

## Book Reviews

*Works intended for notice in this column should be sent direct to the Book-Review Editor (R. F. Bryan, Department of Chemistry, University of Virginia, McCormick Road, Charlottesville, Virginia 22901, USA). As far as practicable, books will be reviewed in a country different from that of publication.*

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**Macrocyclic chemistry: aspects of organic and inorganic supramolecular chemistry.** By B. DIETRICH, P. VIOUT and J.-M. LEHN. Pp. 384. Weinheim: VCH Verlagsgesellschaft, 1993. Price DM 148.00, £61.00. ISBN 3-527-28330-7.

In the preface of this book Lehn writes that it is based on a series of lectures in macrocyclic chemistry, given by him, and that the lecture notes were extended by the other two authors. He also states that it should cover the vast field of macrocyclic chemistry extensively but not exhaustively.

The book is divided in two main parts, the first on Macrocyclic Synthesis, the second is titled Macrocyclic Complexes - Cryptates. Part I is almost pure chemistry, with chapter 1 discussing general synthetic principles, chapter 2 special cyclization reactions and chapter 3 ring-closure methods. It is an impressive and rather comprehensive collection of methods employed in the synthesis of macrocyclic compounds, and covers, among others, porphyrin synthesis, crown ethers, macrolides and macrocyclic lactams. Cryptands are treated in part II of this book. In the discussion of macrolides I missed mention of the interesting macrolactonization method of Yamaguchi, used to produce macrocyclic oligolides from chiral 3-hydroxybutyric acid. This method led to isolation of cyclic compounds with from three to ten 3-hydroxybutyric acid units; interesting in view of the importance of PHB (polyhydroxybutyric acid) as a biodegradable polymer. To fully understand part I, however, a fairly thorough training as an organic chemist is a prerequisite.

Part II is probably more interesting for structural chemists. After introducing the principles of complexation of cations by macrocyclic compounds, chapter 1 discusses synthetic macrocyclic complexes, mainly of the crown ether type. Illustrated with typical examples, all important aspects are treated: complementarity of macrocycle cavity and cation, anion effect, participation of water, second coordination sphere, heteroatoms other than oxygen as complexation sites. Chapter 2 deals with natural macrocyclic ionophores and discusses structural aspects of valinomycin group ionophores, cyclic peptides and the nactins. Ionophores of the nigericin group are not mentioned; they are, of course, not really macrocyclic molecules - forming rings only *via* end-to-end hydrogen bonds. This chapter gives the impression of a somewhat arbitrary collection of compounds, but nevertheless brings home the important points. Chapter 3, dealing with cryptands, is the largest (115 pp.), and the reader can feel that this is where the authors are really at home and at their best. The coverage here is extensive and exhaustive. After discussing synthetic strategies, structural and thermodynamic aspects of metal cryptates are treated, with emphasis on stability and selectivity.

For whom, then, is this book? It will be an excellent introduction for advanced students who start working in this

field, either as synthetic or structurally oriented chemists. They get an up-to-date overview, competently written by the experts, and a broad list of references which will lead them further into the subject. It will also be helpful for researchers working in other fields who want to know what is going on in supramolecular chemistry. Specialists will not find a lot of new information, but will surely want to have this book on their shelves. Crystallographers will probably find the book rather weighted toward chemistry; on the other hand, synthetic chemists will find valuable structural information - mostly in pictorial and, therefore, easily digestible form.

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**Inorganic structural chemistry.** By ULRICH MÜLLER. Pp. viii + 264. Chichester: John Wiley, 1993. Price £14.95 (paperback). ISBN 0-471-93717-7.

The teaching of upper-level undergraduate inorganic chemistry is currently in a period of extensive change and experimentation. Particularly in US colleges and universities, new courses are being created and existing ones redesigned, partly in response to an expansion of the inorganic requirement for accreditation in bachelor-level degree programs by the American Chemical Society, but also reflecting a major renaissance in the subject itself. The rapid growth of interdisciplinary fields such as organometallic and solid-state chemistry and materials science is not only opening new markets for specialized monographs in these areas, but has also led to the redesign of general advanced inorganic texts. Professor Müller's book is in an intermediate category, narrower in scope than a general text but nevertheless covering considerable territory of importance to inorganic chemistry. Some chemists may find it problematic to treat 'structural' inorganic chemistry as an entity separate and apart from, say, reactivity and reaction mechanisms (especially as modern chemistry emphasizes the close intertwining of these aspects). Nevertheless, there is a place for a well written volume that concisely sets forth the main points of inorganic structure in language that is clearly understandable to the average advanced undergraduate, and is suitable as either a reference or a supplemental text in an inorganic course for third- or fourth-year majors. This well organized and attractively produced book, an English language version of the author's earlier prize-winning *Anorganische Strukturchemie*, certainly meets these criteria.

The suitability of this work as a text is enhanced by several features, including excellent artwork and the inclusion

of problems at the end of most (but not all) chapters, with answers provided in the back of the book. The prose is generally clear and well written and the discussions should be easily followed by undergraduate students. Unavoidably in this relatively short book, with an introduction and 19 chapters, most topics are not treated in much depth, but the density of information is high and the author manages to include considerable factual data. Early chapters are devoted to the description of chemical structures; polymorphism and phase diagrams; and structure, energy and chemical bonding. Chapters on the effective size of atoms and ionic compounds are followed by VSEPR descriptions of the structures of compounds of main-group elements and ligand-field theoretical descriptions of compounds of transition metals. A chapter on molecular orbital theory and bonding in solids is followed by three others on the structures of the non-metallic elements, diamond-like structures and polyionic compounds. Spherical packing in metals and compounds, interstitial packing and linked polyhedra are treated in four separate chapters, and the book concludes with a short chapter on the physical properties of solids and two chapters on symmetry. The treatment is up-to-date for the most part - for example, briefly describing and illustrating C<sub>60</sub> fullerenes (one might wish for more on this rapidly burgeoning field).

The coverage of the solid state and molecular clusters is good. One can quibble with the discussion of 'Wade clusters' on p. 133, in which they are said to apply only to 'compounds with a severe electron deficiency'. This view tends to perpetuate the archaic definition of electron deficiency as applying to all boranes and other molecules having multicenter bonding. Such a notion traces to an early misunderstanding of borane structure and bonding, and leads to absurdities - such as labeling as 'electron deficient' even highly stable carboranes and other clusters that have closed-shell electronic structures and no propensity to acquire electrons. An illustration of the confusion that can be engendered by this use of the term is seen in the discussion of polytin clusters (e.g. Sn<sub>5</sub><sup>2-</sup>) on p. 121, where it is said that species of this type cannot be electron deficient because they have lone electron pairs, and hence one cannot in such cases use multicenter bonds 'which are normally

indispensable only for electron-deficient compounds'. But this is nonsense. The fact is, the polytin ions and other Zintl species *do* have both multicenter bonding and lone pairs, as do many polyhedral boron clusters (e.g. :PCB<sub>10</sub>H<sub>11</sub>); there is in fact no inconsistency here, since there is no 'electron deficiency'! The discussion of Wade's electron-counting rules is a little too constricted, and may leave the erroneous impression that they are entirely empirical when, in fact, they are solidly grounded in quantitative molecular orbital theory.

An unusual feature that this reviewer found disconcerting (and surprising in a volume on structure) is the treatment of symmetry. Point groups and space groups are not introduced until the last two chapters. To this reviewer, this is unfortunate since the systematic use of point-group symmetry is an effective tool in teaching and organizing inorganic chemistry, and is almost indispensable in dealing with molecular orbital theory and other topics. Instructors who prefer to use symmetry arguments throughout the course can assign the relevant chapters (18 and 19) as early reading, a workable but not entirely satisfactory arrangement.

There is the usual scattering of grammatical and typographical errors, few of which are serious. On p. 87, the orbital diagram for δ\* (second from the top on the right side) should depict the orbital wavefunctions with alternating signs. The list of single-topic monographs on p. 248 omits the excellent treatment of clusters by Mingos & Wales [*Introduction to Cluster Chemistry* (1990). Englewood Cliffs, New Jersey: Prentice-Hall]. Other errors are mostly routine misspellings or omissions. Overall, this is a fine book that is likely to find a place both as a concise source of information on inorganic structure and as an adjunct text for third- and fourth-year undergraduate courses in inorganic chemistry.

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