

## BOOK REVIEWS

*Natural Products: Their Chemical and Biological Significance.* J. MANN, R.S. DAVIDSON, J.B. HOBBS, D.V. BANTHORPE, and J.B. HARBORNE. John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158. 1994. xii+455 pp. 15.5×23 cm. \$44.95. ISBN 0-470-20002-2.

Any book on natural products that is only 455 pages long must of necessity neglect certain areas of this vast field of chemistry. In a book which includes discussions of both primary and secondary metabolites, one can imagine that the compromises are likely to be substantial. As a counterpoint, one looks at the intended audience, and this volume is indeed "written for final year undergraduate and postgraduate students of organic and medicinal chemistry, biochemistry, pharmacy, and pharmacology." In these terms, the concessions that have been made for this new book on natural products are, with very few exceptions, successful.

There are a number of other general "introductory" books on natural products chemistry available on the market, including, the books of Ikan (1991) which focusses on isolation techniques, the Torsell (1983) and Mann (1987) books which focus on biosynthesis, and the Thompson (1985) volume which is a general, multi-author text. There is none which attempts to succinctly cover the territory of the present book and thus the volume undoubtedly fills a very valuable market niche, for which there is clearly a present need.

The authors of the volume are individually well-known for their contributions to natural products chemistry and they have together prepared a series of seven chapters which reflect both their interest and expertise: carbohydrates (Mann, 61 pages), nucleosides, nucleotides, and polynucleotides (Hobbs, 61 pages), amino acids and peptides (Davidson and Hobbs, 107 pages), fatty acids and their derivatives (Hobbs, 49 pages), terpenoids (Banthorpe, 71 pages), phenolics (Harborne, 27 pages), and alkaloids (Mann, 58 pages). Thus, over 60% of the book is devoted to the products of primary metabolism. Depending on your individual viewpoint, you may feel that this is too little emphasis on secondary metabolites, which are frequently what many chemists (rather than biochemists) regard as "natural products." From an ecumenical perspective, however, the breadth of coverage is indeed impressive.

The text and figures are clearly presented and quite error free, and the necessarily limited reference lists up-to-date. A typical chapter includes a brief history of the compound group, presents some aspects of its biological importance, the breadth of occurrence, some identification features, and outlines the biosynthesis and synthetic approaches to selected key compounds. This works quite well overall, although a discrete section on biological significance in each chapter would have brought focus to particular groups of compounds, as the title implies was the original intent.

In addition, a more consistent approach as to how to cite general and specific works in the respective areas between the different chapters would have helped, as would have the inclusion at the end of the introduction section to the book of a list of sources in natural products chemistry, i.e., the books, journals, databases, etc., which are such a crucial aspect of working in the area. Some other minor peeves include the lack of a discussion of taxol, and the absence of discussions of polyketide biosynthesis and of the terpenoid alkaloids. However, on balance, this is a very worthwhile book as a teaching tool for the target audience of advanced students, and should whet the appetite of the student for more specialized works and the primary literature of natural products. It is recommended for purchase as a general introductory text for undergraduate and some graduate students who need a background in the elements of natural products chemistry.

GEOFFREY A. CORDELL, *University of Illinois at Chicago*

*Bioprocess Production of Flavor, Fragrance, and Color Ingredients.* ALAN GABELMAN, Editor. John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158. 1994. xiii+361 pp. 16×23.5 cm. \$64.95. ISBN 0-4710-3821-0.

Bioprocesses and downstream processing are becoming increasingly important to the application of biotechnology in the production of pharmaceuticals, fine chemicals, and commodity chemicals, as well as many other products, including flavors, essences, pigments, and food products. In the food industry, a wide variety of technologies are available that include biotransformation, as well as more traditional fermentation processes. The application of genetically engineered organisms to the production of flavor, fragrances, and pigments will of course raise important regulatory issues as well as an analysis of the definition of "natural." Gabelman's book as sought to provide the latest information on the subject of bioprocess production of flavor, fragrance, and color ingredients by "thorough coverage of a wide range of technical and regulatory topics that should be useful to anyone associated with the food, flavor, or fragrance industry."

The book is comprised of nine chapters. The first two chapters provide a broad overview of bioprocess

production of flavors, fragrances, and colors and discuss regulatory issues in biotechnology, as well as the definition of "natural." There is some overlap in the chapters, and the discussion of the regulatory issues concerning biotechnology may seem simplistic to some readers of the book.

Chapters 3 and 4 present authoritative overviews of the production of aliphatic, aromatic, and lactone compounds, and fermentation production of pyrazines and terpenoids for flavors and fragrances, respectively. Each chapter provides a review of limited scope of the literature including references up to 1990, with the majority from the late 1980s. The chapters are well written and can be recommended to both specialists and non-specialists wishing to become familiar with the respective topics. Chapter 3 details some bioprocesses and production strategies, and considers precursor/product relations. However, Figures 3.11 and 3.13 add very little to the content. Chapter 4 is divided into two sections, with the first focussing on the production of pyrazines by microorganisms in foods and broth, and the second looking at aroma and flavor terpenoid production. Although many examples are provided, mainly from a biotransformation point of view, one should not expect to find detailed metabolic analyses.

Chapter 5 presents a discussion of "savory flavors," compounds or mixture of materials that either enhance or improve the palatability of foods. This chapter provides a basic survey of the production of hydrolyzed vegetable proteins, yeast-derived flavors, and flavor enhancers. The chapter contains several flow charts and figures that add little to the overall presentation of the chapter.

Chapter 6 details the production of dairy flavors, including cheese flavors, and enzymatic and fermentation production of methyl ketones, lactones, propionic, and acetic acids, and other relevant compounds, including a brief survey of pyrazines important to cheese flavor.

Chapters 7 and 8 provide a look at the production of food colorants by fermentation and the plant tissue culture production of flavors, essences, and pigments, respectively. In Chapter 7 the use of natural colors in foods is presented with the main classes of colorants highlighted concerning their use and production from natural sources. Chapter 8 is essentially devoted to the plant cell culture experience which is that these systems need to be vastly improved before they become viable alternatives to methods currently used. Examples are provided for proof of concept, but much more work is necessary before plant cell culture technology is sufficiently well advanced to allow for the production of flavors, essences, and pigments on a commercially viable scale.

Chapter 9 is a distillation of the most basic genetic engineering techniques and biotransformation applications that span immobilized enzymes, acetone-butanol fermentation, ethanol production, and non-aqueous enzymatic catalysis. The chapter seems to have been written as an introduction to biotechnology intended for first year university students. This chapter appears out of place in this book, in terms of content as well as depth of presentation.

Readers of this book will find that some of the chapters strike a better balance in content than others. I would recommend the book to those interested in the field of bioprocess flavor, fragrance, and color production who require a quick primer on the various topics.

FRANK DICOSMO, *University of Toronto*

*Infrared Characteristic Group Frequencies: Tables and Charts.* (Second Edition). GEORGE SOCRATES. John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158. 1994. xiv+250 pp. 26×22.5 cm. \$74.95. ISBN 0-471-94230-8.

This book provides a comprehensive resource for the interpretation of infrared spectra by presenting a large mass of data culled from literature sources in an organized and useful manner. The author begins with a brief, general introduction to interpretation of infrared spectra which includes a discussion of the origin of spurious bands, covering bands due to effects such as interference patterns as well as those due to solvents. A chart of typical solvent bands is provided, followed by a table that lists common spurious bands by position. This is a valuable tool, particularly to anyone who has had a student unable to figure out a band at ca.  $2350\text{ cm}^{-1}$  (due to  $\text{CO}_2$ ), or who needs to deal with expected or unexpected contaminants in a sample. This section is followed by several extensive correlation charts showing the expected ranges of infrared frequencies for a large number of different functional groups in several different ways. Included in this set is a negative correlation chart indicating the positions where the absence of a band means the absence of a particular functional group. The remaining chapters are devoted to in-depth discussions of individual functional groups. Each chapter discusses particular types or related series of functional groups, e.g., Chapter 3 is devoted to alkenes, oximes, imines, amidines, and azo compounds, while Chapter 10 focuses on carbonyls, and each chapter is arranged with a discussion of the bands expected for each group, followed by charts and tables detailing band positions and intensities annotated with comments to amplify the usefulness of the data. These charts and tables are very comprehensive. For example, there are five tables devoted to esters, chloroformates, and carbonates alone, with lactones handled in a sixth table. Solvent and other effects on the individual bands are also noted. In addition to the usual functional groups, there are

chapters devoted to infrared bands of sulfur and selenium compounds, organic phosphorus compounds, organic silicon compounds, boron compounds, and, of particular interest to inorganic chemists, the near infrared region, and inorganic compounds and coordination complexes. The book is arranged in a manner which makes it easy to use. The usual approach would be to use the charts in Chapter 1 to obtain an overview of the functional groups present in a compound, then proceed to the individual chapters for more information. The vast amount of detailed data may lead inexperienced users to over-interpret spectra, and for many chemists, this book will contain too much information in the detailed chapters. However, the general correlation charts found in Chapter 1 should be very useful for anyone involved in the interpretation of infrared spectra, particularly due to the comprehensive nature of these charts. This book is clearly a valuable reference tool, particularly for those involved in the characterization of new compounds, reaction products, or mixtures for quality control.

ALBERT T. SNEDEN, *Virginia Commonwealth University*

*Tactics of Organic Synthesis*. TSE-LOK HO. John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158. 1994. xi + 450 pp. 15.5 × 23.5 cm. \$59.95. ISBN 0-471-59896-8.

This book on the tactics used to plan organic syntheses is designed as a supplemental text for a graduate synthesis course and will also be of interest to practitioners in the field. The first chapter addresses the advantages of convergent syntheses and extensively covers the use of reiterative processes as a synthetic tactic. Protecting groups, umpolung, and tandem reactions are briefly surveyed in the next three chapters. Three long chapters follow, which present numerous examples of the use of cyclic systems to control the structure and stereochemistry of the product, the advantages of intramolecularity for facilitating reactions and controlling stereo- and regiochemistry, the use of neighboring group participation, template effects, and the use of chelation for control of stereo- and regiochemistry. Symmetry considerations, including the synthesis of unsymmetrical molecules from symmetrical precursors, are covered in the eighth chapter. The final chapter is a catch-all, covering equilibration and isomerization, allosteric control, biomimetic syntheses and divergency. There are approximately 1500 references indicating the vast number of organic syntheses presented. A brief eight-page index listing mainly the synthetic targets with only a few structural types and reactions make it hard to locate specific topics.

The format consists of a series of examples illustrating the specific tactic. Each example consists of a brief paragraph followed by a scheme or equation illustrating the synthetic sequence. The chemical schemes are carefully prepared to illustrate the essence of the tactic. The book contains a wealth of interesting information in this easily accessible graphic form. The examples are well-chosen and current, mostly from the last decade, with many 1993 references. However, within each section, the examples are simply strung together without connection. There is little analysis at the beginning or end of the chapters, making it hard for the reader to get an overview of the synthetic tactic or to organize the vast quantity of information presented.

The strength of this book is the extensive compilation of clearly presented examples covering reiterative processes, control by cyclic arrays, intramolecularity, neighboring group participation, and use of template and chelation effects. This valuable material is not available elsewhere in this conceptual framework. This volume will be a valuable reference for practicing synthetic chemists.

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*Organic Reactions, Volume 45*. LEO A. PAQUETTE, Editor in Chief. John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158. 1994. x + 680 pp. \$99.95. ISBN 0-471-031161-5.

This volume of "Organic Reactions" continues the long series tradition of definitive reviews in the characteristic format, with coverage of mechanism and stereochemistry, scope and limitations, sample experimental procedures, and an extensive tabular survey listing all the examples that could be located. This volume contains two chapters, "The Nazarov Cyclization" by Karl L. Habermas, Scott E. Denmark and Todd K. Jones (158 pages, 196 references), and "Ketene Cycloadditions" by John Hyatt and Peter W. Raynolds (488 pages, 836 references).

The chapter on Nazarov cyclizations discusses the formation of cyclopentenones from divinyl and allyl vinyl ketones, cyclization of silylated or stannylated divinyl ketones, *in situ* generation and cyclization of divinyl ketones, alkyne-based precursors of divinyl ketones, and coupling reactions to form and cyclize divinyl ketones. The mechanism, scope and stereochemistry are clearly covered in 30 pages of text. The structure of the precursors forms the organizational basis of the 128-page tabular survey. The literature is covered through 1991.

The massive chapter on the cycloadditions of ketenes with unsaturated compounds covers all reactions that might involve a cycloaddition, without concern for whether bond formation is concerted or stepwise. The numerous cycloadditions of ketenes to imines forming  $\beta$ -lactams will be covered separately. Literature coverage only through the end of 1988 is understandable due to the scope of material to be covered, but makes the review somewhat dated. The well-known [2+2] cycloadditions with alkenes, allenes, alkynes, dienes, and functionalized derivatives, such as enol ethers and enamines, to form cyclobutanones and cyclobutenones, are covered first. The intramolecular variants of these cycloadditions are also considered. [2+2] Cycloadditions with carbonyl and thiocarbonyl compounds, isocyanates, carbodiimides, nitroso and azo compounds are also detailed. A wide variety of mechanistically diverse [4+2] cycloadditions are then presented. These include examples in which either the carbonyl or alkenyl double bond of the ketene reacts as a dienophile with a diene or heterodiene and examples in which an acyl or vinyl ketene reacts as a diene with alkenes, alkynes, carbonyl compounds, nitriles, imines, or heterocumulenes.

This volume, providing definitive reviews on Nazarov cyclizations and ketene cycloadditions, will be of interest to any organic chemist working in these areas.

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