

# Preface

Biomaterials science is the study of the application of materials to problems in biology and medicine. It is a field characterized by medical needs, basic research, and advanced technological developments. Tissue engineering is a relatively new field which began as a sub-field of biomaterials, and is described as an interdisciplinary field that applies the principles of engineering and life sciences to the development of biological materials that restore, maintain, or improve tissue function or a whole organ. Drug delivery is the method or process of administering a pharmaceutical compound to achieve a therapeutic effect in humans or animals. Controlled release systems, such as microspheres, have been developed and studied in order to enable release of bioactive agents in a controlled desired manner for periods of time which range from several days to several years. These systems serve for various biomedical applications, such as treatment of cancer, treatment of infections, enhancing tissue growth, etc.

When the three above-mentioned fields, i.e. biomaterials, tissue engineering and drug delivery are combined, a new approach in the field of implants and scaffolds for tissue regeneration is achieved. In this regard, biomedical implants with improved clinical performance have recently been developed and studied. The current book focuses on such new emerging novel implants, termed active implants, which are actually drug or protein-eluting implants that induce healing effects, in addition to their regular function. It is the first book to describe a broad range of active implants in terms of matrix formats, incorporated drugs and their release profiles from the implants, as well as cell-implant interactions and functions.

This book contains 18 chapters which are divided into four sections. The first section focuses on drug-eluting implants, namely stents, wound dressings, bio-adhesives and RNA interference enhanced implants, which release hydrophilic or hydrophobic active agents to the surrounding tissue. The second section is dedicated to scaffolds for bone regeneration. A broad range of polymeric structures, composites and nanostructured scaffolds are described. The third section focuses on scaffolds based on natural polymers, such as alginate, hyaluronic acid and chitosan derivatives and fucoidan, for soft tissue regeneration. The last part

describes unique synthetic polymeric systems that can be beneficial for active implants. These include new polylactones, thermosensitive polymers, mucoadhesives and intrinsically conducting polymers. The 18 chapters in this book were written by well-known experts in the field of biomaterials, tissue engineering and drug delivery, who conduct their work in 10 different countries. They present the frontier of knowledge in active implants and scaffolds for tissue regeneration.

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Active Implants and Scaffolds for Tissue Regeneration

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2011, XII, 516 p., Hardcover

ISBN: 978-3-642-18064-4