Preface

Bionanotechnology is a strongly emerging multidisciplinary field fusing nanotechnology with biology. Bionanotechnology combines biological principles with physical and chemical procedures to generate nano-sized building blocks with specific functions and new properties. Bioanotechnology is a particularly interdisciplinary field, involving the development of biologically based procedures, the use of biological components and systems, the design of biocompatible objects and systems and the use of nanotechnology to support biotechnological processes.

In contrast to nanotechnology, which uses the "top down" approach, bionanotechnology employs the "bottom up" strategy to harness nature's capacity to form molecular nanostructures. These biological nanostructures (rods, particles, etc.) based on biopolymers, proteins or DNA can be either directly functionalized by manipulating the self-assembly process or the preformed natural nanostructures can serve as templates for the formation of inorganic nanostructures called biomimetics. In most cases microorganisms form these natural self-assembled nanostructures, with functionality being biologically and/or chemically controlled. Microorganisms are often used to manufacture functionalized nanostructures by metabolic engineering and/or genetic engineering. However, biocatalysts have been also successfully applied for the *in vitro* synthesis of nanostructures. The design space of these self-assembled biomolecule complexes is strongly enhanced by applying additional chemical modifications which leads to almost unlimited functionalities for medical and technological applications.

This book intends to provide a survey on the most striking and successful approaches to produce biogenic nanodevices with emphasis on the use of microorganisms for production. Chapters are dedicated to the biotechnological production of tailor-made biopolymer-based self-assembled nanostructures such as biopolyester inclusions, cyanophycin inclusions and alginates, which can be processed into nanoparticles. Other chapters summarize recent developments in protein- and DNA-based nanodevice production. The book aims to demonstrate the diversity of biological nanostructures, the implied design space and the enormous potential for applications in medicine and technology. Potential applications range from drug delivery to biocomputing.

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