# Preface

Recent advances in nanotechnology have produced a variety of functional nanoparticles such as magnetic nanoparticles, quantum dots, metallic nanoparticles, silica nanoparticles, liposomes, polymersomes, dendrimers, etc. A key feature of these nanoparticles is they are easier to accumulate in the tumor than in healthy tissues. It has been found that the small size of nanoparticles can have profound impact on their mode of endocytosis, cellular trafficking, and processing. Due to the unique attributes such as electronic, magnetic, optical, and structural properties, nanoparticles have been shown to be capable of functioning either as carriers for chemotherapeutic drugs to improve their therapeutic efficacy or as therapeutic agents in photodynamic, gene, thermal, and photothermal therapy or as molecular imaging agents to detect and monitor cancer progression.

The successful integration of diagnosis and therapy on a single agent using multifunctional nanoparticles has led to the birth of a new, highly interdisciplinary research field named "nanotheranostics," which has given hope in developing innovative strategies to enable "personalized medicine" to diagnose, treat, and follow up patients with cancer.

Nanotheranostic agents may offer us a powerful tool for the in vivo assessment of drug biodistribution and accumulation at the target site, for the minimally invasive in vivo visualization of the drug release from a provided nanovehicle, and for the prediction and real-time monitoring of therapeutic outcome. Thus, constructing compact nanoformulations with highly integrated modalities is of the essence in nanotheranostics. Yet, it has been proven to be a big challenge to fuse multiple components on a single nanoscale particle for combined diagnostics and therapy.

Although efficient cancer therapy is still problematic, currently nanotheranostics develops very fast with significant achievements, fostering a new avenue for cancer therapy and diagnosis. To translate these applications into clinical use, the nanotheranostic agents must be optimized by starting with small-animal models and scaling up to nonhuman primate models. This should lay a solid foundation for the long-term development of nanotheranostics into clinical medical practice.

A survey of the recent advances and basic principles of nanotheranostics with a particular emphasis on the design and fabrication of various multifunctional

nanoparticles for cancer imaging (diagnosis) and therapy is summarized in two volumes of books entitled *Advances in Nanotheranostics I: Design and Fabrication of Theranostic Nanoparticles* and *Advances in Nanotheranostics II: Cancer Theranostic Nanomedicine*.

The volume *Advances in Nanotheranostics I: Design and Fabrication of Theranostic Nanoparticles* has three parts: Part I Gold Nanostructure-Based Theranostics, Part II Theranostic Luminescent Nanoparticles, and Part III Dendrimers and Liposomes for Theranostics. Part I includes three chapters, summarizing synthesis, surface modification, and functionalization of gold nanostructures and their use as therapeutic components, imaging contrast agents, and theranostic platforms for imaging-guided therapy. Part II contains four chapters, each focusing on one of the following: fabrication of lanthanide-doped upconversion nanoparticles, quantum dots, and organic dye-loaded nanoparticles, as well as their applications for multimodal imaging and imaging-guided drug delivery and therapy. Part III consists of three chapters, reviewing dendrimers and liposome-based nanodevices, nanoscale imaging agents, drug delivery systems, and theranostic nanosystems for cancer treatment, respectively.

The volume *Advances in Nanotheranostics II*: Cancer Theranostic Nanomedicine has the following structure: Part I Magnetic Nanoparticles for MRI-Based Theranostics, Part II Ultrasonic Theranostic Agents, and Part III Nanoparticles for Cancer Theranostics. Part I contains three chapters, describing controlled synthesis and surface modification of magnetic nanoparticles, molecular imaging of tumor angiogenesis, and MRI-based theranostics with magnetic nanoparticles. Part II consists of three chapters, summarizing ultrasound contrast agent-based multimodal imaging, drug delivery and therapy, and hollow mesoporous silica nanoparticles for magnetic resonance/ultrasound imaging-guided tumor therapy. Part III includes four chapters, demonstrating multifunctional nanoprobes for multimodality imaging and therapy of gastric cancer, nanoparticles for molecular imaging-guided gene delivery and therapy, silica nanoparticles, and micelles for cancer nanotheranostics, respectively.

It is hoped that these books will be of great interest for readers who want to follow up the exciting new development in theranostic nanomedicine. Each chapter was written by well-recognized experts in the related field. I would like to thank the authors most sincerely for their excellent contributions and congratulate them for the brilliant efforts that have resulted in these superb volumes. I also want to express my thanks to Professor Min Wang at the Department of Mechanical Engineering, University of Hong Kong, who is the Series Editor of Springer Series in Biomaterials Science and Engineering, and Springer Beijing office for providing me such a wonderful opportunity to edit these books, especially Ms. June Tang and Ms. Heather Feng for their support in publishing these volumes.

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http://www.springer.com/978-3-662-48542-2

Advances in Nanotheranostics I
Design and Fabrication of Theranosic Nanoparticles
Dai, Z. (Ed.)
2016, VIII, 336 p. 119 illus., 13 illus. in color., Hardcover
ISBN: 978-3-662-48542-2