chapters cover the following subjects: General Survey, Stoichiometric C–H Activation, Catalytic C–H Activation, Catalytic Activation of Methane and Ethane, C–C Bond Cleavage, Activation of Si–Si Bonds, Activation of C–O Bonds, Activation of C–Cl Bonds, Dinitrogen in Organic Synthesis, and Activation of C–F Bonds. These topics are in different stages of development as techniques for practical organic synthesis.

Anyone reading about this area of chemistry for the first time will be struck by the apparent obsession of the investigators with the importance of transition metal–carbon bonds. Admittedly they are important, but the cobalt-catalysed oxidation of cyclohexane is a commercial process involving C–H activation, which probably does not involve M–C bonds although it is catalysed by a transition metal. However, I found very few errors in the book, although I was surprised to see on p.2 the derivation of the word ‘agostic’ being attributed to Crabtree, rather than to M. L. H. Green.

A detailed examination of the chapters reveals an up-to-date survey of the various areas. For example, in the chapter on C–C single-bond cleavage by M. Murakami and Y. Ito, the authors have found a surprisingly large number of examples of this reaction. This type of reaction is less developed than C=C cleavage (olefin metathesis), and a large proportion of the examples involve strained (three and four-membered) rings. There are also reactions involving a pincer-type chelating ligand, and several types of rearrangement or migration reactions. Some elements which are familiar in polymerization reactions such as lutetium, zirconium and hafnium, also undergo reverse insertion reactions, which involve C–C cleavage. Both stoichiometric and catalytic reactions are described in this chapter.

The most challenging system discussed in the book is the triple bond in dinitrogen. However, it is now emerging that the chemistry of coordinated dinitrogen is possibly more varied than the chemistry of coordinated carbon monoxide.

To summarize, this book contains the basis of much important future work which will result from developing the themes presented here. It is not so much a record of what has already been achieved, as a signpost to the areas where future developments lie.

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## X-ray Fluorescence Spectroscopy
R. Jenkins

2nd edn. John Wiley, Chichester, 1999
xviii + 207 pages. £65
ISBN 0-47-129942-1

This book provides a complete introduction to the subject, from the basic physics of the process through to industrial applications. The theory sections have been significantly embellished since the first edition, with a new chapter on X-ray spectra. They are, however, pitched at a level that will make them accessible to any interested reader.

There is also a new section on the historical development of XRF, which provides an interesting insight into the way the technique has matured from an esoteric exercise in physics into a general-purpose industrial tool.

In my opinion, the book is primarily targeted at practical users of the technique, particularly newcomers. It includes, for example, chapters on specimen preparation, qualitative and quantitative work.

I felt that the book does not really do the title justice in that it also provides useful introductions to a number of related techniques such as X-ray lithography, tomography, astronomy etc. There is a full chapter devoted to X-ray diffraction. A surprising omission in this respect is the use of X-ray spectrometry in conjunction with electron microscopy, which receives scant mention.

Overall, I found the book to be very easy to read and a worthwhile addition to the literature on the subject. I am sure that, like the first edition, it will find widespread use both as a teaching aid as well as a reference book for more experienced practitioners

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## Interrelations Between Free Radicals and Metal Ions in Life Processes
## Metal Ions in Biological Systems, Vol. 36
A. Sigel and H. Sigel (eds)
Marcel Dekker, New York, 1999
848 pages. $250
ISBN 0-8247-1956-5

There is so much of interest in this book that it is difficult to know where to begin the review. The central theme is radicals in biology, in particular the interaction of these radicals with metal ions. A wide range of radicals is considered, including superoxide and nitric oxide. There are also chapters on radical processes such as lipid peroxidation, metal-induced carcinogenesis and organocobalt-induced radical formation. In all there are 21 chapters, written by different authors, and five of them are concerned with aspects of the nitric oxide story. The remaining 16 cover a range of topics, some of which have been mentioned already. Although the quality of the contributions to a multi-author work varies, all the chapters are written by acknowledged experts with an air of authority and will be of particular aid to those newly entering a field of research. There is also much of interest for a browser and the vital role of metal ions in biological systems is rapidly perceived.

Radicals are thought to be responsible for many biological processes causing ageing and degenerative disease. There are two chapters of particular interest in this regard. One, by Atwood and colleagues, discusses the pathogenesis of Alzheimer's disease and another, by Multhaup and Masters, is concerned with radical generation and metal binding in neurological diseases and ageing.

The single topic given greatest coverage in this book is nitric oxide in biology. Thirteen years ago this topic did not exist. The award of a Nobel Prize to Furchgott, Murad and Ignarro in 1998 gave public recognition to one of the most remarkable discoveries of the last few decades. Nitric oxide is everywhere in living systems; we missed it because it is so small and has rather distinctive chemistry. The basic principles are described by Fukuto and Wink and nitric oxide modulation by Fung and colleagues. One of the more controversial aspects of nitric oxide activity, formation of the peroxynitrite ion by reaction with superoxide, is described by Koppenol, but readers should be aware that there are other views. The section on nitric oxide in the saliva of blood-sucking insects illustrates the widespread incidence of nitric oxide-related processes, and of particular value is a chapter by Fricker on nitric oxide scavengers as drugs.

This book will be of great interest to all interested in the role of metal ions in biology.

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## The Chemistry of Organic Derivatives of Gold and Silver. The Chemistry of Functional Groups, Vol. 100

Saul Patai and Zvi Rappoport (eds)

John Wiley and Sons, Chichester, 1999 xxv + 734 pages.
£300
ISBN 0-471-98164-8

What a surprise! After browsing quickly through the book, I wondered whether I had picked up the wrong one. I checked the title—and, sure enough, it did say 'organic derivatives of gold and silver', and there was no doubt from the two bold structures on the front cover—two four-valent carbon atoms each with a single bond to Au or Ag—that this was indeed a book about *organometallic chemistry*, compounds containing *metal–carbon bonds*. But is it?

Chapter 1 is said to be concerned with 'General and theoretical aspects of organic gold compounds', but, by my definition, it is not! Most of the compounds discussed do not have any Au–C or Ag–C bonds at all, and indeed many have no C in them (the structures in Figs 3–12, for example). But it is a useful chapter, focusing on *ab initio* calculations (density functional theory) for two-, three- and four-coordinate gold(I) complexes with neutral and charged ligands.

The Mössbauer section (Chapter 2) by Parish concentrates on $\sigma$ and $\pi$-bonded organogold complexes. Mössbauer probes gold itself and can allow determination of the oxidation state of gold and good estimates of the nature and number of bound groups, the limitations being the large sample size, low temperature and expense of the platinum-196 source. Chapter 3 by Liebman *et al.* is also faithful to the 'organo' theme, surveying enthalpies, Gibbs energies and equilibrium constants. Similarly two informative chapters by Schmidbaur and colleagues discuss compounds in which the organic group is a one-electron carbon-bound ligand for silver (Chapter 7) and synthesis and uses of $\sigma$-bonded organogold(I) and gold(III) complexes, homo- and hetero-metallic gold clusters, and alkene, alkyne and carbene complexes (Chapter 8). In contrast to most of the other chapters, cyanide and isocyanide complexes are excluded.

In Chapter 13, Wang and Fackler conclude that dynamic processes and rearrangements displayed by organogold and organosilver complexes are versatile and that mechanistic studies are needed. Horspool in Chapter 10 concludes that there is a scarcity of photochemical transformations of the organic moiety bound to gold and silver and of photochemical fission processes, and widens the scope to include catalytic activity. In Chapter 11, Aitken concentrates on pyrolysis of alkyl and aryl silver and gold compounds, an area of current interest in relation to chemical vapour deposition for electronic applications.

So I did find real organosilver and organogold chemistry in the book, but there were also six or so chapters for which 'organo' means a wide variety of ligands. For me, this was a welcome surprise, since my main interest is non-organometallic.

Fricker describes the historical use of gold in medicine, along with currently used injectable and oral gold(I) thiolate complexes (for treatment of rheumatoid arthritis), in Chapter 16. He discusses the possible mechanism of action: enzyme inhibition and inhibition of transcription of the genes for crucial mediators of inflammatory processes. It is also possible to design gold antitumour, anti-infective and antiviral agents. The need for improved understanding of the molecular and biochemical mechanisms of action of gold compounds is clear. NMR studies are potentially powerful and these are described by Shaw in Chapter 4. For silver, these are two NMR-detectable isotopes, $^{107}$Ag and $^{109}$Ag but for gold we must rely on ligand nuclei such as $^{1}$H, $^{13}$C, $^{15}$N and $^{31}$P since $^{197}$Au, the only isotope of gold in Nature, has a high quadrupole moment and a low magnetogyric ratio, and is highly insensitive to detection.

Chapter 14, on syntheses and uses of isotopically labelled compounds of silver and gold, is very wide-ranging, from $^{2}$H and $^{18}$O isotope effects to NMR nuclei