
Preface

Nanoscience and technology focuses on synthesizing structures that have at least one dimension on the sub-100 nm length scale. It deals with investigating the fundamental properties of such structures, which usually differ significantly from that of the bulk material, and taking advantage of these qualities in constructing novel materials and devices or developing unique applications. Owing to widespread interest and investment, biomedical nanotechnology, or the use of nanostructures in medicinal applications, is an area of intense research that is growing and progressing at a rapid pace. This rapid development is driven by the fact that nanomaterials often offer superior capabilities when compared with conventionally used materials for the detection, diagnosis, and treatment of disease. Further, they have the potential to enable real-time disease detection and therapy and to advance point-of-care systems.

The goal of this volume is to provide an overview of biomedical nanotechnology, from the conception of novel materials in the laboratory to the application of such structures in the clinic. After a brief introductory chapter, the first section consists of protocol chapters which provide practical information on the synthesis of a variety of solution-phase and surface-bound nanomaterials and their application in sensing, imaging, and/or therapeutics; most chapters provide step-by-step instructions and insight into overcoming possible pitfalls and challenges. The chapters are written by leading researchers in biology, chemistry, physics, engineering, and medicine from academia, industry, and the national laboratories. The second section consists of a series of case study/review chapters that discuss the toxicology of nanomaterials, the regulatory pathways to US Food and Drug Administration (FDA) approval of these materials, their patenting, marketing, and commercialization, and the legal and ethical issues surrounding their use. These are written by experts in the science, social science, business, law, and ethics communities. Nanotechnology looks not only to revolutionize medical care but the fundamental property differences associated with nanomaterials and the potential for their use as multicomponent/multifunctional structures are also transforming the aspects of these fields that take part in mediating their introduction to the public.

This volume is a useful reference for scientists and researchers at all levels who are interested in working in a new area of nanoscience and technology or in expanding their knowledge base in their current field. The case study/review chapters are meant to inform scientists of routes they can take in moving their research beyond the bench, so they can design their systems with real-world considerations in mind. In turn, this volume also will be of interest to the social scientist, lawyer, or businessperson who wants to learn about the salient points of nanotechnology as they are applied to their field.

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Argonne, IL

Sarah J. Hurst



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