

Preface to the 2nd Edition

The importance of metals in biology, the environment and medicine has become increasingly evident over the last twenty five years. The movement of the electrons in the electron transfer pathways of the photosynthetic organisms and in the respiratory chain of mitochondria, coupled to proton pumping to enable the synthesis of ATP, is carried out by iron- and copper-containing proteins (cytochromes, iron–sulphur proteins and plastocyanins). The water-splitting centre of green plants (photosystem II), which produces oxygen, is based on the sophisticated biological use of manganese chemistry. Metals like cadmium, manganese and lead in our environment represent a serious health hazard. Cadmium is present in substantial amounts in tobacco leaves, so that cigarette smokers on a packet a day can easily double their cadmium intake. Yet, while many metals are toxic, many key drugs are metal based – examples are Cis-platin and related anticancer drugs, and lithium carbonate, used in the treatment of bipolar disorder. Paramagnetic metal complexes are widely used as contrast agents for magnetic resonance imaging. Numerous trace metals are also required to ensure human health, and while metal deficiencies are well known (for example inadequate dietary iron causes anemia), it is evident that excessive levels of metals in the body can also be toxic.

It has been clear from the outset that the study of metals in biological systems can only be approached by a multidisciplinary approach, involving many branches of the physical and biological sciences. The study of the roles of metal ions in biological systems represents the exciting and rapidly growing interface between inorganic chemistry and the living world. It has been defined by chemists as bioinorganic chemistry, and by biochemists as inorganic biochemistry. From 1990–97 the European Science Foundation funded a programme on the Chemistry of Metals in Biological Systems.¹ This resulted, in the course of what turned out to be a monumentally important meeting held in the Tuscan town of San Miniato, in the launching of important initiatives around the international consensus name 'Biological Inorganic Chemistry'. The outcome was the creation of the *Society of Biological Inorganic Chemistry (SBIC)* in 1995, with Dave Garner as its first President,² and the *Journal of Biological Inorganic Chemistry (JBIC)* in 1996 with Ivano Bertini as its first Editor. These then joined the already existing **ICBICs** (International Congress of Biological Inorganic Chemistry) and **EUROBICs** (European Congress of Biological Inorganic Chemistry), to form a series of acronyms, which all now use the stylized French word for a ballpoint pen '**bic**' to designate the term biological inorganic chemistry. While I use the definition Biological Inorganic Chemistry in this book, I would like to indicate to the prospective reader that this text will deal to a much greater extent with the biochemical aspects of metals in living systems rather than with their inorganic chemistry.

The success of the first edition of '*Biological Inorganic Chemistry*' stimulated both myself and Elsevier to produce a 2nd expanded edition, which I trust will serve a useful role for both students and teachers of this ever dynamic field. I have tried where possible to include up to the minute illustrations of the fundamental messages

1. The Steering Committee of this Programme, which I joined in 1992, was made up of Helmut Sigel (Basle, Switzerland) as chair, Ivano Bertini (Florence, Italy), who organized the San Miniato meeting; Sture Forsen (Lund, Sweden), Dave Garner (Manchester, UK), Carlos Gomez-Moreno (Zaragoza, Spain), Paco Gonzales-Vilchez (Seville, Spain), Imre Sovago (Debrecen, Hungary), Alfred Trautwein, Lübeck, Germany), Jens Ulstrup (Lyngby, Denmark), Cees Veeger (Wageningen, Holland), Raymond Weiss (Strasbourg, France), and Antonio Xavier (Oeiras, Portugal).

2. He was succeeded by Elizabeth C. Theil (1998–2000), Alfred X. Trautwein (2000–2002), Harry B. Gray (2002–2004), Fraser Armstrong (2004–2006), Bob Scott (2006–2008), Trevor Hambley (2008–2010), José Moura (2010–2012).

that I have tried to articulate as clearly and with as much enthusiasm as in the first edition. The organisation of the book has been structured around three parts — Basic Principles, Metals in Biology and Metals in Medicine and the Environment. Not only is the text updated and more intensively resourced, but I have included new Chapters on Non-metals in Biology, Metals in Brain Function, Metals and Neurodegeneration, Metals in Medicine and Metals as Drugs and Metals in the Environment, while a number of other Chapters have been significantly expanded.

I would like to thank again my long-term collaborator Professor Roberta Ward for her help with Chapters 20 and 21 and to Frédéric Lallemand for drawing most of the Figures, as well as Adrian Shell and Louisa Hutchins at Elsevier, Oxford for their understanding and patience. I also thank all my colleagues who have encouraged me by their supportive comments on their utilisation of the First Edition, remain responsible for any errors or mistakes, and hope that this text which I enjoyed writing will give as much pleasure to its reader, and hopefully encourage some of them to embark on the exciting adventure which the study of metals in biological systems represents.

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