Book Reviews

Phytochemistry in the Genomics and Post-Genomics Eras. Recent Advances in Phytochemistry. Vol. 36. Edited by John T. Romeo (University of South Florida) and Richard A. Dixon (Samuel Roberts Noble Foundation). Pergamon/Elsevier Science Ltd., Oxford, UK. 2002. x + 258 pp. 6 × 9 in. $165.00. ISBN 0-08-044116-5.

This volume presents a selection of papers from the symposium of the same title held at the 2001 meeting of the Phytochemical Society of North America. It represents some of the first fruits of attempts to apply genomics techniques to the field of phytochemistry. A baker's dozen (13) of authors report on advances they have made in the field. As might be expected, some of the first problems to yield results are in the domain of biosynthesis. Lange et al. report on their functional genomic strategies for essential oil biosynthesis, using gene expression in isolated peppermint glandular trichome cells to prepare a cDNA library containing biosynthetic enzymes for mint monoterpenes. Similarly, the abundant cytochrome P-450 enzymes of plants that appear to catalyze many biosynthetic oxidations have been clustered from *Arabidopsis* by Feldmann et al., and specific steps in brassinosteroid biosynthesis are linked to the individual enzymes. Halkier et al. contribute a chapter applying similar techniques to glucosinolate biosynthesis.

A second theme in the chapters is the application of metabolite profiling by LC-MS as a technique in plant functional genomics. This is more familiar territory for phytochemists, and it is only the comprehensive profiling strategy that moves beyond basic analytical chemistry. A number of other themes centered on other types of compounds (e.g., saponins) or species (in the genus *Medicago*) show that this is a fertile field for both basic and applied research. Clearly genomics is beginning to have an impact beyond the more heavily funded human medical genomics. The frontiers of science are rapidly expanding in the plant genomics dimension, limited only by funding and the willingness of investigators to enter the field.

For plant scientists, especially those interested in biosynthesis, this would be a useful book to summarize the state of the art. For those not familiar with genomic sciences, it may be tough reading; however, the editors have done a good job of producing an up-to-date and readable summary of the field.

John A. Beutler

National Cancer Institute
Frederick, Maryland 21702

NP030702C

10.1021/np030702c

Alkaloids. Nature's Curse or Blessing. By Manfred Hesse. Verlag Helvetica Chimica Acta, Zürich, Switzerland, and Wiley-VCH Weinheim, Germany. 2002. xii + 413 pp. 16 × 18 cm. $135. ISBN 3-906390-24-1.

The explanation for the rubrick "Nature's Curse or Blessing" was not apparent, even after a frustrating search, but a similar rubrick could be applied to Hesse's book, namely, "Fascinating and Frustrating". This book represents a truly scholarly approach to the realm of alkaloids, but all too often, when one is fascinated by an interesting statement or speculation, there is no reference or other means to pursue or verify; hence, frustration. There are far too many misleading or nonreferenced statements to attempt to enumerate them all.

The first chapter delves into the history behind the term "alkaloid" and then provides the author's definition, namely, "nitrogen-containing organic substances of natural origin with a greater or lesser degree of basic character". Amides (paclitaxel) are included (certainly an example of a lesser degree of basic character), as are amino acid decarboxylation products, such as serotonin, which serves as a widely distributed neurotransmitter. A logical extension would be to include norepinephrine, histamine, and dopamine, compounds that few if any chemists would call "alkaloids". Surprisingly, mescaline and mescal bottons are not treated at all.

The second chapter provides a classification of alkaloids, based on heterocyclic ring systems, with comments on occurrence in the plant kingdom. For the nonbotanist a chart depicting orders and families of plants would have been useful. Comments, often lengthy, on the biological activity of certain alkaloids are introduced in both the text and occasionally in a footnote. Readers are advised to look at each reference as they proceed through the book, in order not to miss some salient point. The chapter does present a useful attempt at structural classification of a wide range of plant alkaloids, but animal alkaloids are relegated for the most part to a brief section in Chapter 9. There is a misleading statement (p 32) that the order "Hymenoptera (ants and wasps) are known for ....alkaloids". Only the family Formicidae (ants) are known for such alkaloids. Nor is how poisons of fire ants can "cause grain harvest failures" referenced. In some cases, a figure, such as Figure 2.7, occurs several pages before the alkaloid (but not the plant) is mentioned in the text. That figure is cited in the text as a source of glaucine from *Carydalis* and *Dicentra*, not berberine from *Mahonia*, as stated in its legend.

The third chapter presents in detail two examples of structure elucidation; the case of coniine is interesting from a historical context, and the case of villastonine from a standpoint of combined chemical and spectroscopic solution of a very complex structure, before the advent of current powerful NMR spectral techniques.

The fourth and fifth chapters discuss possible artifacts and chiral properties. The sixth chapter presents the synthesis of coniine and several more complex alkaloids. The seventh chapter on chemotaxomy opts to present a detailed analysis of the occurrence of indole alkaloids with a monoterpene component in three plant families. Only a limited attempt to present the broader picture of alkaloids as possible taxonomic indicators is provided. In the eighth chapter, both established and speculative biosynthetic routes are presented for a variety of alkaloids.

The ninth chapter is titled "Biological Significance of Alkaloids" and proposes a variety of possible reasons, some quite speculative, of how plants might have benefited from evolving such compounds. Unfortunately, the section on "Poisons from Amphibians" is replete with errors and

omissions. The alkaloids and bioactive peptides, biogenic amines, and bufadienolides are stored in granular "poison glands" not in the mucous-producing glands. There were several publications prior to the original publication of this book in 2000 indicating that dendrobatid and mantellid frogs avidly take up alkaloids fed to them unchanged for storage in skin. Such results have led to the proposal that most alkaloids in frog skin come from dietary sources. Interested readers that are unfamiliar with these publications, which are not referenced, will be misled by the statement that "There are no convincing answers yet". The structure of monomorine (**23**) is incorrect; it is an indolizidine, not a pyrrolizidine. One final error should be mentioned, namely, that the frog shown in Figure 9.10 is not the Ecuadoran *Epipedobates tricolor*, source of the unique nicotine-like alkaloid epibatidine, but instead is Costa Rican *Dendrobates granuliferous*. It is unfortunate that the powerful analgetic epibatidine, whose structure was reported in 1992, is not mentioned, nor are other related alkaloids, such as anatoxin, ferruginine, and darlingine. The eserine-like alkaloids, named pseudophrynamines, from a genus of Australian frogs ought to have been mentioned, as should unique spiropyrrolizidine alkaloids, including nitropolyzonamine from millipedes and oxime analogues from frogs.

The section on "Alkaloids as Medicines" complements frequent brief mentions in the first chapter to medical applications, but will be rather superficial to readers interested in medical applications of alkaloids.

The final two chapters on history and selected active principles make interesting reading, but still there are omissions or frustrations. In Figure 11.21, only the seizure data are plotted and not the drug fatalities, although the left vertical axis is so labeled. In the last chapter one is left wondering why the treatment of historical aspects of alkaloids does not mention the origin of decaffeinated coffee and the origin of adding caffeine to cola drinks. Many will quarrel with the statement that "nicotine does not lead people into actual physical addiction". The statement that *R*- and *S*-nicotine have the same effect is interesting (see p 200 also), since centrally the natural *S*-nicotine is manyfold more potent than the *R*-enantiomer.

In toto, despite the many frustrations, errors, and omissions the book makes for fascinating reading and I recommend it as a beautifully done and illustrated coverage of many aspects relative to the alkaloids found as secondary metabolites throughout the plant kingdom. It is a very ambitious undertaking and, in large measure, successful.

John W. Daly

National Institute of Diabetes, Digestive and Kidney Diseases
National Institutes of Health
Bethesda, Maryland 20892

NP030705P

10.1021/np030705p

The Simple Plant Isoquinolines. By Alexander T. Shulgin and Wendy E. Perry. Transform Press, Berkeley, CA. 2002. xxxv + 624 pp. 16 × 23.5 cm. $40.00. ISBN 0-9630096-2-1.

Catalogs of natural products are rare items indeed because of the sheer volume of literature work required. This compilation includes traditional isoquinoline and benzylisoquinoline alkaloids, and the rearranged derivatives of benzylisoquinoline, such as the pavines, the aporphines, the protoberberines, and the morphinans. Plant coverage is limited to the angiosperms.

Organizationally, this volume is comprised of three "parts" and three appendices. Part 1 lists the trivial names of the alkaloids. Part 2, the real body of the book (419 pages), presents the structural formulas of the alkaloids by increasing complexity of substitution, with their plant sources given alphabetically. This requires the development of a new recognition system for the alkaloids which is "based on the location of the substituents and their identity in the nuclear isoquinoline skeleton before it is distorted by a hypothetical "ortho attack". The devised system requires substantial explanation to which the authors devote the next 30 pages. It results in a situation where a particular substituted parent nucleus is considered and then the alternative biosynthetic processes are enacted to yield the various alkaloid structures. Although this can yield traditional alkaloid groups being presented somewhat together, that is frequently not the case; page 154, for example, presents four alkaloids in the three different structure groups. Part 3 of the book is a summary of the botanical names of the plants, listed alphabetically, and the alkaloids that have been isolated from them. The three appendices of the volume are a listing of the families to which the various taxa yielding the alkaloids belong, an analysis of the *Chemical Abstracts* approach to naming certain alkaloids, and the decoding of the journal abbreviations to the full journal names.

In practical use, this volume has some important limitations. If you know the name of an isoquinoline alkaloid and wish to find whether it has been isolated from a particular plant, this volume is an excellent source of that information. Thus it serves effectively at the chemotaxonomic level. If you isolate an alkaloid with a particular molecular ion and wish to know what alkaloids have that mass, or wish to track down the proton or carbon spectral data of a particular alkaloid, this book will not serve. There are no molecular formulas, and therefore no molecular weights, listed for any of the alkaloids, and thus no associated indices. In addition, no access is provided to leading references for spectroscopic or physical data that would have tremendously aided the bench chemist in rapidly identifying an isolate. On the other hand, the quality of the presentation is high, the structures are clear, and the typeface is very readable. This book can be recommended as a very useful reference for chemistry and biology libraries, and also for personal libraries, given the moderate cost, although the limitations indicated above diminish its overall impact.

Geoffrey A. Cordell

College of Pharmacy
University of Illinois at Chicago
Chicago, Illinois 60612

NP0307035

10.1021/np0307035

Basic Atomic and Molecular Spectroscopy. By J. M. Hollis (University of Reading). John Wiley & Sons, Inc., New York, NY, and The Royal Society of Chemistry, UK. 2002. viii + 184 pp. 19 × 245 cm. $34.95. ISBN 0-471-28162-X (paperback).

This is one of the books in a series entitled "Basic Concepts in Chemistry" by various authors. Each volume in this series is confined to a single topic, and they are

intended for undergraduate science courses. Ultimately, this volume covers atomic and molecular rotational and vibrational spectroscopy in detail, focusing mainly on the theory and techniques of infrared (IR), Raman, and ultraviolet (UV). NMR spectroscopy and IR spectroscopy as applied to organic chemistry are not included, appropriately, since these would likely comprise individual volumes of their own.

The chapters vary in length, but are typically between 10 and 20 pages in length. The first two chapters of the book define important basic terms and concepts in spectroscopy, followed by a good, albeit somewhat brief, explanation of the electromagnetic (EM) spectrum. It is during this discussion of the nature of light, and hence of color itself, that the limitations of the simple two-tone color scheme are made clear to the reader. Throughout the book, the text and diagrams are in black and white, with highlights and selected portions in orange. The next five chapters are concerned with the quantum and electronic states of atoms and simple molecules and a very good basic discussion of molecular vibration and rotation phenomena. Chapter 8 is a nice transition into the last third of the book, with an introduction to important features relating to the experimental aspects of spectroscopy, for example, types of EM radiation sources, the Beer−Lambert law, and various inherent limitations of spectroscopic measurement such as line broadening and light scattering. The final three chapters furnish an excellent, straightforward explanation of rotational, vibrational, and electronic spectra of selected simple molecules, with an emphasis on interpretation. Good, clear examples of the various spectra are provided in these chapters.

Several problems are given at the end of each chapter, and answers, with explanations as needed, are included in the back of the book. The scope of the topics covered in the chapters, however, suggests that additional problems would enhance the usefulness of the book as a learning tool.

One of the strengths of the book is its intended focus on the conceptual, interpretive, and visual aspects of the subject, avoiding the tendency toward excessive mathematical detail common in first year undergraduate textbooks. Overall, this volume fulfills its goal of providing a very clear, basic understanding of the subject matter for readers at any college level. It would be particularly useful as part of a broader course in general or physical chemistry at the undergraduate level. Along with the other volumes in this series, this book affords the possibility of a modular approach to learning, and I would highly recommend it, particularly for undergraduate chemistry educators interested in alternatives to the rigid confines of the all-inclusive textbook approach.

Gil Belofsky

Department of Chemistry and Biochemistry
The University of Tulsa
Tulsa, Oklahoma 74104

NP030704X

10.1021/np030704x