. A wealth of carefully selected illustrative spectra, tables of absorption wavelengths, and intensities are given, well tied in with the text. The conjugated diene, polyene, and polycyclic hydrocarbon chapters are particularly well written, containing summaries of many empirical regularities supported by tables and graphs. Theory and empirical regularity are nicely and lucidly tied together. The chapters on  $\alpha$ ,  $\beta$  unsaturated carbonyl compounds and heterocyclics are also well developed from the standpoint of empirical regularities of the spectra and accounting of  $\pi \rightarrow \pi^*$  and  $n \rightarrow \pi^*$  promotions. There are, in addition, detailed chapters on substituted hydrocarbon spectra, steric effects, organic ion and radical spectra, organic sulfur, phosphorus and halogen spectra, and a less detailed one on inorganic complexes. These provide a comprehensive and systematic discussion of electronic spectra of key classes of organic compounds (charge transfer spectra, both intermolecular and intramolecular, and alkyl halide spectra have been slighted, however). Because of the wealth of illustrative spectra and careful treatment of empirical regularities, these chapters will be useful to molecular spectroscopists as well as to chemists in general. The reviewer's principal criticism stems from the omissions (or lack of emphasis) in the nine introductory chapters. Since the authors have not emphasized local selection rules, they cannot give an adequate discussion of intensities in carbonyl or heterocyclic spectra. The important (to the chemist) spectroscopic moments are not discussed in sufficient detail to be useful to predict or discuss intensity effects on substitution, and thus spectroscopic evidence for expansion of valence shells in organometallic and halogen compounds is unmentioned. The lack of attention given to distinguishing zeroth and higher order configurational interaction in the early chapters leaves the energy level patterns of polycyclic hydrocarbons and sterically hindered molecules somewhat unclear. The 66 pages on steric effects fail to provide a basis for distinguishing between the spectra of *o,o'*-substituted dimethylanilines and *o,o'*-substituted anisoles, for example.

Two chapters (54 pages) on emission spectra (containing several errors) and on spectroscopic determination of equilibrium constants conclude the book. There is a good glossary and a set of character tables (not needed) in an appendix. The references are fairly extensive, but in some cases the reference where points were first covered is omitted.

WHITMORE CHEMICAL LABORATORY  
THE PENNSYLVANIA STATE UNIVERSITY  
UNIVERSITY PARK, PENNSYLVANIA

LIONEL GOODMAN

**Inorganic Adduct Molecules of Oxo-Compounds.** By INGVAR LINDQVIST, Uppsala, Sweden. Academic Press, Inc., 111 Fifth Avenue, New York 3, N. Y. 1963. 128 pp. 16 X 24 cm. Price, \$6.50.

There have been instances where the publication of a critical summary or review of work in a field of investigation has led to a greatly increased rate of development of that field. This catalytic effect has resulted because the author collected relevant material from diverse sources, organized it, pointed out the places where data were sparse or missing, and suggested a tentative theory or theories which subsequent investigation would confirm or modify. It is very likely that Dr. Lindqvist has written in the present brief monograph such a review of molecular compounds formed by oxo-compounds acting as donors.

The book is concerned with molecular compounds (adducts) formed by the reaction of a donor molecule having an unshared pair of electrons with an acceptor molecule lacking a pair of electrons necessary to complete a stable octet or other stable grouping of electrons. However, the treatment is restricted to those molecular compounds where the donor molecule has an oxygen atom bound solely to a single atom of another element. The information, often arising only incidentally to other types of investigations, has been gathered from such diverse fields as

studies in nonaqueous solvents, metal separations (POCl<sub>3</sub> addition products of ZrCl<sub>4</sub> and HfCl<sub>4</sub>), and catalysis of organic reactions. After considering the conditions for adduct formation and the characteristic coordination numbers of various elements, the author presents tables of and brief comments about adducts

with donor molecules containing the groups:  $>C=O$ ,  $RC=O$ ,  $>NO$ ,  $-NO_2$ ,  $-N=O$ ,  $>P=O$ ,  $>As=O$ ,  $>Sb=O$ ,  $>S(=O)_2$ , and  $>Se=O$  as well as adducts with SO<sub>2</sub> and SO<sub>3</sub>. Then the author summarizes the results of studies of adduct molecules in the liquid state and in solution, affinity studies, structural data, charge distribution, decomposition, and catalytic activity. He concludes by rationalizing the experimental facts within a number of general aspects and by pointing out where additional data must be obtained to permit a truly theoretical treatment of the subject. The significance of this book is that it will make the task of future investigators easier by their having available a summary of the literature and a clear statement of the places where additional study will very likely yield results of real significance.

The book has some faults. While it has a table of contents, it has no subject index. The references are listed by year but not alphabetized within each year. Thus one may have some difficulty locating a subject after an initial reading. Although the author states why certain adducts were omitted, this reviewer feels that other references (like those to the work of A. F. O. Germann) were omitted which should have been included. The quality of workmanship of the publishers is excellent.

RESEARCH DEPARTMENT  
KOPPERS CO., INC.

W. CONARD FERNELIUS

MONROEVILLE, PENNSYLVANIA

**Compound Semiconductors. Volume 1. Preparation of III-V Compounds.** Edited by ROBERT K. WILLARDSON, Bell and Howell Research Center, Pasadena, California, and HARVEY L. GOERING, Battelle Memorial Institute, Columbus, Ohio. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1963. xxii + 553 pp. 18 X 26 cm. Price, \$25.00.

The American and English chemical literature contain very few comprehensive surveys dealing with the preparation of inorganic compounds. If one needs the information, there is always "Gmelin." The time when compounds were synthesized as an end in itself has long passed. This is even more true for the III-V compounds which are playing such a central role in semiconductor technology and solid state physics. Physicists and chemists who intend to study the electronic transport properties or the dislocation patterns in one of these binaries will usually obtain their crystals from commercial sources.

The present volume should rather be looked upon as a magnificent description of the state of the art (as of 1962) in that area often described as "crystal growth" (and its ramifications). This area is truly "interdisciplinary"; a host of chemical, metallurgical, crystallographic, and physical techniques has been brought to bear on the problem of manufacturing the most perfect single crystals. A large number of those techniques were learned during the "germanium-and-silicon" years (forties and early fifties). However, many of these methods have reached their present level of sophistication only through their application to the III-V compounds. Although the members of this family are quite a bit more complicated in their chemical and physical behavior than the group IV elements, our knowledge of their properties has attained an unusually high level in only 10 years. Hence the choice of the III-V binaries as an illustration of the different aspects of crystal growth is a happy one.

The editors of this book have decided to include the following subjects: chemical synthesis of the compounds, single crystal growth and zone melting, purification of the constituents, detection of impurities (by spectrochemical means, mass spectrometry, colorimetry, activation analysis, and electrical resistivity), thin films, surfaces, diffusion, segregation, crystal structure, and chemical bond, as well as thermodynamical properties (phase diagrams, heats of formation, etc.). Besides the compounds of Al, Ga, and In with P, As, and Sb, some attention is given to BP, AlN, and GaN. More than 60 authors from both sides of the Atlantic Ocean have contributed to this book.

This reviewer was particularly impressed by the cleavage studies of G. A. Wolf, the spark source mass spectrometer (R. Brown, R. D. Craig, and J. D. Waldron of A.E.I., Ltd., Eng.), the anisotropic segregation of impurities in InSb (Mullin), and the clean surface investigations of Larrabee and of Haneman. That the contributions are of course rather uneven in quantity and quality has become a cliché remark.

It is regrettable that this book contains no information concerning the preparation of p-n junctions and tunneling barriers. Al-