

BOOK REVIEWS

The Flavonoids: Advances in Research since 1980. Edited by J.B. HARBORNE. Chapman & Hall, 29 West 35th Street, New York, NY 10001-2291. 1988. xiv + 620 pp. 18.5 × 24.5 cm. \$247.50. ISBN 0-412-28770-6.

This text is the third volume in the series of "The Flavonoids", completely covering the primary literature in the area from 1981 to 1985. Those familiar with this topic are no doubt in possession of the earlier volumes, and will certainly want to add this latest review to their library. The 3rd volume contains sixteen chapters authored by specialists in the area: "The Anthocyanins," "Flavans and Proanthocyanidins," "C-Glycosylflavonoids," "Biflavonoids," "Isoflavonoids," "Neoflavonoids," "Flavones and Flavonols," "Flavone and Flavonol Glycosides," "The Minor Flavonoids," "Miscellaneous Flavonoids" (which include diarylpropanes, cinnamylphenols, homoisoflavonoids, sphagnorubins, rearranged and degraded flavonoids), "Biosynthesis," "Distribution of Flavonoids in the Lower Plants and its Evolutionary Significance," "Distribution and Evolution of the Flavonoids in Gymnosperms," "Flavonoids and Evolution in the Dicotyledons," "Distribution and Evolution of the Flavonoids in the Monocotyledons," and "Flavonoids and Flower Color." The text includes an Appendix consisting of valuable known flavonoid checklists, as well as an extensive plant species index and a subject index. These allow for rapid and facile location of structures and plant species of interest. The 3rd volume is heavily referenced to the primary literature, making it an absolute necessity for those in the field. It covers occurrence, structures (>4000!), biological properties, synthesis, and biosynthesis of the flavonoids in a clear and precise fashion. Discussions of problematic structures in the literature alert the reader to exercise caution in choosing relevant compounds for structural/chemotaxonomic comparisons. This invaluable work is highly recommended for plant biochemists, botanists, natural product chemists, phytochemists, and pharmaceutical and medicinal scientists. The high price will preclude purchase for many personal libraries, but the book should be part of every academic, pharmaceutical, and governmental library.

MICHAEL S. TEMPESTA, *University of Missouri*

Patai's Guide to the Chemistry of the Functional Groups. S. PATAI, John Wiley and Sons, 605 Third Avenue, New York, NY 10158. 1989. vii + 455 pp. 15.5 × 23.5 cm. \$57.95. ISBN 0-471-91526-2.

The series "The Chemistry of Functional Groups" began to be published in 1964 under the able editorship of Saul Patai, and at this time some 59 volumes have been published. The scope of the series is such that it takes a minor research project to determine whether the series contains relevant information for a particular application, and the editor has thus produced this handy guide to the series. The guide consists of a chronological listing of the published volumes, with a detailed synopsis (approximately half a page long) on each chapter. Each synopsis includes the number of references and their cutoff date for that chapter, and also lists other chapters that are relevant to or complementary to the subject matter.

This guide will be a useful resource for anyone who has access to the Patai series and who needs information from it on a regular basis.

DAVID G.I. KINGSTON, *Virginia Polytechnic Institute and State University*

Mass Spectrometry/Mass Spectrometry. Techniques and Applications of Tandem Mass Spectrometry. KENNETH L. BUSCH, GARY L. GLISH, and SCOTT A. MCLUCKEY. VCH Publishers, Suite 909, 220 East 23rd Street, New York, NY 10010. 1989. xii + 333 pp. 16 × 24 cm. \$75.00.

Tandem mass spectrometry may yet prove to be the natural product chemist's most potent spectroscopic tool. It is capable of screening complex mixtures for chemical compounds of particular classes as well as providing structural information on individual compounds. As a form of mass spectrometry, it has high sensitivity and is applicable to compounds of all structural types, and it has demonstrated capabilities for

the discovery of new natural products including those present at trace levels. With the rapid increase in availability of MS/MS instruments, especially triple quadrupoles, an increasing number of natural products chemists are able to use the technique. This book will be invaluable in such an endeavor.

The book covers many facets of modern mass spectrometry. It treats ionization techniques and types of analyzers, both of which occur in almost bewildering variety and with ever-increasing capabilities. This material is presented clearly and in a fashion which gives the book value as a general mass spectrometry text. The various types of MS/MS experiments are presented with close attention to practical considerations on how to obtain and interpret data. Here even the expert sometimes needs guidance since there are often differing methods of obtaining the same type of information. The authors also take one through the fundamentals of the ionic collision processes which underlie 2D mass spectrometry. This material is presented at a level which is commensurate with its importance and with great clarity. The book is also strong in its coverage and literature citations of the applications of MS/MS to a wide range of problems. Examples of applications of MS/MS to natural products are found in a section which discusses alkaloids, xanthenes, flavanoids, and mycotoxins, all of which have been identified and quantified in the crude plant tissue as well as in extracts of various types. This information has value in chemotaxonomy, biosynthetic studies, validation of structure and of sample purity, and in studies of ion chemistry. Readers of this journal may also find the applications section covering food chemicals, forensics, pharmaceutical applications, and biological compounds of special interest.

The publisher and authors have produced a text which should see increasing use as the technique of MS/MS continues to grow. The instrumentation and fundamentals sections of the book are likely to be of particular value. Natural products chemists looking for additional spectroscopic capabilities will want this book within reach.

R. GRAHAM COOKS, *Purdue University*

The Logic of Chemical Synthesis. E.J. COREY and XUE-MIN CHENG. John Wiley and Sons, 603 Third Avenue, New York, NY 10158. 1989. xii + 436 pp. 18.5 × 26 cm. \$29.95. ISBN 0-471-50979-5.

"If there is any key to success in planning a synthesis, it is to work the problem backwards." This venerable axiom known to all students of organic synthesis came under close systematic scrutiny by Professor Corey and his associates in the mid-1960s as part of an ongoing effort to develop computer programs for chemical synthesis. That goal was reached, and en route useful procedures for perceiving and analyzing problems in synthesis were formulated. In *The Logic of Chemical Synthesis* Professor Corey and his coauthor, Xue-Min Cheng, detail a systematic approach to planning complex syntheses using concepts developed in the Corey laboratory over the past 20 years. Although virtually all of the examples derive from compounds of nature, the strategic principles are generally applicable to any carbon-based structure. The book is divided into three parts: "General Approaches to the Analysis of Complex Synthetic Problems" (98 pp.), "Specific Pathways for the Construction of Complex Molecules" (240 pp.), and "Guide to the Original Literature of Multistep Synthesis" (68 pp.).

Part One begins with a brief historical overview of natural product synthesis followed by definitions and examples of concepts central to systematic synthetic planning. Briefly stated, retrosynthetic analysis entails successive simplifications of a target structure along various pathways leading eventually to a commercially available starting material. Each simplification is achieved through application of a "transform," the retrosynthetic equivalent of a synthetic "reaction." The selection of transforms is guided by strategies which simplify the synthetic problem. The choice of strategies is governed by structural features such as molecular size, topology, functional group content, stereocenter content, chemical reactivity, and kinetic stability. Most of Part One is devoted to detailed discussion of general strategies designed to "speed the discovery of fruitful synthetic pathways." Major topics include Transform-Based Strategies, Structure-Based and Topological Strategies, Stereochemical Strategies, Functional Group-Based and Other Strategies, and Concurrent Use of Several Strategies. Numerous documented examples are included to illustrate the applicability of the approach.

Part Two ("synthesis in action"), through detailed flow-chart analysis, summarizes multistep syntheses of some one hundred natural products carried out over the past thirty years by Professor Corey and his co-workers. These are organized according to structural types: Macrocyclic Structures, Heterocyclic Structures, Sesquiterpenoids, Polycyclic Isoprenoids, Prostanoids, Leukotrienes and Other Bioactive Polyenes; each is briefly annotated with points of special interest. Besides illustrating the concepts delineated in the first part of the book, Part Two offers a rich storehouse of synthetically significant transformations in attractively displayed and readily visualized format. Where appropriate, information on reaction stereoselectivity and optical rotation of nonracemic intermediates is also noted.

The third and final part of this work ("Guide to the Original Literature of Multistep Synthesis") is a compilation of natural products arranged according to structural type (acyclic, monocyclic, fused bicyclic and tricyclic, bridged bicyclic, etc.) for which one or more total synthesis has been recorded. Each structure is labeled with an identifying name followed by an abbreviated literature reference to reported syntheses arranged in chronological order. Only the last name of the principal author is given in the abbreviated reference. Within each general type the structures are arranged by increasing complexity. This collection does not list every natural product that has been synthesized, nor does it include references to Professor Corey's contributions. Nonetheless, with nearly 600 representatives, it covers virtually all of the important targets of the past thirty years or so. Thus it serves to provide an impressive measure of the state of the art, and it identifies the major players in the field.

The Logic of Chemical Synthesis can be appreciated at many different levels. To the academic or industrial chemist whose primary concern is the design of synthetic pathways it offers new insights and strategies for planning. On a less sophisticated level it contains a wealth of explicit chemical transformations of potentially general applicability. Finally, it documents synthetic routes to hundreds of natural products and provides a good historical perspective of progress in the field. Furthermore, it is well suited to information retrieval through focused browsing. The clean ChemDraw graphics are a pleasure to behold, and they greatly enhance comprehension of the complex subject matter. Clearly, substantial thought was invested in the preparation and placement of structural formulas. Furthermore, the entire work appears to be free of error. Priced at \$29.95 the volume is well within reach of students and professionals alike, to whom it is highly recommended.

JAMES A. MARSHALL, *University of South Carolina*

Identification of Essential Oils by Ion Trap Mass Spectroscopy. R.P. ADAMS. Academic Press, 1250 Sixth Avenue, San Diego, CA 92101. 1989. viii + 302 pp. 15.5 × 23.5 cm. \$39.95. ISBN 0-12-094230-2.

This book is a "How to" reference for the identification of compounds in essential oils using gas chromatography/ion trap mass spectroscopy. In Part A there are 16 pages of text briefly discussing ion trap and quadrupole mass spectroscopy, spectral variation as influenced by "space charging" and tuning of the ion trap, the role of retention times in library searches for compound identification, and the instrumental operating conditions used to generate the mass spectra. Although brief, there is sufficient information to allow a novice capillary gas chromatographer to set up and operate the gc/ion trap ms system described.

The remaining portion of the book, Part B, is divided into five appendices. The largest of these (Appendix 3) shows the spectra of 502 compounds listed alphabetically. The majority of the compounds are mono- and sesquiterpenes, with a few diterpenes; the remainder are phenolics and aliphatic hydrocarbons, esters, and alcohols. With each spectrum is the structure, common name, CAS name and registry number, molecular formula, formula weight, retention time (DB-5 column), and synonyms for the common name. All information is presented clearly and is easy to access. In other appendices the compounds are listed alphabetically, chronologically by retention time, and by CAS registry numbers. There is also a cross index to the common names. For quick reference it would have been helpful to have included appendices listing the compounds by chemical classes, base peak m/z , and molecular formula. Typographic errors and omissions appear to be minimal.

This text is not essential for the library of every natural product chemist, but it should be included in the libraries of institutions conducting natural product research. It does contain some very useful and easily accessible information for compounds commonly found in plants and would make a good reference for those individuals studying terpenes. Researchers currently using or planning to use ion trap ms would want a copy of this book at their disposal.

RICK G. KELSEY, *USDA Forest Service*

Biopolymers: First Naples Workshop in Bioactive Peptides. Edited by E. BENDETTI, C. PEDONE, T. TANCREDI, P. TEMUSSI, and M. GOODMAN. John Wiley and Sons, 605 Third Avenue, New York, NY 10158. 1989. ii + 530 pp. 16.5 × 25.5 cm. \$50.00. ISBN 0471-50943-4.

Researchers in the field of bioactive peptides are not short of international symposia to attend, and books emanating from these symposia are published with due efficiency, appearing within the calendar year or so of the symposia taking place. Thus the current publication has to compete with similar reports from the European (West and East), American, and Japanese Peptide Symposia. In such a specialized field it is inevitable that there will be overlap of subject matter and personnel presenting work at the various confer-

ences. It is also to be expected that much of the work will also appear in learned journals in due course as full papers carrying detailed experimental data.

This publication from the 1st Naples Workshop on Bioactive Peptides held in May 1988, entitled "Conformational Analysis of Peptides: Relationships and Interactions," has certainly a different "feel" and style from the other publications referred to above in that it has been published as issue no. 1 of volume 28 (1989) of *Biopolymers*. The papers (43 in total) on average occupy about 10 pages each of clear typescript, giving evidence that the papers have been carefully examined and edited in the usual manner of the *Biopolymers* journal. The length of the papers has allowed a good balance between background work, discussion, and tabulated data.

The thrust and emphasis in the papers is the application of modern and advanced technology in X-ray diffraction, high-field nmr, and cd spectroscopy to rationalizing the three-dimensional active structures of a number of bioactive peptides and their analogues. The authors of the papers are leaders in their respective research fields, and therefore the publication is very much a "state of the art" report on what can be achieved by modern physical methods. Some of the papers also place in context the influence of structural modifications in the peptide framework on the conformation of peptides, and very many of the contributions are important in the structure-activity-relationship context.

The papers that do include some synthetic work within them also carry detailed experimental data, while the ones emphasizing the application of physical methods carry a great deal of data in clear tabulated form or as reproduced spectra. The standard of presentation is indeed high, and the publishers are to be complimented for this high standard achieved so soon after the symposium. Subscribers to *Biopolymers* who are also interested in the bioactive peptide field will find excellent value in this issue and will obviously benefit at the end of the year from a detailed index to the papers. The price tag of the individual issue is also a very good investment, since the content pages within the issue will lead the investor into an attractive set of papers, including six color plates of computer graphics.

JOHN S. DAVIES, *University College of Swansea, Wales*

Glutathione—Chemical, Biochemical, and Medical Aspects, Part B. Edited by D.O. DOLPHIN, R. POULSON, and O. AVRAMOVIC. Wiley-Interscience, 605 Third Avenue, New York, NY 10158. 1989. xvi + 848 pp. 16.5 × 24 cm. \$125.00. ISBN 0471-60184-5.

This volume is Part B of the third volume of the series *Coenzymes and Cofactors*. Part A contained chapters related primarily to the history, chemistry, biochemistry, physical properties, and metabolism of glutathione. Part B covers the role of glutathione in various physiological, pharmacological, toxicological, and nutritional processes. This book consists of 19 chapters, the topics of which provide a broad range of information related to functions of glutathione.

This book can be highly recommended as a reference source for researchers investigating functions of glutathione. One of its strengths is the wide range of topics that is covered. In most chapters, the role of glutathione in the processes under discussion is well defined. In a few cases (e.g., melanin pigmentation and thyroid hormone metabolism), less information is available and thus the role of glutathione is currently less definitive.

As would be expected in a compilation of chapters by several authors on a common topic, some overlap exists among chapters regarding basic aspects of glutathione function. However, this overlap is tolerable because it allows each of the chapters to be read independently. The editors provided limited cross-referencing of common topics among chapters in this book and between this book and Part A. A greater unity would have resulted if more cross-referencing had been provided.

Most chapters in this book contain a lengthy bibliography, and the subject index to the book also is comprehensive. Another useful feature, especially in a book this large, is the index of authors whose work is referenced.

The editors of this book have assembled a notable collection of chapters into a book that clearly meets their stated objectives. This volume, together with Part A, provides a comprehensive source for researchers working in the various areas of glutathione structure and function.

DAVID R. BEVAN, *Virginia Polytechnic Institute and State University*

Activation and Functionalization of Alkanes. Edited by CRAIG L. HILL. John Wiley and Sons, 605 Third Avenue, New York, NY 10158. 1989. xi + 372 pp. 18 × 26 cm. \$49.95.

Although alkanes constitute a major chemical resource, their inherent unreactivity traditionally limits the number of methods for their conversion into other chemical classes. In recent years, however, this problem has attracted the interest of chemists from a variety of subdisciplines. Through a series of essays by authors who are recognized experts in the field, this book provides an up-to-date review of the critical literature involving the modification of saturated hydrocarbons.

The book begins with an introductory chapter describing in general terms various homogeneous systems (organometallic, biological, etc.). The second chapter reviews the electrophilic chemistry of alkanes, particularly in superacid media. Several chapters dealing with organometallic-based systems follow. Included in these are metal phosphine complexes of Ir and Pt, cyclopentadienyl complexes of Ir and Rh, and high-valent lanthanide and actinide systems. Several chapters review biological and "biologically-inspired" oxidations (cytochrome P-450 and related systems as well as a variety of model systems). The book concludes with a chapter detailing studies from duPont's Central Research Department, treating, in addition to many of the aforementioned topics, classical free radical chain chemistry and metal/zeolite systems.

Overall, the subject is explored from the viewpoint of various chemical subdisciplines and blends together in a coherent, unified framework. Each chapter focuses on the phenomenological aspects of the chemistry, as well as details of reaction mechanism, energetics, and potential applications. The chapters describing the P-450 monooxygenases are an especially timely review of this important and rapidly evolving area and might be of particular interest to readers of this Journal. The modest cost of the book makes it a desirable and affordable addition to anyone's personal library.

JAMES M. TANKO, *Virginia Polytechnic Institute and State University*

Chemical Analysis of Polycyclic Aromatic Compounds. Edited by TUAN VO-DINH. Wiley-Interscience, 605 Third Avenue, New York, NY 10158. 1989. xxiv + 494 pp. 15.5 × 23.5 cm. \$85.00. ISBN 0-471-62889-1.

Polycyclic aromatic hydrocarbons (PAHs or polyarenes) and related molecules are widespread environmental pollutants. Because some polyarenes are relatively potent carcinogens, this class of molecules represents a potential major health hazard to human populations. Recent research has elucidated the structures of the active polyarene metabolites. Important advances have also been made in the development of methods for the analysis of the complex mixtures of PAH compounds that occur in urban atmospheres, smoke stack effluents, cigarette smoke, and elsewhere in the environment.

This book surveys the wide range of methods currently available for the analysis of polyarenes, heteropolyarenes, and their substituted derivatives in the complex mixtures found in environmental samples. These include both traditional methodologies, such as gas and liquid chromatography techniques, uv and fluorescence spectrometry, and mass spectrometry, as well as innovative new techniques such as micelle-mediated analysis, resonance-enhanced multiphoton ionization mass spectrometry, and surface-enhanced Raman spectrometry. Also included is a chapter on immunological methods for the detection and quantitation of exposure of humans to polyarenes. While this is a multi-authored book, it is well edited, and the contributions of individual authors do not seriously overlap. Individual chapters are written by well qualified experts who provide for each topic generally clear introductions that meet the needs of nonspecialists.

One might anticipate that a book with this title might contain one or more chapters on nmr methods for the analysis of PAH structures. ¹H- and ¹³C-nmr techniques are among the principal methods employed by organic chemists for PAH molecular structural assignment. Nmr analysis has also played an important role in the identification of biologically active PAH metabolites and in the determination of the structures of their DNA adducts. However, the reader who is seeking information on these topics will be disappointed, because nmr methods are not discussed. Other notable omissions include electric linear dichroism and X-ray crystallography. The rationale for their omission is their unsuitability for routine analysis of environmental samples. While these exclusions are compatible with the objective of the book, they are mentioned to alert potential readers who might expect to find these topics included.

A minor point is the use of the acronym PACs throughout the book to stand for polycyclic aromatic compounds. Aside from its unintended political connotation, it is an unfortunate choice, largely because it is unnecessary.

In summary, this monograph serves the need of bringing together in a single volume critical reviews of a wide range of methods for the analysis of PAH compounds in the environment. Currently these methods are scattered throughout the literature. This volume provides a valuable up-to-date source of references on these topics and can be recommended for purchase by libraries and by individuals interested in environmental analysis.

RONALD G. HARVEY, *University of Chicago*

The Biosynthesis of Secondary Metabolites. 2nd ed. RICHARD B. HERBERT. Chapman and Hall, 29 West 35th Street, New York, NY 10001. 1989. xiii + 231 pp. 15.5 × 23.5 cm. \$69.95 (cloth). ISBN 0412-27540-6. \$29.50 (paper). ISBN 0412-27720-4.

The first edition of this monograph was published in 1981, and it is now out of print, 4000 copies having been sold. I used this first edition for several years as a text in a course which I teach each year, on the biosynthesis of natural products, for graduate and undergraduate students. The new edition is an excellent review of the present state of knowledge on the origin of secondary metabolites produced by plants, animals, and microorganisms. The author is a former co-worker of Alan Battersby and has made important contributions on the origin of isocyanides and various classes of alkaloids. The book indicates that he is thoroughly familiar with the literature on biosynthesis.

The origin of so-called "primary metabolites," i.e., compounds which are found in all species (Krebs cycle intermediates, porphyrins, protein α -amino acids), is not discussed. However, key references are given to review on the origin of many of these natural products.

In Chapter 1 (Introduction), the origins of some natural products which are found in many species, for example, the fatty acids, are described. In this chapter biochemical reactions which occur in the formation of many diverse natural products (oxidative coupling, methylation, hydroxylation) are outlined. The methods for studying the stereochemistry of biochemical reactions are also found in this chapter.

Chapter 2 (Techniques for Biosynthesis) is an informative one on the methods which have been used for studying the origin of natural products, using radioactive and stable isotopes and cell-free (enzymes) system. Both the beginner and more advanced investigator will find useful material here. For example, it is pointed out that the signals obtained in ^2H -nmr spectra can be made sharper by raising the temperature of the sample above room temperature.

Polyketides are described in Chapter 3 arranged according to the number of acetate or propionate units involved in the formation of the ultimate natural product. I learned for the first time that C_3 units, when found in fungal polyketides, are elaborated from acetate plus a methyl group derived from methionine. In actinomycetes these C_3 units are derived from propionate.

Chapter 4 describes terpenes and steroids, with a detailed account of the formation of cholesterol from squalene (correctly depicted with the all-trans stereochemistry of the internal double bonds).

Chapter 5, entitled "The Shikimic Acid Pathway," starts with the biosynthesis of shikimic acid and chorismic acid followed by the various aromatic compounds derived from these acids, sometimes plus acetate or terpene derived pieces.

Chapter 6 (Alkaloids) is the longest one (55 pages) in the book, reflecting the diverse origin of this class of natural products. I would also claim that most of the compounds discussed in Chapter 7 (Microbial Metabolites Containing Nitrogen) are alkaloids (gliotoxin, lysergic acid derivatives, phenazines). Penicillin, cephalosporin, and other β -lactams are also discussed in Chapter 7.

All the chapters have ample references (ca. 770 with several to work published in 1987) which often direct the reader to the origin of natural products which have not been described in detail. Only a few minor errors were detected (p. 71, methyl groups missing from C-21 of the steroids; p. 123, anabasine from *Nicotiana glauca* is racemic; p. 153, (+)-chelidonine is the mirror image of the depicted structure), and they do not detract from this valuable book, which I strongly recommend to all interested in the origin of natural products.

EDWARD LEETE, *University of Minnesota*