Bioinspiration and Biomimicry in Chemistry

The most advanced chemical laboratories on our planet exist in the cells and structures of living organisms. Nature performs an astonishing range of selective syntheses and transformations of both organic and inorganic systems and, what is more, it achieves this under ambient conditions. It is not surprising, therefore, that research groups across the world strive to understand and emulate natural chemical processes. "Bioinspired" or "biomimetic" chemistry is flourishing and this new book is ideally timed to overview this broad and diverse field.

The book starts with a brief and interesting history of terms such as biomimetics and biomineralization, including a discussion of Mankind's long-standing fascination with copying nature and understanding her processes. This is put nicely into context using quotes from previous books in this field. The introductory chapter then goes on to explain the layout and content of the main chapters of the book in terms of broad themes including nanostructures, hierarchical structures, self-assembly and functionality. Given the very diverse range of themes (catalysis, organic synthesis, crystallization), it was crucial for the authors and editors to ensure that the chapters contained clear descriptions of fundamental concepts and scientific background. This has been achieved extremely well and while the chapters are a mixture of styles, each one successfully introduces the reader to the specific field. This is aided by schematic illustrations in most cases. In overviewing existing research for each chapter, most of the authors present a broad and varied perspective of many examples, rather than focusing on their own contributions. In addition, a strong point of the book is there is some good critical discussion of existing literature, for example giving possible drawbacks to certain methods.

There are several chapters associated with self-assembly, starting with a discussion of the driving forces and then giving multiple examples of supramolecular systems such as cages, or liposomes in Chapter 2. This is followed by a much more conceptual, "textbook-style" chapter on cooperativity. The style is very different but I think this gives an important, more fundamental perspective on some of the factors in self-assembly. Building on these concepts, Chapter 4 then introduces molecular machines in nature, followed by the synthetic examples using chemical reactions to drive changes in molecular interactions. Chapter 8 then extends the length-scale into liposomes and vesicles and Chapter 9 discusses macromolecules, inspired by the ability of natural polymers to form complex, functional and often hierarchical structures. Metal-organic complexes are also covered in detail in this book, particularly in a very enjoyable chapter on bioinspired catalysis. This gives an insight into fundamental enzymatic catalysis and how knowledge of natural catalytic systems may be applied to synthetic catalysts. Again the chapter is clearly explained for readers unfamiliar with catalytic concepts.

Biomimetic materials chemistry is also covered thoroughly in this book. This has been quite extensively reviewed, but the concise introductions and discussion of recent advances make this an important addition to the book. Composites, biomaterials, Gecko-inspired adhesives and bioinspired photonics are also covered in separate chapters. It should be noted that some of the chemistries and techniques in these second two chapters are more widely applicable than just photonics and adhesives. The book finishes with two quite different chapters—firstly biomimicry in organic synthesis and the possibility of synthesizing complex molecules by first elucidating their biosynthesis. As a reader not overly familiar with organic synthesis, I still found this chapter extremely clear. Finally, the book is concluded with a discussion of nature as a complex system, a thought provoking summary and consideration of the wider implications of biomimetic chemistry.

As a resource for chemists, the main advantage of this book is this diversity, which makes it stand out from more specific discussions of e.g. biomimetic materials chemistry. In this sense, the book would provide a good reference to someone new to the field or as part of a reading list for a course on biomimetics and bioinspiration in chemistry. In addition, for readers who have worked in one area of biomimetic chemistry for some time, this book is broad enough to give some interesting insight into some very different chemistries.

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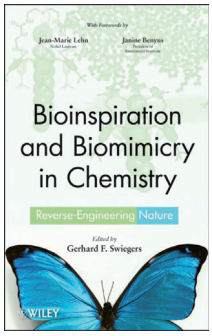

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