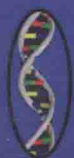


Nanotechnology Science and Technology



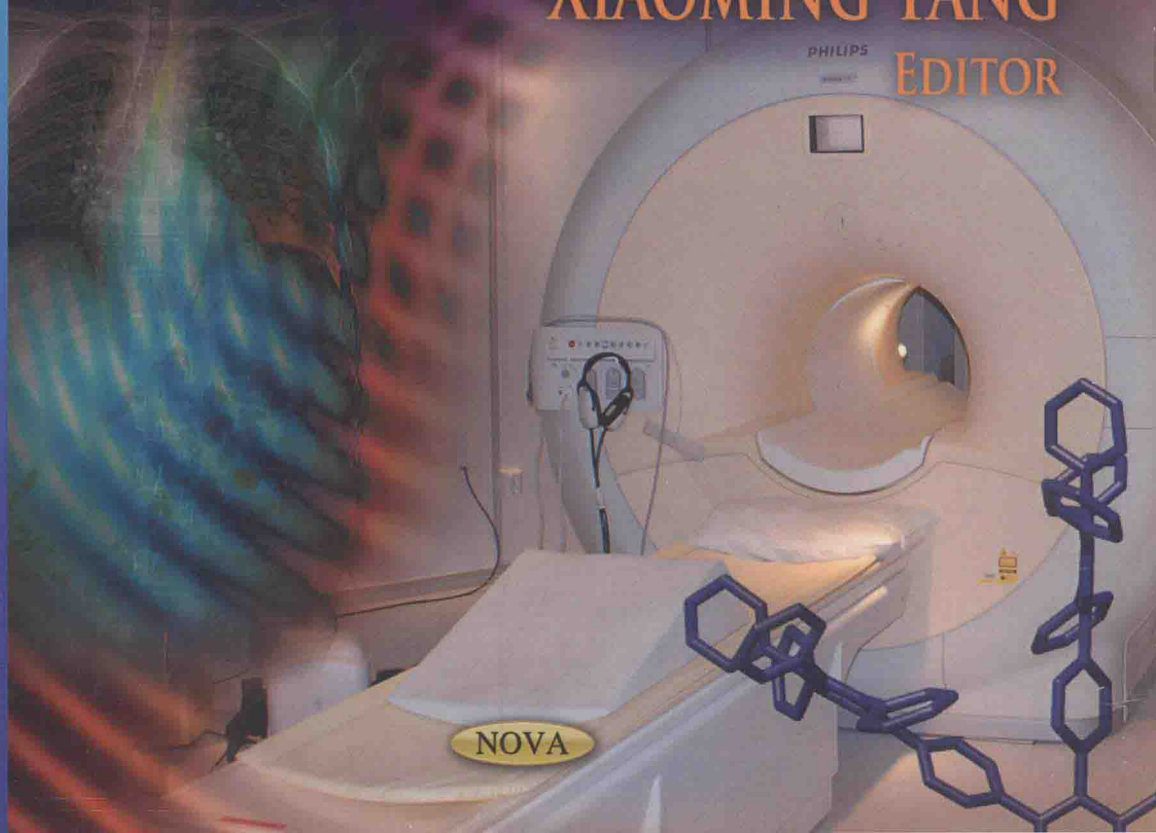
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NANOTECHNOLOGY IN MODERN MEDICAL IMAGING AND INTERVENTIONS

XIAOMING YANG
EDITOR

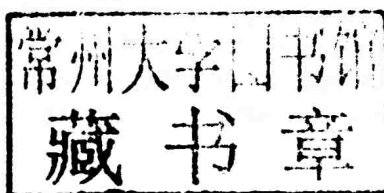


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New York

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*To my amazing family, Hongxiu, Kristiina & Karoliina,
who keep my life in perspective.*

Foreword

I am honored to have the chance to write the foreword for the textbook, *Nanotechnology in Modern Imaging and Interventions*. My enthusiasm is based upon two factors. First, it provides me the chance to recognize the excellence of the book editor, Dr. Xiaoming Yang. Secondly, it is a chance to acknowledge an area of incredibly impactful convergence bringing together minimally invasive image-guided intervention, molecular imaging and nanotechnology.

In regards to Dr. Xiaoming Yang, MD, PhD, he is a professor, interventional radiologist, and accomplished researcher in molecular imaging and interventional radiology. I met him over a decade ago, when I was a Vice Chair and he was a newly arrived junior faculty. I recall his statement to me that he thought obtaining NIH funding could be a true catalyst for his innovative work and that he was going to "submit a couple of RO1's." Not long after, I learned that both his grants were, in fact, funded, an extraordinary accomplishment for a young investigator. During the years that have followed, I have observed that extraordinary is 'ordinary' for Dr. Yang as he has relentlessly pursued the advancement of the frontiers of interventional molecular therapies and nanotechnology. He represents the substantial impact that a translational physician scientist can have continuing the tradition of imaging scientists lessening the morbidity and mortality of disease through developing and implementing improved methods for diagnosis and intervention. His work, and that of his colleagues, is taking us beyond conventional X-ray, CT, MRI and scintigraphy into molecular imaging using nanotechnology.

The ability to remotely evaluate physiologic processes in vivo was made possible with molecular imaging. Nanoparticle-based imaging, such as MR imaging with ultrasmall paramagnetic iron oxide particles, has already gained clinical acceptance. I expect to see the same with other nanoparticle-based imaging, especially those conjugated with specific ligands that target tumor cells. Nanotechnology holds great promise in future medical care and will revolutionize medical imaging.

This book will bring you current concepts and advances in nanoparticle-based imaging and imaging-guided interventions. The chapters are arranged from basic concepts to clinical questions and to innovative solutions, which are written by scientists and clinicians, some of which are faculty members of our very own highly talented faculty in the Department of Radiology at the University of Washington in Seattle. The primary goal of this book is to provide in-depth views on what are the potentials of nanoparticle-based imaging and interventional therapies, and how to bring this new technology closer to patient care.

It is my prediction that this book will serve as an essential tool in bridging the knowledge gaps between bench scientists and clinicians, and stimulate interests in multidisciplinary collaborations to speed up the application of nanotechnology in medicine. Congratulations on this great effort.

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Preface

The rapid progress of nanoscience over the last two decades has generated great interest in applying nanotechnology to modern medicine. If proven safe and successful, this new approach will not only challenge traditional concepts of disease prevention and diagnosis, but will also reshape interventional and therapeutic approaches towards various illnesses. As expected, careful selection and fine-tuning of nano/micro-scaled particles, especially those with “3-in-1” functions of imaging, targeting, and transporting, are the keys to particle-based imaging and image-guided interventions.

This can only be achieved through the cooperative, multidisciplinary effort of various scientific fields, including medical imaging, nanotechnology, material science, synthetic chemistry, molecular and cellular biology, computer science, and even others. While still in an early phase of development, particle-based imaging and interventions have already exhibited exciting potential for probing the bases or “roots” of diseases, such as identifying altered molecular profiles and/or cellular characteristics prior to the appearance of visual anatomic alterations.

As refinements of nanotechniques continue to take place, with emphasis of clinical application, nanoparticle-based imaging and intervention will have significant impact on improving global health care in the near future.

Scientists from various disciplines around the world have already done outstanding work in developing various nanotechnology-based imaging modalities, such as molecular and cellular imaging with X-ray-based computerized tomography (CT), ultrasound, magnetic resonance (MR), optics, and nuclear medicine. However, clinical applications of these new imaging techniques are still very limited.

This can be attributed to a gap existing between basic science and clinical practice; whereby, scientists have no direct access to patient care, while clinicians lack the time or means to learn such new technological evolutions. In order to bring the two parties together, a bridge needs to be built between basic science and clinical practice, as termed “translational medicine” by the US National Institute of Health (NIH).

Our primary goal for writing this book is to facilitate the translation of nanotechnology-based imaging modalities from laboratory benches to clinical practice.

The authors come from several continents around the world and are experts in the fields of nanotechnology, material science, medicine, biomedical engineering, pathology, medical imaging, and interventional radiology.

We hope this book will provoke common interest, brainstorming and cooperation among professionals in both technology and medicine, and will bring nanomedicine one step closer to improving patient care.

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