

Preface

Last decades have seen remarkable advances in computer-aided design, engineering and manufacturing technologies, multi-variable simulation tools, medical imaging, biomimetic design, rapid prototyping, micro- and nano-manufacturing methods, and information management resources, all of which are expanding the horizons of most biomedical engineering fields and the related medical device industry. Emerging areas such as tissue engineering and biofabrication, which depend on biomedical microsystems or microdevices capable of interacting with cells and tissues, such as cell culture systems, scaffolds, and advanced implants, are directly bound to these technological advances.

The present book covers such topics in depth, with an applied perspective and providing several case studies that help to analyze and understand the key factors of the different stages linked to the development of biomedical microsystems aimed at interacting at a cellular level, from the conceptual and design steps, to the (rapid) prototyping, validation, and industrialization phases. Main current research challenges and future potential are also discussed, taking into account relevant social demands and a growing market already exceeding billions of dollars. In time, advanced biomedical microdevices will decisively change procedures and result in the medical world, dramatically improving diagnoses and therapies for several types of pathologies. But if these biodevices are to fulfill present expectations, today's engineers need a thorough grounding in related design, simulation, testing and manufacturing technologies, and intimate cooperation between experts of different areas has to be promoted, as is also analyzed within this handbook.

The text is aimed at anyone working or simply interested in biomedical engineering, in the tissue engineering and biofabrication areas and in the medical devices industry, including physicians, scientists, and industrial, biomedical, chemical, electrical, and materials engineers. It is also a comprehensive introduction for students studying biomedical engineering at masters level, as well as for researchers planning to carry out a Ph.D., linked to the development of biomedical microdevices for interacting with cells and tissues, and pursuing improvements in tissue engineering materials, methods and (bio)devices, towards

effective biofabrication strategies. Designed for maximum readability, without compromising scientific rigor, this handbook provides a broad overview of these rapidly evolving disciplines, also discussing main breakthroughs and expectations.

I truly hope it might be of help for students and researchers and even motivate them to follow some of the research directions outlined.

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