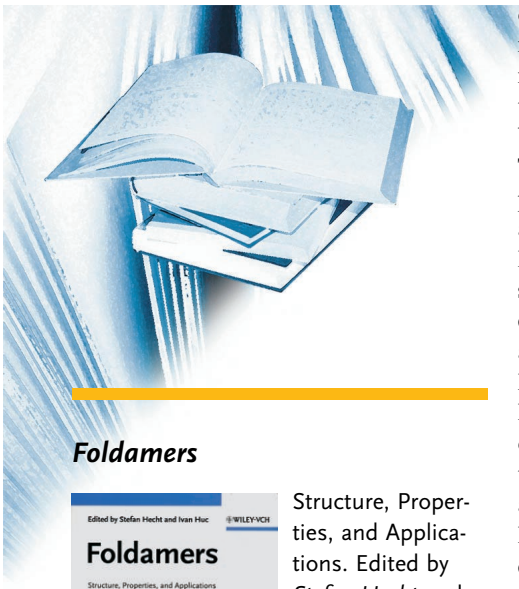
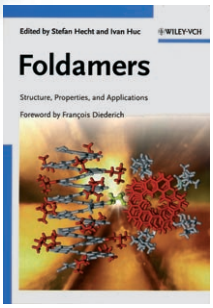


Foldamers



Structure, Properties, and Applications. Edited by *Stefan Hecht* and *Ivan Huc*. Wiley-VCH, Weinheim 2007. 434 pp., hardcover € 159.00.—ISBN 978-3-527-31563-5

It is said that humans have wanted to fly ever since they became aware of birds. More recently, but analogously, chemists have longed to mimic the marvelous functions of proteins by using non-natural molecules. A protein's activity usually depends upon the adoption of a specific folding pattern, and one of the most recent attempts at protein mimicry focuses on oligomers and polymers that adopt defined conformations. These molecules have come to be known collectively as "foldamers". Stefan Hecht and Ivan Huc have assembled an excellent volume on this relatively new branch of chemistry.

The editors have elicited and organized a collection of essays from leading scholars in foldamer research and allied fields. The chapters are remarkably well coordinated to present the reader with a comprehensive and informative perspective on foldamer research. The first four chapters offer a broad overview of foldamer design strategies. The topics of these chapters progress steadily and logically from local conformational constraints through longer-range intramolecular interactions to foldamer-based assembly.

In Chapter 1, Huc and Cuccia provide an extremely thoughtful discussion of foldamers in which local non-covalent interactions lead to long-range conformational order. As the authors show, this approach requires that the foldamer building blocks be comparatively rigid. The presentation is systematic, and the principles initially outlined by the authors are amply illustrated from published examples. Chapter 2 makes a smooth transition to foldamers that contain more flexible building blocks, and therefore rely at least partially on longer-range interactions, particularly hydrogen bonds, for conformational order. Le Grel and Guichard show how the principles evident in the folding of α-amino acid backbones (i.e., proteins) have been extended to backbones that contain longer amino acids (e.g., β- and γ-peptides) or related building blocks (e.g., aminoxy acids and hydrazino acids) and mixtures of building block types. In Chapter 3, Zhao and Moore make the next logical step by discussing foldamers in which solvophobic interactions between segments of the backbone drive the adoption of compact conformations. These authors begin with a very interesting discussion of solvent-driven self-assembly of amphiphilic molecules. They show how this branch of chemistry represents a prelude to the design of oligomers that undergo solvophobically driven folding. The authors discuss the challenge that harnessing solvophobic forces presents, because of their intrinsically low structural specificity, and describe the strategies that various researchers have employed to promote the adoption of specific conformations. Chapter 4 extends the general development to specific intermolecular interactions involving foldamers.

Subsequent chapters focus on more specific topics, each of which is important in the context of foldamer research. Chapter 5 deals with the folding and self-association of α-amino acid oligomers containing non-natural residues, and Chapter 6 discusses computational approaches to the study of foldamer conformations. Each of these chapters comes from a leading laboratory in the subject area, but both are a little disappointing because the authors focus so heavily on their own work. In Chapter 7, Hamilton and co-authors provide an excellent broad survey of "foldamer-based molecular recognition", an area of increasing activity. This topic flows logically into the next one, "biological applications of foldamers", which is ably presented by Koyack and Cheng in Chapter 8. Chapter 9 exemplifies the thoughtful approach taken by the editors in their effort to produce a book that is of broad utility. The topic, "protein design", could easily have been presented in a way that would deflect the chemists who are likely to be the main readers of this book. Fortunately, however, Jestin and Pecorari have put together an exposition of this obviously foldamer-related topic that is clear, well-organized, and appropriately light-handed. The authors cover all of the topics that a biologically orientated chemist should understand, but Jestin and Pecorari wisely limit themselves to just a few appropriate examples to illustrate each topic.

In Chapter 10, Chworos and Jaeger offer a very thorough and lucid review of designed DNA- and RNA-based systems. It is quite reasonable to regard these systems as "foldamers," although most workers in this area would probably not use this designation. Nevertheless, the spirit that motivates this research will be easily recognized by chemists interested in foldamers. The astonishing range of non-natural structures and activities that has been achieved in this field provides powerful inspiration for foldamer research. Chapters 11 and 12 discuss helical polymers, another subject that has a life outside the foldamer field, but is well-chosen for this book. Yashima and Maeda provide an overview, and then focus on polyacetylenes. Nolte and co-authors deal with rigid polyisocyanides in the following chapter. Chapter 13, by Hecht and co-authors, discusses foldamers at surfaces, an area that is full of promise but in which there are not many examples up to now. The authors begin with a thought-provoking discussion of the differences between folding in solution and folding at an interface. This chapter is a fine way to end this intriguing volume, because it is clear that a great deal remains to be done in this particular area of foldamer research. Indeed, the entire foldamer field is still quite young, and therefore offers fertile terrain for new scholars and for more established scientists seeking new topics. Anyone

who considers joining this field, or who just wants to know what is being done in the area, will be fortunate to have the efforts of editors Hecht and Huc at hand.

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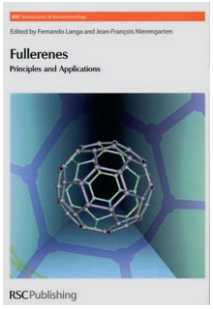
Fullerenes



Principles and Applications. Edited by *Fernando Langa* and *Jean-François Nierengarten*. Royal Society of Chemistry, Cambridge 2007. 398 pp., hardcover £89.95.—ISBN 978-0-85404-551-8

Since the discovery of C_{60} in 1985, studies on the chemistry, physics, and biochemistry of fullerenes and related compounds have been at the forefront of research. Fullerene research is now a truly interdisciplinary branch of science. Fullerene-based derivatives have been shown to have a wide range of physical and chemical properties that render them attractive for supramolecular assemblies, nanostructures, and new advanced materials for optoelectronic devices. Recent studies have also shown that fullerenes exhibit interesting biological activities. All these aspects of fullerene science are summarized in different chapters of this book. The 11 chapters provide a deep insight into the chemistry of fullerenes and carbon nanotubes, and also discuss their applications.

The editors devote the first chapter to the production, isolation, and purification of fullerenes, including incarcerated fullerenes—those that contain one or more atoms inside the hollow cage. Chapter 2 continues with the chemical reactivity of fullerenes, and describes important examples of their derivatization. The chapter ends with the formation of bis-, tris-, and multi-functionalized fullerenes, and discusses factors that affect the position of addition. Chapter 3 is concerned with the electrochemical properties of fullerenes and their derivatives. Chapter 4 discusses light-induced processes in multi-component fullerenes. Intramolecular charge transfer in fullerene derivatives is described, with numerous spectral data. Chapter 5 is devoted to fullerene-containing dendrimers, which are constructed by covalent or non-covalent approaches. The chapter also discusses the formation of Langmuir–Blodgett films and liquid crystals and their potential for optoelectronic devices. Chapter 6 summarizes the construction of supramolecular fullerenes or carbon nanotubes based on electronic (donor–acceptor) interactions such as hydrogen-bonding or π–π interactions.

The later chapters describe the applications of fullerene derivatives and supramolecules. Chapter 7 reviews the promising field of applications to artificial photosynthesis, non-linear optics, and the preparation of photoactive highly organized films and nanostructures. Then Chapters 8 and 9 focus on applications for solar cells, with many examples that are concisely described. Chapter 10 reports the most recent progress on applications of fullerenes in biology and medicine. Chapter 11 reviews recent advances in the rapidly developing areas of covalent and non-covalent approaches to the functionalization of carbon nanotubes (CNTs), aimed at the development of multifunctional CNT materials. The chapter concludes with a survey of synthetic strategies to separate metallic and semiconducting CNTs.

The editors have done excellent work in compiling this book. As a whole, the book *Fullerenes—Principles and Applications* is an invaluable source for all chemists, physicists, and biochemists who are interested in fullerenes, carbon nanotubes, and nanomaterials. It provides the most up-to-date survey of the area, and is highly recommended.

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