J|A|C|S BOOK REVIEWS

Transition Metals in the Synthesis of Complex Organic Molecules, 3rd ed. By Louis S. Hegedus (Colorado State University) and Björn C. G. Söderberg (West Virginia University). University Science Books: Sausalito, CA. 2009. xii + 460 pp. $76.75. ISBN 978-1-891389-59-7.

Transition Metals in the Synthesis of Complex Organic Molecules is the most recent edition of the Hegedus monograph, which traces its origins to the synthetic chapters of the book *Principles and Applications of Organotransition Metal Chemistry* by Collman, Hegedus, Norton, and Finke of the 1980s. Like earlier editions, this one is intended to be a hybrid between a graduate course text and an advanced monograph. As such, the authors attempt to find a balance between instructing and appreciating the state-of-the-art.

The introductory chapters are on formalisms, electron counting, and basic organometallic reaction mechanisms and clearly are targeted at chemists whose background in organic chemistry is solid but whose background in transition metal chemistry may be weak. Subsequent chapters are based on the type of complex encountered, specifically hydrides, metal–carbon σ-bonded complexes, carbonyls, carbenes, alkene/diene/dienyl complexes, alkyne complexes, η^3-allyls, and arene complexes.

There has been a very serious effort to update the book since the previous 1999 edition. Significant sections have been added or expanded on asymmetric hydrogenation, cross-coupling, C–H activation, arene amination, metathesis chemistry, rhodium allyls, and gold alkyne complexes. The references have nearly doubled and are extensive through 2007, with a few references from 2008. The authors have taken very little out from the previous edition, and as a result, the book is approximately 25% longer than the previous edition; nevertheless, it has not become unwieldy. The authors attempt to stay true to the book's genesis as an instructional tool and work through the mechanisms as much as possible even when such mechanisms are still the subject of much speculation. In their attempt to make the book as comprehensive and current as possible, the authors end sections in some instances by simply giving examples of related transformations, on rare occasions as a "bewildering array", to quote from the authors' own words.

There are a couple of minor criticisms. The introductory treatment of stable transition metal 16-electron complexes is very brief, particularly given their importance in cross-coupling reactions. Also, on occasion, reaction intermediates are not written so that the metal oxidation state is readily discernible to the reader. Errors are few, and I count exactly one that is chemically substantive.

The book easily meets the authors' goals. It would make an excellent text for graduate students and would be usable for students coming from both organic and organometallic backgrounds. Each section allows the reader to become familiar with the current literature rapidly, and it is useful for practicing chemists who simply wish to gain an appreciation of the subject by leafing through and looking at the schemes. Finally, this is an excellent book that is very reasonably priced and of outstanding value.

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JA9105545

10.1021/ja9105545

Bionanodesign: Following Nature's Touch. By Maxim Ryadnov (University of Leicester, UK). Royal Society of Chemistry: Cambridge. 2009. x + 238 pp. $199. ISBN 978-0-85404-162-6.

The functional character of all biological molecular machines arises from an intimate link between their physical and chemical variables, which manifests itself most vividly at nanoscale where several energy scales converge (see Phillips, R.; Quake, S. R. The Biological Frontier of Physics. *Phys. Today* **2006**, *59*, 38–43). The complexity arising from this confluence of scales makes teasing out the principles that connect form and function a formidable task. This is especially true for proteins. DNA-based assemblies with their smaller set of rules and studied in more than a hundred laboratories across the globe have been shown to perform significantly beyond what Nature provided (see Seeman, N. An Overview of Structural DNA Nanotechnology. *Mol. Biotechnol.* **2007**, *37*, 246–257). In this book, Ryadnov takes a broad look at a variety of self-assembled bioinspired systems based on proteins and DNA. The book consists of three main sections: the first is dedicated to DNA nanotechnology, the second to encapsulation in protein cages, and the third to molecular scaffolds that mimic the extracellular matrix and provide basic materials for tissue engineering.

Each part starts with a solid introduction to the respective area, which is both accessible and reasonably comprehensive and should prove useful to the nonspecialist. Abundant examples follow; unfortunately, however, these are grouped under headings that are obscure in terms of the content of the section. For some reason, all section titles follow a somewhat metaphorical participial construction, e.g. "Escaping walled" refers to endocytosis, that effectively reduces the usefulness of the table of contents. When looking for a particular topic, the reader is forced to browse through a repository of molecular struts, tiles, motifs, and multiscale networks, which are often presented together with their general construction principles.

In organizing the material, the author emphasizes form rather than function. It is worth noting that, if one makes a difference between function and design, the title of the book is somewhat misleading. According to the famous architect, C. Alexander, "design is the process of inventing physical things which display new physical order, organization, form, in response to function..." (see Alexander, C. *Notes on the Synthesis of Form*; Harvard University Press: Cambridge, 1964). With few exceptions, the structures described here are not obtained in response to a particular function—sometimes the main reason for their existence seems to be that they could be made. Descriptions of potential applications or fundamental problems that would benefit from the unusual combinations of shapes and materials are scarce. However, the emphasis on "nano" more than "technology" was the author's avowed intention from the beginning. Furthermore, there are more than a few examples in the history of science of transformative discoveries that were initially perceived as solutions in search of a problem. One hopes that such treasures can be found among the systems discussed in the book, which does a good job of keeping up with the developments in a rapidly growing field, although some major omissions exist. For example, although a fair amount of space is spent on the Caspar−Klug theory for spherical capsids, no mention is made about its generalization to nonspherical capsids.

In conclusion, the goal of creating synthetic systems that work with similar precision and efficiency as biological systems continues to be hampered by an insufficient understanding of how biological systems function as well as our still limited abilities in manipulating and measuring the nanoscale properties of living matter. This is why there is a need to expand the experimental toolbox and manufacture elementary building blocks that have the ability to self-assemble into organized structures akin to biological ones. Ryadnov's review of bioinspired nanomaterials is a timely contribution to this fast-paced field.

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JA910674M

10.1021/ja910674m

Engineering the Bioelectronic Interface: Applications to Analyte Biosensing and Protein Detection. Edited by Jason J. Davis (University of Oxford, UK). Royal Society of Chemistry: Cambridge. 2009. x + 260 pp. $129.00. ISBN 978-0-85404-165-7.

The pH electrode begot the concept of an oxygen electrode, which begot the concept of a glucose biosensor in the 1960s. The latter evolved into a product on the global market 40 years later and is said by some to be worth $7B in sales. To this day there are concerns about the quality of the data provided by these devices, but there is no doubt that the lives of millions of diabetics have been both improved and extended by such sensors. It is natural to ask why cannot we test for some biomarker other than glucose and create another commercial success for a similar transducer. After decades of trying, we still cannot. This book helps us understand why it is so hard to get biological recognition elements to "talk" to electrode surfaces while still maintaining their selectivity and ability to turn analytes into products. The eight chapters are of uniformly good quality and provide a critical assessment of the recent literature on matching conducting or semiconducting substrate surfaces to protein elements that achieve sensor selectivity. How can one be attached to the other for optimal electrical communication between the two? There is plenty of information here on self-assembled monolayers, the use of carbon nanotubes, and the alternatives to direct electrical communications vs the use of mediators or organic conducting "wires" as approaches to addressing this issue.

There have been many new tools in surface science that enable detailed assembly and analysis of tailored surfaces. The use of these is well represented here. However, there is very little information on the design and performance of practical sensors. As suggested by the title, the focus is on the challenges of interfacial chemistry.

This volume is professionally produced and indexed. The figures have been well selected and are useful. Although the last chapter notes applications where biosensors have potential for clinical diagnostics, nothing in this volume suggests that the struggle to achieve this potential for very many analytes will occur anytime soon. Challenges include insufficient selectivity, nonspecific adsorption, and concentration limits-of-quantitation that are far too high for real samples. Instability of sensors with respect to both shelf life and use remains problematic as do the challenges of calibration.

This volume has a lot to offer in fundamental chemistry with regard to its title. A betting person is likely to do better with mass spectrometry, chromatography, and various immunoassay formats to determine biomarkers where they must be determined in the goop. Nevertheless, I highly recommend this volume to the many who are working doggedly in this field to prove me wrong.

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JA9108648

10.1021/ja9108648