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BOOK REVIEWS

Cellular and Biomolecular Recognition: Synthetic and Non-Biological Molecules. Edited by Raz Jelinek (Ben Gurion University of the Negev, Israel). WILEY-VCH Verlag GmbH & Co. KGaA: Weinheim. 2009. xx + 350 pp. $180. ISBN 978-3-527-32265-7.

Biomolecular recognition is the understanding of biological function at the molecular level and is important to many different areas of research, ranging from biophysics, biochemistry, and molecular biology to pharmaceutics and bioengineering. Although remarkable progress has been made for in vitro characterizations and studies, the main goal of research in this area is to understand and manipulate the recognition in real biological environments. In vivo studies are thus critical to understanding the underlying biological function. The various contributors to this book provide novel experimental approaches and insights toward biomolecular recognition in biological systems.

In Chapter 1, Niu et al. describe intriguing virus-like particles and their biological functions and discuss research in the development of functional materials from viruses. This is followed by a chapter by Borchers et al. on a class of biomimetic nanoparticles designed to provide defined binding sites for biomolecules. In Chapter 3, Sokolov discusses the application of atomic force microscopy and fluorescence methods for the analysis of silica particle interactions with cells, and in Chapter 4, Marx outlines the pharmaceutical and therapeutic potential of the concept of chiral molecular imprinting, which is directly related to induced molecular recognition. Weinstain and Shabat present therapeutic applications of catalytic antibodies to selective cancer chemotherapy in Chapter 5. This is a promising technology based upon molecular recognition of transient biological species. In the next chapter, Raman and Campopiano explore molecular interactions involving synthetic and natural molecules in immune systems, interactions that are critical events for stimulating the immune response, and in Chapter 7, Ma and Cheng present the application of unique biomimetic polymer assemblies exhibiting colorimetric and fluorescent properties for the analysis of biological processes and biomolecular sensing.

Elegant synthetic biomimetic systems (receptors) that are designed to bind specific proteins are discussed by Polkowska et al. in Chapter 8. In Chapter 9, Sim and Cao provide a review of the applications and analysis of surface plasmon resonance, a powerful methodology for studying biomolecular interactions, and Willumeit focuses on the significance of membrane interactions of natural and synthetic peptides in varied biological processes in the next chapter. In the remaining three chapters, Shi et al. cover the contribution of fluorescent and luminescent quantum dots for analysis of varied cellular and biological processes; Aurilia et al. describe the utilization of new advanced fluorescence spectroscopy for biosensing applications of the protein binding family; and Kim et al. review the comprehensive body of work aimed at developing new approaches for studying molecular interactions through imaging and detecting ions and charge molecules.

The experimental approaches summarized in this book are quite broad, although there are other methods not covered in this book that are worth mentioning, such as the single-molecule approach, near- and far-field optical imaging methods, etc. It would also have been nice to see a review on developments in theory and computational methods toward understanding *in vitro* and *in vivo* biomolecular recognition. Still, the book should appeal to students and researchers in different areas who are interested in state-of-the-art developments in the field of biomolecular recognition. I recommend it without reservation.

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JA102523M

10.1021/ja102523m

Click Chemistry for Biotechnology and Materials Science. Edited by Joerg Lahann (University of Michigan, Ann Arbor). John Wiley & Sons, Ltd.: Chichester. 2009. xx + 412 pp. $155. ISBN 978-0-470-69970-6.

The editor describes this volume as consisting of "16 loosely connected chapters" that give "a comprehensive view on this rapidly emerging field." This should give the reader a good idea of the book's style. It is up-to-date in its content and references (to 2009). It is not an operational handbook or guidebook, but rather a critical examination of the field by workers active in the area.

The book begins with a very brief chapter by the editor entitled "Click Chemistry: A Universal Ligation Strategy for Biotechnology and Materials Science", which reveals the common theme of the remaining chapters. The idea of a "universal ligation strategy" is that it will be a powerful tool in many fields, particularly with respect to the creation of new materials that are derived from the covalent combination of multiple components. Such a strategy represents a technical challenge, and treating each instance as a new problem requires making judgments and selections about potential solutions. Click chemistry, on the other hand, is a set of solutions in search of problems. Sharpless and co-workers defined it as "a set of powerful, highly reliable, and selective reactions for the rapid synthesis of useful new compounds and combinatorial libraries" (*Angew. Chem., Int. Ed.* **2001**, *40*, 2004−2021). Although the first chapter lists eight reactions that can be considered to be appropriate for executing a click reaction, scientists have voted with their flasks: most of the book is concerned with applications of Cu(I)-catalyzed azide−alkyne cycloaddition (CuAAC) in contexts that are as diverse as they are demanding. CuAAC was developed simultaneously and independently by two research groups who published sufficiently detailed and practical methodology to get the field off to a rapid start less than 10 years ago. Although alternatives have appeared, their method remains the great favorite, with minor tweaks.

As noted above, the book begins with an introduction to its chapters but not to the field. Too many authors make up for this deficiency by summarizing the generalities and background with varying degrees of success and much repetition. Fortu-

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nately, unlike a novel or textbook, you can start anywhere in this book and not be at a disadvantage. I recommend Chapter 13 by Dieterich and Link. It gives an excellent and concise introduction to the field and provides a clear set of examples of click-formation of bioconjugates. The chapter by Baskin and Bertozzi also makes very nice reading for a perspective on comparative methodologies and introduces the concept of bio-orthogonality. To illustrate this concept, they discuss the fact that neither azides nor terminal alkynes exist in proteins or nucleic acids and they do not react with any functionalities within these macromolecules. Of course, azides and alkynes react voraciously with one another in the presence of Cu(I), ignoring their surroundings and forming stable, defined conjugates. However, for intracellular processes, Cu(I) is not acceptable, and the authors focus on attaining similar bio-orthogonality with metal-free coupling as developed in their research group using approaches that include adapting the Staudinger reaction as a coupling process.

There are also discussions in the book of the diverse applications of click chemistry in the fields of materials and polymer science, and these are full of surprises and invention. With synthetic chemistry reduced to rather simple constructs, materials can be produced seemingly at will. The biotechnological prospects are also remarkable: in principle you can create complex entities in simple blocks.

The writing and coverage of the chapters ranges from excellent to tolerable. There are some grammatical and spelling errors, but in general the production is carefully done. The book would benefit from a more complete index, a glossary of terms, a better overview, and more about the authors than simply their names and addresses. It does provide insights and experience from a diverse group of experts, and those who buy it will have a valuable state-of-the art picture that will guide their reading and future interests. However, the topic is sufficiently broad that reviews have appeared recently in journals that duplicate the territory, and some are even more up-to-date. Examples include Issue 4 of the 2010 volume of *Chemical Society Reviews*, the article by Meldal and Tornøe in *Chemical Reviews* (**2008**, *108*, 2952), and the special issue of *QSAR & Combinatorial Science (***2007**, *26* (Issue 11−12), 1110) that is devoted to areas closely related to biomolecules.

In summary, this book is a valuable addition for workers in the field as well as for those who have some knowledge of it and want to learn about the directions developments can take. An avid reader will be rewarded with exciting prospects in materials and biotechnology that benefit from the wonders of click chemistry.

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JA102850Q

10.1021/ja102850q