# Book Reviews *

**Modern Chromatographic Analysis of Vitamins. 3rd Edition, Revised and Expanded**. Edited by Andre P. De Leenheer, Willy E. Lambert, and Jan F. Van Bocxlaer (University of Ghent, Belgium). Marcel Dekker: New York. 2000. xii + 616 pp. $195.00. ISBN 0-8247-0316-2

This invaluable, recently revised text sets the gold standard for a comprehensive state-of-the art reference book on chromatographic methods of vitamin analysis. The wealth of information found in this book ensures that it will be a staple on the shelves of any researcher involved in vitamin research. The clarity of the writing and excellent organization of the material makes its contents easily understood by the beginning scientist. Yet the immense amount of detail, with over 1450 tables, drawings, and references, will appeal to even the most seasoned investigator.

The highlight of this book is the review of the basic chemistry, biochemistry, and metabolism of each of the vitamins. Although each chapter is organized in a slightly different manner, all the chapters are well constructed and easy to follow. The chapters contain exquisitely detailed diagrams of multiple isomers and biochemical reactions as well as graphic representations of spectral analyses. For example, figures illustrate transcriptional control by vitamin D, reversed-phase HPLC separations of folate, and capillary zone electrophoresis of ascorbic acid. Additionally, literature reviews are presented in both tabular and textual form to create an effective and organized synopsis of historical and present techniques.

Another exciting feature is the background material on extraction procedures, preparation, handling, and storage of samples. References included in this section lead the investigator to original sources with more extensive details. Of particular use to laboratory personnel are the "general considerations" that outline the nuances of working with each particular vitamin. The pros and cons of each method are discussed, including tips for avoiding common pitfalls. Some of the applications are divided into categories, such as clinical, in vitro, foodstuffs, and pharmaceuticals, whereas other sections are organized by biological samples and plasma and red blood cells. A variety of methods are covered, ranging from high-performance liquid chromatography to mass spectrometry to capillary electrophoresis. Most of the chapters end with a section on recent advances and future trends.

A minor weakness of this book is the somewhat inconsistent scope of content among its chapters. For example, the chapter on vitamin D has superb descriptions in the introductory (history, biochemistry, and physiology) and analytical sections (chromatographic methods), as well as applications. It also includes concise tables with over 200 references. The chapter on folate, however, could be enhanced by the addition of clinical relevance to the methods presented. The chapter on thiamin is lacking in recent references, but the authors attribute this to a lack of new research in the area.

In summary, this outstanding book is highly recommended as a reference for those interested in chromatographic analyses of vitamins. The diverse and extensive amount of scientific information, analytical techniques, and applications makes this a valuable resource for the investigative scientist.

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**Physical Methods in Bioinorganic Chemistry: Spectroscopy and Magnetism**. Edited by Lawrence Que, Jr. (University of Minnesota). University Science Books: Sausalito, CA. 2000. x +556 pp. $78.00. ISBN 1-891389-02-5

Bioinorganic chemistry has greatly benefited from a wide array of physical methods that probe the active metal centers of protein and enzymes. These methods provide detailed information on the geometric and electronic structure of the metal and its ligands. In many cases these methods have allowed identification of substrate or inhibitor complexes, or catalytic intermediates, and in doing so have elevated our knowledge of the chemistry out of the speculative realm.

This book, written by experts in the field, is an excellent compilation of chapters on a variety of these methods. While there are other notable books available on physical methodologies for inorganic chemistry, this is the first such introductory level book to focus on the wide range of problems unique to biological applications. This book will be useful as a text in a course for advanced undergraduates and beginning graduate students. In many of the chapters, not only are the underlying physical principles addressed, but care is given to providing many case studies. Many spectra are displayed and their interpretations given, providing students with a good sense of typical spectral data from many different techniques on a wide array of protein complexes. Advanced researchers with limited experience in a given method will also find many practical aspects regarding basic spectral acquisition and interpretation of data. The level of difficulty in the book varies from qualitative to more mathematical; however, these variations can be addressed with course lectures. Although three of the chapters have problem sets (with solutions), this book would greatly benefit from additional problems for the other chapters; nevertheless, the pedagogical aspects of this book are excellent. This book will also be a useful reference and should be an essential acquisition for libraries.

The first nine chapters of the book cover the following techniques: (1) electronic absorption spectroscopy, (2) resonance Raman spectroscopy, (3) EPR spectroscopy, (4) ESEEM/ENDOR spectroscopy, (5) CD/MCD spectroscopy, (6) Mössbauer spectroscopy, (7) magnetism, (8) NMR of paramagnetic molecules, and (9) X-ray absorption spectroscopy. The final chapter (10) contains case studies on cytochrome *c* oxidase and isopenicillin N synthase, which nicely illustrate how data from these various physical methods can be assimilated to give an understanding of the active site chemistry of enzymes.

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**The Weak Hydrogen Bond In Structural Chemistry and Biology (International Union of Crystallography, Monographs on Crystallography, 9)**. By Gautam R. Desiraju (University of Hyderabad) and Thomas Steiner (Freie Universität Berlin). Oxford University Press: Oxford and New York. 1999. xiv + 507 pp. $150. ISBN 0-19-850252-4.

Every chemist is familiar with the concept of a hydrogen bond of the form X−H- - -Y, where X and Y are strongly electronegative atoms N and O. Many textbooks state that C−H groups do not form hydrogen bonds because the electronegativity of C is not high enough. If you subscribe to this belief, then you need to read this excellent monograph on the existence of C−H- - -Y hydrogen bonds and their significance to all aspects of chemistry. The book contains close to 900 references to the literature on this subject, most of them from the last four years. Even if you are already a student of the hydrogen bond, you should read this book to understand the pervasiveness of the weak hydrogen bond interaction. For those who know little about hydrogen bonds, the entire book provides excellent coverage of the topic. For those already familiar with a particular area of hydrogen bonding, selected chapters may fill in the gaps where knowledge is lacking.

The introduction contained in Chapter 1 covers the historical perspective of all hydrogen bonds from the very strong F−H- - -F to the very weak C−H- - -F and lays the groundwork for how weak hydrogen bonds fit into the overall scheme of things. The following chapter covers the archetypes of the weak hydrogen bonds C−H- - -O and C−H- - -N, starting with the earliest studies in the 1960s. This chapter gives an honest and fair evaluation of the proponents and opponents of the weak hydrogen bond concept. The general properties of this type of interaction are laid out in detail with numerous examples from the crystallographic, vibrational spectroscopic, and computational literature. Here you will find discussions of the issues concerning the length and angular properties of hydrogen bonds, the effects of acidity

*Unsigned book reviews are by the Book Review Editor.

and basicity on the strength of the weak hydrogen bond, and the new role of the Cambridge Structural Database as a data mining tool for the statistical analysis of not only weak hydrogen bonds but many other types of structural interactions. Also discussed is the importance of cooperativity in hydrogen bond formation, that is, how the formation of one hydrogen bond can exert a directing influence on the formation of others. There is also a very interesting discussion on hard vs soft hydrogen bonds. Both organic and inorganic chemists are familiar with the hardness and softness concept to describe the relative reactivities of electrophiles and nucleophiles. They will appreciate the fact that hard hydrogen bond donors will more likely combine with hard hydrogen bond acceptors and soft donors with soft acceptors.

Chapter 3 provides detailed coverage of additional types of weak hydrogen bonds involving $\pi$-acceptors such as phenyl, alkynes, alkenes, other types of weak acceptors, such as S, Se, Te, and stronger acceptors, such as isonitriles, carbanions, and halide anions. Numerous examples of additional weak donor hydrogen bonds, such as S−H- - -Y with Y = O, N, S, halide, and $\pi$ as well as weak donors, such as P−H, Se−H, As−H, and Si−H, are provided. For the organometallic chemists, there is a subchapter on metal atom acceptors X−H- - -M and metal atom donors M−H- - -A.

The next chapter begins a discussion of concepts in supramolecular chemistry and how weak hydrogen bonds play a role in directing the formation of supermolecules, of which crystals are the supermolecules par excellence. This is a relatively new subject area. Although determination of crystal structure has been around since the dawn of X-ray analysis, crystal engineering—the design of crystals with specific properties—is relatively new. Predicting crystal structures is not a trivial problem. One can go so far as to say that predicting crystal structures is to chemistry what predicting protein folding is to biology, which is an unsolved problem at present. This chapter outlines various computational and experimental approaches to crystal structure and how weak hydrogen bonds may play a directive role in the outcome. Also included in this chapter is a discussion of the role of weak hydrogen bonds in the formation of the inclusion compounds involving crown ethers, calixarenes, cyclophanes, and cyclodextrins.

Chapter 5 is devoted to weak hydrogen bonds in biological structures. This chapter gives some insightful descriptions of the role of weak hydrogen bonding in determining the conformational properties of proteins and nucleic acids. The discussion of nucleoside and nucleotide conformational preferences is especially noteworthy.

A five-page summary and a well-annotated reference section complete the book. The references are in alphabetical order with cross references to the page in the book where they are mentioned.

Although there is not a single wave function to be found in this monograph, the authors make a reasonable attempt to describe some of the theoretical work in this field. I would have liked to have seen more references to Bader's "atoms in molecules" approach to this subject, especially where it relates to what the authors describe as stabilizing vs nonstabilizing X−H- - -Y interactions. One is left with the uncomfortable impression that nonstabilizing H-bonds can have net nonzero forces on the atoms, when in fact all atoms in a crystal must be at a local minimum with net zero force. Nevertheless, the contents of this book will appeal to both experimentalists and theoreticians alike. It is a welcome addition to what is now indisputably an important concept in the elucidation of molecular recognition.

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**Advances in Supramolecular Chemistry. Volume 7**. Edited by George W. Gokel (Washington University School of Medicine). JAI Press: Stamford, CT. 2000. x + 289 pp. $115.00. ISBN 0-7623-0678-5

This seventh volume of *Advances in Supramolecular Chemistry* maintains the excellent standard set in prior editions by offering in-depth accounts of contemporary research in supramolecular chemistry. Each chapter is extensively referenced, clearly presented, and copiously illustrated. While two of the five chapters in this current edition deal with the assembly of ion channels, the remaining chapters, which cover the chemistry of calixarenes, macrocyclic molecular sensors, and crystal engineering, capture the diversity of topics found in the ever-expanding field of supramolecular science. As such, this volume represents an excellent addition to any library catering to readers with a general interest in supramolecular chemistry.

Chapter 1 is entitled "Supramolecular Assemblies in Natural and Artificial Ion Channels". Authors Kirkovits and Hall introduce this subject with a presentation of the general classes of ion channels found in natural systems. The various mechanisms of ion transport and ion selectivity are discussed, and biophysical techniques for the measurement of single ion channels are described. This introduction sets the stage for a survey of synthetic peptide-based ion channel models, engineered natural ion channel models, and finally, artificial ion channel models. The theme of ion transport is continued in Chapter 2, entitled "Ion Recognition and Transport by Poly-(*R*)-3-Hydroxybutyrates and Inorganic Polyphosphates". A focused and detailed account of the properties of poly-(*R*)-3-hydroxybutyrates and inorganic polyphosphates in relation to their function in ion transport is provided by the author, Rosetta Reusch.

"Functionalized Macrocyclic Ligands as Sensory Molecules for Metal Ions" is the subject of Chapter 3. This review, authored by Xue, Savage, Bradshaw, Zhang, and Izatt, emphasizes important developments in macrocycle-based chemosensing and is organized into three sections: fluorescent sensors for alkali metal cations, alkaline earth metal cations, and transition metal cations. Special attention is given to fluorescence-based systems and the selective complexation of metal ions.

The fourth chapter, "Chirality in Calixarenes and Calixarene Assemblies", is the longest chapter in this volume and includes nearly 300 literature citations. This outstanding review is divided into three sections: chirally modified calixarenes, calixarenes containing stereogenic centers in the macrocycle, and inherently chiral calixarenes. In the course of their presentation, authors Vysotsky, Schmidt, and Böhmer describe a spectacular panorama of calixarene-based architectures and highlight applications in fields as diverse as host−guest chemistry, transition-metal catalysis, and molecular self-assembly. This chapter unites a range of topical subfields in the general area of supramolecular chemistry while at the same time providing a thorough analysis of calixarene stereochemistry.

Moulton and Zaworotko conclude this volume with a chapter entitled "From Molecules to Crystals". This account begins with a historical perspective on the emerging field of "crystal engineering" and develops into an outline of several concepts unique to this new discipline, including the definition of various types of supramolecular isomerism. Following this, some representative two- and three-dimensional organic, organometallic, and hybrid networks are described. The simple aesthetic appeal associated with crystalline networks is sufficient to enamor most chemists to this largely "uncharted" area of research.

In summary, this volume of *Advances in Supramolecular Chemistry* covers an eclectic set of research topics in the area of supramolecular chemistry. Consequently, it should be of immense use to the expert and to those with a growing interest in supramolecular science.

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**Forensic and Environmental Detection of Explosives**. By Jehuda Yinon (Weizman Institute of Science). J. Wiley and Sons: Chichester, New York, Weinheim, Brisbane, Singapore, Toronto. 1999. xviii + 286 pp. $100.00. ISBN 0-471-98371-3

This book describes the principles and methods used in the forensic and environmental detection of explosives and discusses some of the problems that typically occur when using these applications. The topics covered include (1) Classification of explosives and basic terms; (2) Vapor detection methods (sniffers); (3) Probing radiation methods (bulk detection); (4) Systems integration and performance testing; (5) Tagging of explosives; (6) Environmental detection of explosives; and (7) Detection of landmines.

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