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Book review

Handbook of Metalloproteins
I. Bertini, A. Sigel, H. Sigel (Eds.); Marcel Dekker, New York, Basel, 2001, xxvii + 1182 pages, ISBN 0-824-70520-3 (US$ 265)

Following the renaissance in inorganic and coordination chemistry in the 1950s, the subject of bioinorganic chemistry has burgeoned over the past 30–40 years. Much more recently, genomic and proteomic analysis has allowed the definition of all of the proteins expressed in an organism and the complete genomes of an increasing number of microorganisms and several eukaryotes are now available. Many proteins need metal ions in order to function and since the properties of metal ions are critically dependent on their ligands, structural analysis is of great importance. Fortunately, the techniques of X-ray structural determination, often using synchrotron radiation, and NMR spectroscopy are also making great strides and protein structures are being solved and published with increasing frequency. The above combination of exciting advances persuaded the editors to attempt to capture the current status of the bioinorganic chemistry field in this single handbook. The book is intended for advanced students and scientists in the fields of bioinorganic chemistry, inorganic chemistry, coordination chemistry, biochemistry, biophysics, clinical chemistry, medicine, pharmacology, etc. Recognising that the field is fast moving and that even in a book of this size it is only possible to cover a representative set of proteins, the editors have also included the addresses of a number of useful web sites and have pointed the reader to other texts and series in the area.

The Handbook consists of 23 chapters written by 43 international experts and focuses on Na, K, Mg, Ca, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, and W, and their roles in proteins. However, other metals are also discussed as substitution probes in metal ion-protein interactions or for their toxicity. Some metals are considered in single chapters but iron and copper are each covered by four chapters and three are devoted to zinc. Apart from the introductory and the final 'Perspectives' chapters, the rest follow the general format of Introduction; Enzymes/proteins of known structure; Enzymes/proteins of unknown structure; Structure–Function relationships; Perspectives. The Introductions summarize the coordination chemistry of the metal that is relevant to its biological role and where possible give some comments on its metabolism and homeostasis. All of the chapters cover the literature up to 1999 and some have references into 2000 but, inevitably, some have been overtaken by events, particularly where new protein structures have recently been published, e.g. with the nickel enzyme carbon monoxide dehydrogenase/acetyl-CoA synthase (CODH/ACS) where it is now clear that the Ni atom is an integral part of the FeS cluster rather than simply linked to it. One slight irritation is that the colour figures are all collected together at the beginning of the book. This undoubtedly helped to keep costs down and the figures are all duplicated in black and white in the main text, nevertheless it is still necessary to leaf back and forth through the book to relate the descriptions to the colour figures.

Organometallic chemists will probably be most interested in the chapter on cobalt enzymes where the making and breaking of metal–C bonds is best established. This subject has moved forward significantly recently with the determination of the structures of some B_{12} enzymes in more than one state. These studies have revealed the linking of substrate binding at one site with Co–C bond fission at another, thus demonstrating the subtle way in which nature can harness and control chemistry. In addition organometallic chemists will find much interest in the chapters covering the Ni–Fe and the Fe-only hydrogenases where the metals are coordinated by CO and CN ligands. The source of these normally poisonous small ligands is unclear, as is their involvement in the enzyme turnover. The latter is an area of much speculation and intensive effort by the modelling community.

Despite the length of the Handbook, it is apparent that most authors found it difficult to cover all of the subject matter in depth. This is hardly surprising since whole books (e.g. in the series edited by Sigel and Sigel) have been devoted to the subject matter of most of the chapters. Therefore each chapter tends to become telegraphic in style and to reveal the primary interests of the author(s). Some authors cover model chemistry in some depth but others deal almost exclusively only with the proteins. It is probably fair to say that few will be satisfied with the treatment of their favourite subjects since none is treated in sufficient detail. I make an exception of the chapter on iron–sulfur proteins, which I found excellent and comprehensive but my favourite enzymes, nitrogenase and the copper-containing nitrite

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reductase, are dealt with in a rather cursory manner. Nevertheless, if I were looking for an introduction to a topic or if I were planning a course on metals in biology, then the Handbook would be a very good starting place. In particular many authors have solved the space constraints by including a variety of useful tables. In brief, although few individuals are likely to be able to afford a personal copy of this Handbook, many will probably want it nearby on the library shelves.

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