(20 min) at −78°, warmed rapidly to ca. −10°, and treated with iodine as in the previous cases to oxidize the phosphite. It was found that the 3′-5′ phosphotriester was more readily separated from the 3′-3′-phosphotriester (formed in small amount by reaction of excess phenoxyacetylthymine with the dichloridite) after removal of the phenoxyacetyl protecting groups. Accordingly the reaction products were treated (20 min) with 4.5 *M* ammonium hydroxide in 1:1 dioxane–water, conditions which led to complete cleavage of the phenoxyacetic esters without disturbing the *o*-chlorophenyl protecting group. Thin layer chromatography on silica (with perchloric acid spray to indicate the position of methoxytrityl ethers) showed that all the methoxytritylthymidine had reacted and that none of the 5′-5′ phosphotriester (**1**) had formed.[8] The *o*-chlorophenyl ester of thymidylyl[3′-5′]-3′-*O*-mono-*p*-methoxytritylthymidine (**4**) was isolated by preparative chromatography on silica plates using tetrahydrofuran–1,2-dichloroethane (1:3): 65% yield; mp[6] 130–133°; R_f (EtOAc–THF 2:1) 0.15; λ_{max} 232 nm (shoulder, ϵ 18,600); 265 nm (ϵ 20,800); λ_{min} 246 (ϵ 14,600).[9]

These phosphotriesters were converted by successive hydrolysis with 80% aqueous acetic acid (10 min at 100°; to hydrolyze the *p*-methoxytrityl ether) and 0.1 *M* sodium hydroxide (3 hr at 25°; to remove the phenoxyacetyl and *o*-chlorophenyl protecting groups) to the corresponding dinucleoside phosphates, which were characterized by their reactivity toward snake venom and spleen phosphodiesterase. For example, the 3′-5′ isomer, dTpT, was completely degraded to thymidine and thymidine phosphate (1:1 ratio) by both enzymes.

Control tests with 3′,5′-O-protected nucleosides showed that the thymine ring and the *N*-benzoyl derivatives of the purine nucleosides and deoxycytidine are stable to phosphorochloridites in the reaction medium, even at room temperature. In addition to phenoxyacetyl and methoxytrityl, the benzoyl and β-benzoylpropionyl protecting groups were found to be compatible with the phosphorylating reagent.

Experiments are in progress to optimize the yields and to extend the phosphite coupling method to the synthesis of oligonucleotides containing all four common nucleotides.

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(9) Compound **3** was separated in 52% yield from products of a comparable reaction before treatment with ammonia by multiple development on silica plates with ether–ethyl acetate (3:1), mp 110–115°, R_f (EtOAc–THF, 2:1) 0.34.

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Book Reviews

Introduction to Modern Inorganic Chemistry. Second Edition. By K. M. MacKay and R. Ann MacKay (University of Waikato, Hamilton, New Zealand). Intext Educational Publishers, New York, N.Y. 1974. xiv + 305 pp. $11.50.

The second edition, which was originally published in Great Britain in 1972, is not substantially changed from the first edition. The first portion is concerned with the electronic structure of atoms and molecules, the solid state, solutions, and experimental methods. The larger, second portion follows with a discussion of periodicity and the descriptive chemistry of various groups of elements.

A total of twenty-nine additional pages have been distributed throughout the new edition, with sections discussing spectroscopic methods and inorganic reaction mechanisms particularly expanded. A new, brief (7 pp) appendix entitled "Molecular Symmetry and Point Groups" has been provided, and the appendix entitled "Further Reading" now contains specific references for topics appearing in all sections of the text. SI units are used throughout, with minor exceptions. No problems have been included.

The title of this text is not supported by the light treatment afforded some of the more recent developments in inorganic chemistry. Thus, the chemistry of the transition metals is presented with heavy emphasis on oxides and halides whereas topics in bioinorganic or organometallic chemistry receive relatively little attention (the latter is covered in three pages). In general, an effort to cover the widespread areas which loosely constitute inorganic chemistry has resulted in too many topics which are only briefly discussed. As such, their presentation is often too condensed to educate the neophyte and too superficial to be useful to those more experienced.

John R. Shapley, *University of Illinois*

Polyvinyl Alcohol. Edited by C. A. Finch. Wiley-Interscience, New York, N.Y. 1973. 622 pp. $35.00.

Because it cannot be prepared from its own monomer, poly(vinyl alcohol) stands out as a unique polymer of industrial importance. All attempts to synthesize the monomer vinyl alcohol have resulted in its rearrangement tautomer, acetaldehyde. Instead, poly(vinyl acetate) is synthesized, followed by the hydrolysis or ester interchange removal of most (but not all!) of the acetate groups. Besides molecular weight dependence, the properties of poly(vinyl alcohol) are contingent upon the degree of hydrolysis, the "blockiness" or distribution of the remaining acetate groups, and slight degrees of tacticity imposed by variations in the synthetic technique.

"Polyvinyl Alcohol" presents a detailed account of many of the important properties and applications of poly(vinyl alcohol). Since most uses involve water solubility at one point or another, great emphasis is correctly placed on the aqueous solutions or dispersions of poly(vinyl alcohol), or how its properties are affected by the presence of water.

While Chapters 1 and 2 present an excellent historical introduction and general properties discussion of poly(vinyl alcohol), Chapters 3 through 7 relate to synthetic aspects, and Chapters 8 through 10 present physical properties. Chapters 11 through 21 are application oriented, discussing uses in warp sizing, paper manufacture, adhesives, films, and many others. For example, Chapter 16 gives an account of the adhesive behavior of the polymer. Especially interesting is the use of poly(vinyl alcohol) as a remoistenable adhesive, on postage stamps, for example. The moisture plasticizes the polymer, reducing its glass transition from ca. 70°C to below room temperature, providing the necessary tack. The discussion lacks cross referencing, however, and the use-oriented discussion on pages 419 to 423 should refer to pages 168 and 358, which develop the physical behavior aspects well enough. Chapter 17 develops the use of poly(vinyl alcohol) as an emulsifier and a protective colloid, with applications to emulsion polymerization.

Since this reviewer is especially interested in polymer blends, he was gratified to see several discussions of the topic in the text. Appendix 1 (virtually a chapter in itself) treats compatibility with starch, cellulosics, and acrylics in some detail.

A major omission, recognized by Finch (p XIV), is the study of poly(vinyl alcohol) as a fiber. In the synthetic and aqueous-use oriented aspects, the book seems very complete. The book presents a real international flavor in its authorship, and correctly portrays the very extensive role the Japanese have played in the development of the polymer. The book is intended for the industrial chemist working in the field and not as an introduction to poly(vinyl alcohol). Overall, the book is well written and will provide the large and growing poly(vinyl alcohol) industry and other interested readers with an invaluable source book; it should be in the library of anyone working on poly(vinyl alcohol).

L. H. Sperling, *Lehigh University*

Carbonium Ions. Volume IV. Edited by G. A. OLAH (Case Western Reserve University) and P. v. R. SCHLEYER (Princeton University). Wiley-Interscience, New York, N.Y. 1973. xii + 459 pp. $29.95.

Volume IV of the Olah-Schleyer compilation "Carbonium Ions" continues the heading "Major Types" from the two preceding volumes (Volume I was "General Aspects and Methods of Investigation"). Six chapters are presented.

"Arylcarbonium Ions" by H. H. Freedman reviews the formation, thermodynamics, and structures of stable tri- and diarylcarbonium (-carbenium) species. The isolation of trityl cation salts in 1901 may be said to mark the beginning of carbocation chemistry, and the original branch of the field has prospered along with its descendants by modern physical methods. Notable achievements have been the measurement of thermodynamic effects for a wide variety of substituents and an increasingly detailed understanding of conformational properties of trityl and related cations. Less stable arylcarbonium ions as reactive intermediates are not included in this chapter. "Cycloheptatrienylium Ions" (tropylium ions) are covered by K. M. Harmon. Physical properties and reactions of the parent and derivative ions are systematically presented. Special emphasis, however, is placed on preparative information, including some previously unpublished aspects of the work of the late H. J. Dauben, Jr., with whom the author was a coworker.

F. S. Scott and R. N. Butler have contributed a chapter on "Azacarbonium Ions," i.e., amino- and amidocarbonium ions and nitrilium and aminonitrilium ions. A diversity of data has been brought together on such species, whether as mechanistically inferred intermediates, detected equilibrium species, or stable salts. A complementary chapter is on "Protonated Heteroaliphatic Compounds," by G. A. Olah, A. M. White, and D. H. O'Brien. Contemporary studies, principally by nuclear magnetic resonance, have provided much information on the relative strengths of organic weak bases, sites of protonation of molecules with several basic atoms, and exchange and conformational properties of the conjugate acids. Such work has supplied direct evidence on numerous cations elsewhere postulated as transient reaction intermediates.

"Bridgehead Carbonium Ions" are presented by R. C. Fort, Jr. Bridgehead solvolytic reactivities, which have provided central evidence on the preferred planarity of (at least tertiary) carbonium ions, have recently been impressively reproduced by force-field calculations. Other newer developments include the elucidation of a number of exchange and rearrangement processes, largely involving adamantanes, and the demonstration of marked product dependence on configuration in solvolyses of condensed-ring bridgehead substrates.

A topic which has gathered increasing experimental attention in recent years is "Degenerate Carbonium Ions," surveyed in the present volume by R. E. Leone, J. C. Barborak, and P. v. R. Schleyer. Degenerate carbonium ions are those of the same constitution and energy (in the absence of differential ion-pairing or medium effects) and related by rearrangement. Mechanistic data are obtained as isotopic-label and optical-activity changes. These systems are the central subjects in investigations of sigma-delocalized carbocations where driving forces of constitutional rearrangement are absent. Nmr studies of stable carbonium ions in superacid media have revealed degenerate rearrangements in several systems previously assumed to be static. For a number of ions the emerging picture is one of complex rearrangements corresponding to raised time-average symmetry.

Coverage in each of these chapters is extensive, with between 150 and 330 literature citations, and editing has been thorough. The Olah-Schleyer "Carbonium Ions" series continues here to provide a valuable collection of authoritative and timely reviews over a wide-ranging and fundamental area of organic chemistry.

J. Eric Nordlander, *Case Western Reserve University*

Amorphous and Liquid Semiconductors. Edited by J. TAUC (Brown University). Plenum Publishing Corp., New York, N.Y. 1974. ix + 441 pp. $28.00.

This text attempts a general experimental and theoretical survey of disordered solid and liquid structural, optical, and electrical properties. The central focus is on the fundamentals rather than on applications. Organic glasses and polymers are mentioned in passing, but the emphasis is decidedly on inorganic semiconductors. While the title includes liquid semiconductors, only one chapter (out of seven) is devoted to that subject. The writing is by international experts and very readable; it should be understandable to those outside the field who are familiar with elementary solid state physics. This book is valuable for those researchers wishing a rapid and concise introduction to the state of noncrystalline semiconductor art up to about 1972. The topics surveyed include both structurally and locally disordered solids and range over thermodynamics, nucleation kinetics, bonding models, electronic structure and mobility theories, optical and electrical properties, and device applications through switching and memory effects.

William L. Greer, *George Mason University*

Environmental Engineer's Handbook. Volume I. Water Pollution. Edited by BELA G. LIPTAK (Crawford & Russell, Inc.). Chilton Book Co., Radnor, Pa. 1974. lxxiii + 2018 pp.

This handbook will be valuable to all concerned with water pollution whether the contamination is organic, inorganic, or radioactive. Occurrence and detection are discussed, but the strength of the handbook is in treatment methods. Treatment methods—physical, chemical, and biological—are covered in considerable detail. The discussion and treatment of water pollutants are comprehensive, authoritative, and excellently presented. An exception is the inexcusable omission of copper.

The handbook has an excellent table of contents and is well indexed, superior to many handbooks I have consulted. It has many valuable graphs and charts. Of minor importance, but unfortunately, the chart listing technical societies inexplicably omits The American Chemical Society, The American Electroplaters Society, and The Water Pollution Control Federation.

C. F. Waite, *Water and Light Board, Newberry, Michigan*

Comprehensive Biochemistry. Volume 29A. Comparative Biochemistry, Molecular Evolution. Edited by M. FLORKIN (University of Liege, Belgium) and E. H. STOTZ (University of Rochester). American Elsevier Publishing Co., New York, N.Y. 1974. xiv + 328 pp. $36.00.

This is Volume 29A of Section V in the familiar "Comprehensive Biochemistry" series edited by Florkin and Stotz. Section V also contains seven other volumes which cover various topics in molecular biology, bioenergetics, immunochemistry, cytochemistry, and photobiology. Volume 29 is published in two parts. Part A, the subject of this review, consists of two chapters: one by M. Florkin on "Concepts of Molecular Biosemiotics and Molecular Evolution," and one by T. Swain on "Biochemical Evolution of Plants." Part B is scheduled to contain chapters by J. deLey on "Biochemical Evolution of Bacteria," M. Florkin on "Biochemical Evolution of Animals," and M. Florkin on "Prebiological Evolution."

I found the chapter by Swain on plant evolution to be logically organized and clearly written. It begins with a brief discussion of taxonomy, a discussion of the origins of plants and the biomolecules formed from early plants which are found in ancient sedimentary rock, and a discussion of plant evolution based on the fossil record. The main body of the chapter considers biochemical evolutionary markers. Plant taxonomy based on homologies in DNA, RNA, and protein sequencies is discussed first. The evolutionary information found in the metabolic control mechanisms which direct the biosynthesis of the wide array of organic compounds synthesized by plants is then considered in some detail. This section would be especially interesting to the natural products chemist since all his favorites including alkaloids and terpenes are discussed. Suggestions, based on evolutionary arguments, are made for the roles of these compounds in the plants. A chemist who has mainly been interested in structures might be prompted to consider problems in chemotaxonomy after reading this section. My only criticism of Swain's writing is that speculation is often presented as fact.

I found the chapter on molecular evolution to be very difficult to comprehend. The writing style is uneven because often side issues dealing with priority or controversies are discussed which make it difficult to concentrate on the main theme. Furthermore, the extensive use of jargon also makes the reading difficult. The author apparently recognized that the jargon would be a problem, so he included a glossary of terms at the end of the article. However, it is difficult to maintain the chain of thought while constantly referring to the glossary. This chapter may be a useful discussion of the basic concepts of molecular evolution for the expert; however, the nonspecialist will find it pretty tough going.

James P. Ferris, *Rensselaer Polytechnic Institute*

The Science and Technology of Aerosol Packaging. Edited by J. J. SCIARRA and L. STOLLER. John Wiley & Sons, New York, N.Y. 1974. 710 pp. $35.00.

This book is a comprehensive compendium of 24 articles by 21 authors, apparently intended as both a reference for the industry and an educational text.

As a reference it is a worthwhile book, since most areas of both the science and technology are covered. The index is helpful and complete, but the reference value would have been enhanced if some of the tabular material were in the form of appendices. For instance, many of the properties of various propellants should have been collected together at the end.

As a text for educational purposes the material suffers from the fragmentary treatment of a multi-author text. Some material, such as vapor pressures of multi-component mixtures, is treated well in several chapters using somewhat inconsistent formalism. For instance, the equations of state on page 93 are incorrect until one realizes that the temperatures are in °R while the figures and text are in °C or °K. Some material is, however, taken for granted. A number of chapters discuss relative propellant cost, but nowhere in the text is the list of approximate prices at some date in the past which would help to focus the discussion.

Overall, the breadth of knowledge included and the comprehensive character make up for the few textual errors and erroneous (or useless) figures which are included.

D. H. Stedman, *University of Michigan*

Molecular Orbital Methods in Organic Chemistry—HMO and PMO. By WILLIAM B. SMITH (Texas Christian University). Marcel Dekker, Inc., New York, N.Y. 1974. vii + 161 pp. $14.50.

This book is intended as a text or an accessory text for an undergraduate level organic chemistry course on approximate molecular orbital theory. The emphasis of the book is on readily calculable and usable results; little effort has been wasted on proving the theoretical basis or validity of the methods. The aim, apparently, is to present as quickly and rapidly as possible an overview of how approximate MO theory can be advantageously exploited by organic chemists. The treatment is thus primarily qualitative, although many simple problems and examples are given in nearly all the chapters. None of the problems require computing machinery more complicated than a slide rule.

The introductory chapters provide the basis for Hückel theory: the Schroedinger equation is presented, the hydrogen molecule is solved using LCAO- MO's, and the technique is extrapolated, by means of examples (ethylene, butadiene, benzene), to Hückel MO theory. Subsequent chapters cover the calculation of bond orders, charge densities, dipole moments, and the properties of heteroatom compounds. First-order perturbation theory as applied to approximate MO theory (PMO method) is introduced, the concepts of aromaticity, antiaromaticity, and resonance are explained, and these ideas and methods are used in the final chapters to interpret and explain problems of chemical reactivity. In particular, nucleophilic and electrophilic substitution, electrocyclic reactions, cycloadditions, sigmatropic rearrangements, and the Woodward-Hoffmann rules are all treated, using a variety of examples.

The tone of the book is well expressed in the preface: "For the purist, [Hückel] MO theory contains such gross and conflicting approximations as to render it meaningless. However, the organic chemist is usually more of a pragmatist. He is willing to settle for useful results even though these may sometimes be due to a fortuitous cancellation of errors. As will be seen, both HMO and [Perturbation] MO theories provide answers for the chemist. If he will keep the limitations of the theories in mind, both theories can be of value."

Unfortunately, this book is all too brief and does not provide sufficient perspective or depth for students to be able to judge the limitations or even the validity of the simple calculations espoused. Because of its many examples of the applications of HMO and PMO theory to the properties and reactivity of organic compounds, this book will be quite useful as a source of lecture material for someone teaching an introductory approximate MO theory course. The students taking the course, however, might be better advised to purchase the only slightly more expensive but much more thorough texts by Dewar or Streitwieser.

G. G. Christoph, *Ohio State University*

The Sea. Volume 5: Marine Chemistry. Edited by EDWARD D. GOLDBERG (Scripps Institution of Oceanography). John Wiley & Sons, New York, N.Y. 1974. xiv + 895 pp. $39.95.

This latest volume of "The Sea" is more than a review of historical and current literature on marine chemistry; it is a working manual which describes the derivations and uses of many current theories. It provides a fair amount of fundamental knowledge and many new facts and concepts.

"The Sea. Volume 5" is divided into 23 chapters grouped into six parts—Thermodynamics of the Seawater System, Air-Sea Interactions, The Sedimentary Cycle, The Impact of Life Processes Excluding Man, The Impact of Man on the Chemistry of the Oceans, and Origin of the Oceans.

The book is well designed for those people already somewhat familiar with marine chemistry who are seeking basic conceptional information about some particular aspect of the subject. None of the chapters is difficult to follow although they may require careful reading. But a natural products chemist seeking information on the cycling of organic materials in the marine environment or an environmental chemist seeking basic concepts on air-sea interactions can find what he needs in this book.

It is a pleasure to find a chapter on marine natural products in a book which otherwise deals mainly with the chemistry of the sea itself. Perhaps people reading this book for other aspects will take time out to glance at this chapter and learn something about the chemistry of the creatures which live in the sea. Likewise, chemists looking for another review on marine natural products will be forced to page through a book on ocean chemistry. Perhaps they will pick up some interesting and useful information in areas outside their own field.

Every author noted that in marine chemistry the available data are both too meager and too imprecise. They agree that far more work still needs to be done. "The Sea. Volume 5" is an excellent source book for those who will be doing more.

Timothy Erdman, *Chevron Research Company*

Monographs on ESR: Electron Spin Resonance in Chemistry. By L. A. BLUMENFELD, V. V. VOEVODSKI, and A. G. SEMENOV (Academy of Sciences of the USSR). John Wiley & Sons, Inc., New York, N.Y. 1973. xii + 322 pp. $32.50.

The most exciting part of this book is its title. When originally published over ten years ago in Russia, this must have been a most stimulating monograph. The first half deals with the fundamentals of ESR. It includes chapters on the construction of ESR spectrometers and on the theory of ESR spectra. The second half is devoted to the application of ESR to chemical problems which range from electron delocalization phenomena, through radiolytic and catalyst studies, to the investigation of organic structures.

The Russian edition was later translated into German with the addition of new material in trace quantities. The present version is a translation from the German which may be of interest to historians since there are only three references dated 1963 or later. I cannot agree with the translator that this book will "help the reader to see ESR in full perspective" nor, with regard to biological applications, that it will "add to Western thought on the subject".

K. U. Ingold, *National Research Council Canada*

Transport Analysis. By DANIEL HERSHEY (University of Cincinnati). Plenum/Rosetta Edition, New York, N.Y. 1974. x + 353 pp. $9.95.

This paperback book is written in three parts. In the introductory part over two chapters, the author presents a good discussion of matrices, tensors, and Laplace transforms applied to linear and nonlinear diffusion equations. The second part consists of derivations of momentum-transport equations, transport analysis in fluid-flow phenomena, derivation of mass-transport equations, and transport analysis in mass-transport phenomena. A good number of examples are chosen from various disciplines where these methods are of importance. For example, the author discusses the Bingham and Power law models of non-Newtonian fluids. However, he does not motivate the models nor does he explain the sorts of suspensions for which you might expect them to be useful. There is a short discussion of unsteady low-Reynolds-number flows. In the third part of the book, having introduced finite difference calculus, the author discusses transport analysis in cascaded systems.

A great asset of this book is that it is very general in its treatment of topics, is lucid, and treats every mathematical step in detail with nothing of the "can be shown" business. At the end of each chapter there are a selected set of assignments and a good set of problems to practice on. The general discussions, especially in the later chapters, are concerned with engineering-oriented problems, especially useful to chemical engineers, reactor problems, and such others. There are some very interesting, but brief, discussions on rheology of complex fluids.

There is no doubt that this will be a invaluable book at an intermediate level for both senior-undergraduate and graduate students in engineering and the physical and life sciences. To a researcher it provides a very handy reference guide. This would be a good book to program a course around for an interdisciplinary type of study on transport problems.

K. V. Rao, *Clarkson College of Technology*

High Energy Electron Scattering. By RUSSELL A. BONHAM (Indiana University) and MANFRED FINK (University of Texas). Van Nostrand-Reinhold Co., New York, N.Y. 1974. vii + 311 pp. $24.50.

This book, No. 169 in the ACS Monograph Series, is intended as a handbook on the use of high-energy (keV) electron scattering to probe atomic and molecular structure. Following a concise (and thorough) introduction (79 pp) to the requisite scattering theory and atomic and molecular wavefunction calculations, the core of the book (136 pp) concerns the use of scattering data to probe atomic and molecular charge and momentum densities, and to determine molecular energy levels. The book concludes with a discussion (87 pp) of many experimental aspects of electron scattering measurements.

I have reservations about the accessibility of the introductory material on scattering, particularly to students and researchers in chemistry with little or no previous familiarity. The material is there, and with effort it can be assimilated, but it is most certainly not at an introductory level.

The core of the book is quite stimulating. In particular, there is seen the thrust of electron scattering work to extract meaningful chemical information. Most striking is the attempt to obtain electron density maps that provide unique characterization of molecules, and even, perhaps, individual bonds within a molecule. There emerges the very close interplay between theory and experiment required to analyze results of electron scattering experiments. Thus, this kind of work is at the same time a challenge to theory to unravel the molecular physics, and a stark proving ground for the development and testing of methods for the calculation of molecular structure.

The book is in the main heavy going, reflecting perhaps the complexities of the field. This in itself may deter many. This is unfortunate, since the reward, developing new insights into molecular structure, may be high.

Dan Dill, *Boston University*

Basic Organic Reactions. By WILLIAM MCCRAE, Heyden & Son, Ltd., London. 1973. xiii + 216 pp. $9.90 (casebound), $5.35 (paperbound).

In this book the author has attempted to describe the basic essentials of the commonly employed organic reactions in synthesis. The first two chapters introduce the basic concepts of molecular structure and reaction mechanisms. Chapters 3, 4, and 5 contain the most used synthetic organic reactions grouped under the functional headings of acylation, alkylation, and halogenation. There are chapters on oxidizing and reducing agents followed by two chapters on rearrangements and miscellaneous reactions. Throughout the book the treatment of the subject matter is concise but clear. Each reaction is followed by a laboratory procedure illustrating the principle in use. There are review questions at the end of each chapter.

The book should be an excellent supplementary text for an undergraduate course in organic chemistry whereby a student may accomplish a quick review before the final examination. It should be of particular value in a laboratory course in organic synthesis.

O. P. Goel, *Parke, Davis & Company*

Gaschromatographia Spettrometria Di Massa Nello Studio Di Farmaci. Edited by A. FRIGERIO (Institute for Research in Pharmacology). Tamburini Publishers, Milan, Italy. 1973. xii + 192 pp.

This paperback is directed at the growing body of researchers using mass spectrometry as an analytical tool for pharmacological studies dealing with drugs and their metabolites. The book is unlikely to attract a large number of readers since it is written in both Italian (60%) and English (40%). In addition almost all of the material presented can be found in several other excellent texts dealing with either mass spectrometry or drug metabolism. Chapter I (by N. Uccella) contains a brief introduction to mass spectrometry in general. Included are sections dealing with GC-MS, molecular separators, EI-CI-FI techniques, energetics of unimolecular decompositions, and metastable ions. Chapter II (by G. Belvedere and A. Frigerio) contains a discussion of techniques for isolating and preparing biological samples for GCMS. Of the next four chapters, two by A. Frigerio-G. Belvedere and R. E. Finnigan are concerned with analytical application of GCMS in pharmacological studies. The third outlines the utility of high resolution mass spectrometry in drug metabolite research, and the fourth describes the use of GCMS computer systems for the identification of dangerous drugs. The final chapter contains a brief discussion of the use of stable isotopes in drug research. The book will be of little value to active researchers in the field, since very few references (113) have been cited. The book also fails as an introductory text, since the discussion of each topic is less than adequate. This reviewer finds little on which to recommend the above text.

Donald F. Hunt, *University of Virginia*