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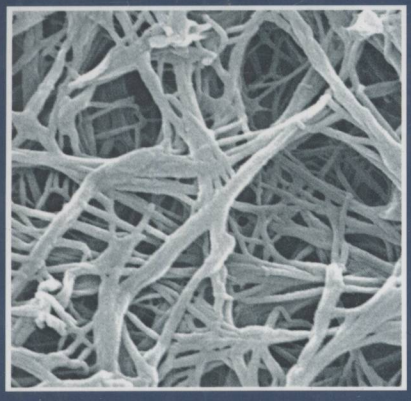

Tissue engineering using ceramics and polymers

Edited by Aldo R. Boccaccini and Julie E. Gough

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Tissue engineering using ceramics and polymers

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Introduction

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The field of tissue engineering has advanced dramatically in the last 10 years, offering the potential for regenerating almost every tissue and organ of the human body. Tissue engineering and the related discipline of regenerative medicine remain a flourishing area of research with potential new treatments for many more disease states. The advances involve researchers in a multitude of disciplines, including cell biology, biomaterials science, imaging and characterisation of surfaces and cell–material interactions. In the field of biomaterials, for example, many additional and novel processing techniques have been developed for the construction of improved porous scaffolds and matrices, including a much wider variety of polymers, ceramics and their composites with tailored micro- and nanostructure, surface topography and chemistry as well as optimised properties for the intended application in tissue engineering strategies. There are in fact many more materials being investigated for potential scaffolds, including novel uses of natural materials, combinations of natural and synthetic materials and new structures designed to mimic extracellular matrix at all relevant scales (macro, micro and nano), which are intended to provide scaffolds that are closer to the *in vivo* cellular environment. There is also strong emphasis on biomechanics and the effects of mechanical forces on the cell response and subsequent tissue formation, again, aiming to mimic the conditions *in vivo*. Along with major advances in the design of materials and control of their properties, there have been huge advances in understanding the cell biology of the cell response to artificial environments, substrates and scaffolds, with recent emphasis on the suitability of stem cells for tissue regeneration and the restoration of function.

This book aims to combine some of the most recent innovative research with reviews of specific aspects of tissue engineering to provide an up-to-date source for undergraduate, postgraduate, academic and industrial readers. Advances in the related areas of biomaterial science, cell biology and characterisation techniques are reported, and the relevance of the chosen biomaterial (polymer, ceramic) is highlighted.

Part I of this book contains chapters concerning the materials of choice for tissue engineering – polymers, ceramics, bioactive ceramics and glasses and

composites. It contains some general issues related to novel tissue engineering strategies with emphasis on transplantation of engineered tissues, surface modification of scaffolds and combined tissue engineering and drug delivery approaches. Specific chapters on state-of-the-art characterisation techniques are also included with particular reference to those techniques of major relevance to tissue engineering: X-ray photoelectron spectroscopy and secondary ion mass spectrometry, environmental scanning electron microscopy, confocal microscopy and Raman spectroscopy.

Part II of this book focuses on some specific examples of organ and tissue regeneration. It covers some of the highly challenging, more recent advances in tissue engineering such as liver, kidney, bladder, intervertebral disc, lung, cardiac tissue and intestine and also recent advances in nerve bioengineering. Some of the largest, longer-standing areas of tissue engineering research (including bone, skin and cartilage) which require new innovative approaches are covered. There has been a great deal of activity in determining and optimising new cell sources for tissue engineering which is mentioned in various areas of the book.

We hope this book will be a valuable source of information and an inspiration to new and existing researchers in the field.

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