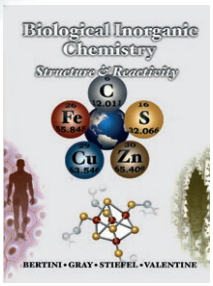
Biological Inorganic Chemistry



Structure and Reactivity. Edited by *Ivano Bertini, Harry B. Gray, Edward I. Stiefel* and *Joan S. Valentine*. University Science Books, Sausalito 2007. 739 pp., hardcover $ 98.25.—ISBN 978-1-891389-43-6

This book represents a major contribution to the field of bioinorganic chemistry, especially as it is targeted on teaching at the senior undergraduate or graduate levels, a market that is growing, but for which few books have been published in the past several years. Although a number of books that can be used for teaching, including background use in bioinorganic research groups, have been published since Eichhorn's mammoth compendium for researchers, *Inorganic Biochemistry* (1973), and Ochiai's more compact monograph for classroom use, *Bioinorganic Chemistry—An Introduction* (1977), they are all now outdated. On the other hand, the discipline of bioinorganic chemistry, also variously called inorganic biochemistry, metal ions in biology, or biological inorganic chemistry, has flourished. A key element in the growth in the area is the interdisciplinary development of the techniques required for the recent major progress: molecular biology for recombinant proteins and mutations, more details of unusual coordination chemistry, important techniques for revealing structural details, and theoretical methods. These have all contributed to a thriving and highly successful 35 years of bioinorganic chemistry, which has been celebrated in an ever-widening range of specialist journals, conferences and symposia, with the multiple sessions and week-long activities of the biannual ICBIC underpinning them all. So today, we are comfortable and conversant with a range of chemistries that can account in detail for a remarkably complex and intricate incorporation of all facets of metals into biologically active roles. So, this new book is a timely, very important, and useful addition to the field.

The editors and contributors of *Biological Inorganic Chemistry—Structure and Reactivity* include some of the pioneers in the field, in particular Bertini, Gray, Stiefel, and Valentine, which makes it an exciting contribution, bringing together a wonderful array of chemistry, in the manner of previous authors such as Eichhorn, da Silva & Williams, Ochiai, and Lippard & Berg. The book really does provide the required panoramic view of bioinorganic chemistry, both cutting-edge science and the past, which is a relatively infrequent situation for a book covering such a wide range of material in a compact form. In fact, it is like opening the combined programs of all the bioinorganic chemistry conferences held this year and seeing session after session of research, so that you wish to attend every one. In a book, this is possible, and Bertini and the co-editors have assembled such a book. Indeed, this book is a great read for those fortunate enough to have spent their research life in the field and for those who have watched many of these different topics develop, or for those who teach courses in bioinorganic chemistry, as well as for those just starting.

Understandably, as one also finds in other books aimed at teaching rather than just stating the information, there are many places where one wishes that more pages could have been devoted to a particular topic. Of course, that might have resulted in a book of 1300 pages, like that published by Eichhorn in 1973. For use in teaching, there has to be a limit on both size and content, and the editors made that decision with this book, which has 739 pages.

The editorial team arranged the book in three parts, which is rather confusing. Part A, which starts at Chapter II, is a section of six chapters encompassing 129 pages that "sets forth the unifying principles of the field". Part B "treats specific systems in detail", and is written by a very large group of authors recognized as experts in their respective fields. Finally, there are two tutorials (really Part C) which "review the basics of biology (I) and inorganic chemistry (II)", followed by four appendices: an extensive list of Abbreviations (Appendix I), a very useful Glossary (Appendix II), a couple of pages on literature (Appendix III) that is redundant in today's age of computer searches, and lastly, a minimalist text on the ways to obtain protein structures (Appendix IV), which was an opportunity to assist student readers. Another Appendix III on "Physical methods in bioinorganic chemistry", which is mentioned on page xxiii, was not included, which is to be regretted, as that would have been useful.

Part A begins with an evolutionary and environmental perspective of biological chemistry, which ends with an excellent (for the bioinorganic chemist) simplified view of the tree of life. This chapter is an excellent starting-point for both undergraduate and graduate courses, and certainly provides enough material for stimulating tutorial discussions. This theme of a general background continues in Chapter III as metals are introduced, with emphasis on the key amino acids in proteins. This leads to Chapter IV on cofactors and a brief selection of what is to come—the beautiful coordination chemistry of biology. Once again, this is an excellent forum for use in both lectures and discussion. Chapter V on transport and storage of metals describes how metal atoms are absorbed and made available. This is an excellent summary, but I would expect this topic to follow Chapter II more logically, as the scavenging for metals must surely come before their incorporation into proteins. The chemistry of biomineralization (Chapter VI) introduces a new side of biology, the materials side, which is often overlooked but is critically important, and this chapter provides yet another excellent introduction. Finally, in Chapter

VII, Peter Sadler and coauthors bring Part A to a close, changing the focus of the book up to this point by describing metals in medicine, an area of wonderful diversity and, of course, beautiful inorganic chemistry. So, by page 135, the editors have decided that the introductions are complete and we are ready for a blow-by-blow account of the details. In my opinion, the omission of a chapter on the toxicity of metals, which is surely a necessary companion to the chapter on metals in medicine, is a shame.

What follows in pages 139–654 are the details of the chemistry of a range of metals. Some included in Part A, most not yet discussed. The majority of the 62 authors listed contribute to these pages. Not surprisingly, some chapters are outstanding; they are gems that both describe their topic and place that topic completely in the field. On the other hand, some chapters really suffer from the format of so many fragmented chapters being written by so many authors.

It is clear that putting together a book with 62 coauthors is a tour de force for any group of editors. How successful is it? The content, as I have described it above, is generally excellent, apart from the absence of chapters on the toxicity of metals. The organization, presentation, and editing are, in my opinion, in need of improvement.

Organization: If the structure of the book is to be based on Part A, Introduction and Part B, Details, then Part A must be shorter and to the point; how else could one use it? 130 pages is a very long introduction. My request as a consumer of books for teaching bioinorganic chemistry (both a graduate course for 30 years and a second year undergraduate course for 3 years) is that the topics should be assembled in a cohesive sequence, so Chapter I should have served this purpose. In the end, I find that the Part A/Part B structure really does not work very well in this book. In particular, many of the chapters in Part B should have followed their Part A introduction. And, finally, I found nothing in the Part A/Part B split that naturally required such a split.

Presentation: The complete lack of color in the chapters, the frequently poor quality of the gray-scale images used, and the poor quality of many of the color images, for example Figure X.1.14, and inefficient use of printing space in the special color section are detrimental to the quality and value of the book. Clearly, cost is the guiding principle here, and the editors give the information for access to the structures and strongly recommend that one should have structure-drawing software open (Appendix IV).

Editing: My major criticism concerns the level of editing of all these chapters, starting with the use of citations throughout the book. As an example to students on how to cite references, much of the book sends the wrong message. A few chapters (e.g., Chapter XII.2) have full and proper citation, with all figures and tables cited to the literature, as it should be, but there are many chapters with no citations to the literature except at the end of the chapter (e.g., Chapter IX.4). It may be that all the works cited in these chapters are those of the authors, but even here there are no copyright statements as guides, and certainly, for the reader, the omission of so many citations makes the further reference and study difficult. Next, nomenclature, especially reference to the oxidation states of metals. There are accepted styles, but this book uses different styles, hardly to be recommended in an inorganic textbook. On page 32 we find Ca^{2+} and Zn^{2+}, whereas on page 33 we find Ca^{II} and Zn^{II}—and so on throughout the book: Fe^{3+} on page 142 and Fe^{II} on page 131. Similarly unacceptable, on page 347 we find $[Fe^{4+}{=}OR]$; this is incorrect nomenclature—if detail is required it can be written as $[Fe^{IV}{=}OR]$.

In summary, this is a major new textbook that brings together the exciting science of bioinorganic chemistry.

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