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BOOK REVIEWS

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