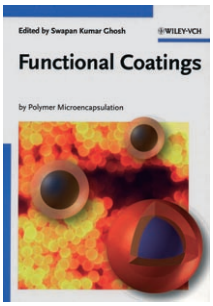
Functional Coatings by Polymer Microencapsulation



Edited by *Swapan Kumar Ghosh*. Wiley-VCH, Weinheim 2006. 357 pp., hardcover € 119.00.—ISBN 3-527-31296-X

Microencapsulation is a hot area of research in colloid science. Creating particles of a few tens of micrometers in size that consist of a core material surrounded by a shell is not only aesthetically pleasing, but also provides an elegant route to solutions for common industrial problems such as dispersing a material in an incompatible fluid, or controlling the release of active components. There are multitudinous methods for preparing core–shell particles, and the types of materials that have been used are similarly numerous. As a result, a large body of literature exists, and Swapan Kumar Ghosh's new book consolidates this literature well.

Ghosh's book gives a condensed summary of the methods of encapsulation synthesis, providing a useful reference source, although with material that is already available from primary sources. Where the book makes itself most valuable is in its comprehensive descriptions of the applications of such particles, information that is scarce in the open literature.

The nine chapters of the book are individually authored, and each could stand alone. As a result, one criticism of the book is that there is slight repetition and a lack of coherence between chapters.

Ghosh has broadly split the book into two halves. The first discusses synthesis, and covers topics that include mini-emulsion polymerization, layer-by-layer deposition, surface polymerization, and liquid encapsulation. The second half concentrates more on the applications of encapsulated particles, an example of which is the slow release of an insecticide that is impregnated into textiles, thereby preventing insect bites. However, this division is not rigid, as each chapter also contains examples of preparation and application.

With its individual chapter style, the work is clearly not a textbook, and readers wanting a "how to" of microencapsulation may be disappointed. However, the book is an impressive collection of views from a number of experts in the field, and as such is an excellent reference source for those active in the area of encapsulation. The extensive table of contents and index make it easy to navigate and find information on a particular subject, and the work is to be recommended to both academia and industry.

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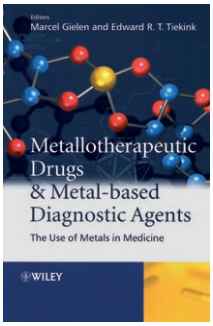
Metallotherapeutic Drugs and Metal-Based Diagnostic Agents



The Use of Metals in Medicine. Edited by *Marcel Gielen* and *Edward R. T. Tiekink*. John Wiley & Sons, Hoboken 2005. 584 pp., hardcover € 235.00.—ISBN 0-470-86403-6

Centuries of folk-medicines lie at the root of main-stream, small-molecule drug design in the pharmaceutical industry today, as medicinal agents are typically derived from lead natural products that show biological activity. Thus, a high percentage of drugs are mainly organic substances that bind to a specific enzyme or protein and alter its function. Through detailed computational structure–activity modeling and extensive screening assays, the vastness of drug–target interaction space can be effectively sampled, and viable drug candidates selected. Remarkably, the atomic composition of these main-stream drugs generally avoids the metals and metalloids that make up much of the remainder of the Periodic Table, mainly because of the potential for toxic effects arising from complex speciation, variable oxidation states, and multiple structures that exist for these elements. Unfortunately, there is a dearth of natural, metal-based molecular scaffolds that can pave the road to new metallotherapeutics, and only a small fraction of the main-stream pharmaceutical infrastructure is devoted to the development of metal-based drugs. Despite these challenges, metal-containing therapeutics have a long and rich empirical history, as exemplified by Paul Ehrlich's arsphenamine agent salvarsan, which served as an anti-syphilitic for 30 years prior to the discovery of penicillin. Today, cisplatin (*cis*-diaminodichloroplatinum(II)), which was first observed by Barnett Rosenberg in the 1960s to inhibit fission of *E. coli* when generated electrochemically in situ at a platinum electrode, serves as a potent chemotherapeutic agent for small-cell lung, testicular, and ovarian cancers.

This is the backdrop to *Metallotherapeutic Drugs and Metal-Based Diagnostic Agents: The Use of Metals in Medicine*, edited by Marcel Gielen and Edward R. T. Tiekink. A systematic and detailed element-by-element examination of applications of metals in medicine unfolds through the 28 chapters of this book. Each chapter (typically about 15 pages with 90 references up to 2004) follows a similar format, detailing the historical origins of the discovery of a particular element's role in medicinal chemistry, the chemical compositions of the active agents, as well as the biological target where known, appropriate clinical data supporting the biological activity, and potential toxicity issues.

This is a broad range of material to cover in a limited space, and so the chapters focus on the key aspects of the subject without aiming to be comprehensive and diluting the theme. In that sense, this is a thoughtful collection of cross-disciplinary science that is both interesting and digestible to a wide scientific audience, and is especially useful as a general overview of the field.

The arrangement of the book marches across and down the Periodic Table by atomic number, highlighting specific elements. It begins with the role of lithium salts in neurological disorders (Chapter 1), and includes boron cages in boron neutron capture therapy (Chapter 2), as well as applications of organosilicon compounds to the treatment of Alzheimer's disease and a broad range of cancers (Chapter 5). Here, the metalloid serves more as a carbon substitute rather than performing a key "inorganic" function like many of the essential mineral and therapeutic salts. Within this theme, the discussion of the role of calcium as a metallotherapeutic drug (Chapter 6) focuses on dietary calcium homeostasis and its influence in hormonal regulation and the treatment of osteoporosis, periodontal diseases, kidney stones, and other afflictions. This chapter marks the beginning of the stepwise evaluation across the third row of the Periodic Table, which includes the first transition series (Chapters 7–14), the metalloids germanium and arsenic (Chapters 15 and 16), and selenium of the Main Group elements (Chapter 17). Chapters 7, "Titanium Anti-Tumor Drugs", and 8, "Insulin-Mimetic Vanadium-Containing Compounds", are more focused on the use of these elements within synthetic compounds that have DNA-binding, antitumor properties (e.g., titanocene dichloride), and on the role of vanadium compounds as anti-diabetics due to their influence in tyrosine phosphorylation via the insulin receptor. Chapter 8 concludes with a thoughtful summary of some of the problems facing the field, such as tissue accumulation, dose mediation, and achieving specificity for uptake in the target tissue. In addition to development of therapeutic compounds, Chapters 9 (Mn), 10 (Fe), 12 (Cu), and 13 (Zn) also contain at least a brief mention of proteins or enzymes containing these metals and the potential for therapeutic inhibition or mimicry. The discussion of Zn in medicine is remarkably diverse, encompassing catalytic, structural, and regulatory properties, and ranging from the effects of Zn deficiency and the immunological role of Zn, to Zn therapy for copper poisoning (Wilson's disease), macular degeneration, and cancer. The discussion of the functions of Co in medicinal applications (Chapter 11) is also wide-ranging in that it covers the role of this metal in naturally occurring cofactors such as cobalamin, as well as in the anti-tumor agent bleomycin.

It is also within these chapters that the use of several of the first-row metals (Mn, Fe, and Co) in magnetic resonance and positron emission imaging emerges. Chapter 28 provides a brief but sound overview of the key properties required for paramagnetic metal contrast agents (relaxation times, specific targeting), with special emphasis on Gd^{III} chelates. The initial tutorial section nicely describes the primary NMR principles for achieving effective contrast. The growing importance of magnetic resonance imaging (MRI) has stimulated developments in the use of radiopharmaceuticals such as those based on ^{99m}Tc (Chapter 18) and $^{186}Re/^{188}Re$ (Chapter 24). The fact that ^{99m}Tc imaging is now a comparatively mature technique leads to a thoughtful discussion about the development of molecular architectures and compound design/targeting, which is of particular interest to synthetic chemists.

Although the earlier chapters identify the role of first-row metals in DNA binding, the later discussion of frameworks based on Ru (Chapter 19) and Rh (Chapter 20) shows that compounds based on these metals are more established as DNA probes and recognized for their potential in photochemotherapy. A discussion of DNA binding and the resulting biological effects would not be complete without inclusion of the mature development of Pt compounds (Chapter 25) and their emerging Pd analogues (Chapter 21). As expected for the heavier elements with no natural biochemical roles, these chapters focus heavily on relationships between the molecular framework and biological activity, and efforts to modulate response and toxicity.

Beyond the roles of the metals mentioned above, and topics that may be more familiar to readers, several chapters describe some much less well-known applications of metals in medicine. In addition to being interesting in their own right, these are areas in which the chemistry and biology have not been so thoroughly studied, which highlights important opportunities for research aimed at a better understanding of mechanisms. Examples include the role of Al in the treatment of ulcers and metabolic disorders (Chapter 4), Ga as a mimetic of ferric iron without redox capabilities (Chapter 14), Ge as a structural center in organogermanium compounds (Chapter 15), and Sb^{III}/Sb^{V} as anti-leishmanial agents (Chapter 23). Although some of these elements may never reach the prominence of platinum in chemotherapy or of iron, copper, and zinc in overall biological significance, to stir the spirit of exploration and discovery one only needs to recall the defining role that the unlikely element arsenic played in the establishment of metals as key contributors to medicine. Thus, *Metallotherapeutic Drugs and Metal-Based Diagnostic Agents: The Use of Metals in Medicine* is a very good overview of the field that can serve as a roadmap to more detailed literature or experimental investigations.

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