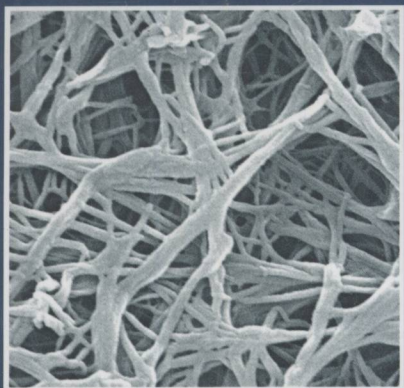


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Tissue engineering using ceramics and polymers

Edited by Aldo R. Boccaccini and Julie E. Gough



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Tissue engineering using ceramics and polymers

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Contributor contact details

(* = main contact)

Editors

Aldo R. Boccaccini
Department of Materials
Imperial College London
Prince Consort Road
London SW7 2BP
UK
E-mail: a.boccaccini@imperial.ac.uk

Julie E. Gough
Materials Science Centre
School of Materials
University of Manchester
Grosvenor Street
Manchester M1 7HS
UK
E-mail: j.gough@manchester.ac.uk

Chapter 1

J. Huang*
Department of Mechanical
Engineering
University College London
Torrington Place
London WC1E 7JE
UK
E-mail: jie.huang@ucl.ac.uk

S. M. Best
Department of Materials Science and
Metallurgy
University of Cambridge
Pembroke Street
Cambridge CB2 3QZ
UK
E-mail: smb51@cam.ac.uk

Chapter 2

Guobao Wei and Peter X. Ma*
Department of Biologic and
Materials Sciences
Department of Biomedical
Engineering
Macromolecular Science and
Engineering Center
The University of Michigan
Ann Arbor
Michigan 48109-1078
USA
E-mail: mapx@umich.edu

Chapter 3

J. R. Jones
Department of Materials
Imperial College London
South Kensington Campus
London SW7 2AZ
UK
E-mail: julian.r.jones@imperial.ac.uk

Chapter 4

S. K. Misra and A. R. Boccaccini*
Department of Materials
Imperial College London
Prince Consort Road
London SW7 2BP
UK
E-mail: a.boccaccini@imperial.ac.uk

Chapter 5

J. Mansbridge
Tecellact LLC
1685 Calle Camille
La Jolla
USA
E-mail: Verajonath@aol.com
JonathanMansbridge@yahoo.com

Chapter 6

K. Shakesheff* and G. Tsourpas
Division of Drug Delivery and Tissue
Engineering
School of Pharmacy
University of Nottingham
Nottingham NG7 2RD
UK
E-mail:
Kevin.shakesheff@nottingham.ac.uk

Chapter 7

N. Tirelli* and F. Cellesi
School of Pharmacy
University of Manchester
Oxford Road
Manchester M13 9PL
UK
E-mail:
Nicola.tirelli@manchester.ac.uk
f.cellesi@manchester.ac.uk

Chapter 8

F. Davis and S. P. J. Higson*
Cranfield Health
Cranfield University
Barton Rd
Silsoe MK45 4DT
UK
E-mail: f.davis@cranfield.ac.uk
s.p.j.higson@cranfield.ac.uk

Chapter 9

Andrew J. Urquhart and
Morgan R. Alexander*
School of Pharmacy
University of Nottingham
University Park
Nottingham NG7 2RD
UK
E-mail:
Morgan.Alexander@nottingham.ac.uk

Chapter 10

A. M. Donald
Department of Physics
Cavendish Laboratory
University of Cambridge
JJ Thomson Avenue
Cambridge CB3 0HE
UK
E-mail: amd3@cam.ac.uk

Chapter 11

S. I. Anderson
Advanced Microscopy Unit
School of Biomedical Science
E Floor Medical School
Queens Medical Centre
Clifton Boulevard
Nottingham NG7 2UH
UK
E-mail:
susan.anderson@nottingham.ac.uk

Chapter 12

I. Notingher
 School of Physics and Astronomy
 University of Nottingham
 University Park
 Nottingham NG7 2RD
 UK
 E-mail:
 ioan.notingher@nottingham.ac.uk

Chapter 13

A. Atala
 Wake Forest Institute for
 Regenerative Medicine
 Wake Forest University Health
 Sciences
 Medical Center Boulevard
 Winston-Salem
 NC 27157
 USA
 E-mail: aatala@wfubmc.edu

Chapter 14

P. Woźniak*
 Department of Biophysics and
 Human Physiology
 Medical University of Warsaw
 Ul. Chalubinskiego 5
 02-004 Warsaw
 Poland
 E-mail: pwozniak@amwaw.edu.pl
 woźniak_piotr@yahoo.com

A. J. El Haj
 Institute for Science & Technology
 in Medicine
 Keele University
 Thornburrow Drive
 Hartshill
 Stoke-on-Trent ST4 7QB
 UK
 E-mail: a.j.el.haj@bemp.keele.ac.uk

Chapter 15

L. Di Silvio
 Senior Lecturer in Biomaterials &
 Biomimetics
 King's College London Dental
 Institute
 Biomaterials Science
 Floor 17, Guy's Tower
 Guy's Campus
 St Thomas' Street
 London SE1 9RT
 UK
 E-mail: lucy.di_silvio@kcl.ac.uk

Chapter 16

Q. Z. Chen, H. Jawad, A. R.
 Boccaccini*
 Department of Materials
 Imperial College London
 Prince Consort Road
 London SW7 2BP
 UK
 E-mail: a.boccaccini@imperial.ac.uk

S. E. Harding and N. N. Ali
 National Heart and Lung Institute
 Imperial College London
 Dovehouse Street
 London SW3 6LY
 UK

Chapter 17

J. Hoyland* and T. Freemont
 Tissue Injury and Repair Group
 School of Medicine
 Stopford Building
 The University of Manchester
 Oxford Road
 Manchester M13 9PT
 UK
 E-mail:
 judith.hoyland@manchester.ac.uk
 tony.freemont@manchester.ac.uk

Chapter 18

S. MacNeil
Tissue Engineering Group
Kroto Research Institute
University of Sheffield North
Campus
Broad Lane
Sheffield S3 7HQ
UK
E-mail: s.macneil@sheffield.ac.uk

Chapter 19

K. Shakesheff
Division of Drug Delivery and Tissue
Engineering
School of Pharmacy
University of Nottingham
Nottingham NG7 2RD
UK
E-mail:
kevin.shakesheff@nottingham.ac.uk

Chapter 20

A. Saito
Division of Nephrology and
Metabolism
Department of Medicine
Tokai University School of Medicine
Bohseidai
Isehara
Kanagawa 259-1193
Japan
E-mail: asait@is.icc.u-tokai.ac.jp

Chapter 21

A. M. Turner and J. Southgate*
Jack Birch Unit of Molecular
Carcinogenesis
Department of Biology
University of York
York YO10 5YW
UK
E-mail: js35@york.ac.uk
alexturner64@doctors.org.uk

R. Subramaniam and
D. F. M. Thomas
Department of Paediatric Urology
St James's University Hospital
Leeds LS9 7TF
UK
E-mail: Ramnath.Subramaniam
@leedsth.nhs.uk
D.F.M.Thomas@leeds.ac.uk

Chapter 22

P. Kingham* and G. Terenghi
Blond McIndoe Laboratories
Tissue Injury and Repair Group
3.106 Stopford Building
The University of Manchester School
of Medicine
Oxford Road
Manchester M13 9PT
UK
E-mail:
paul.j.kingham@manchester.ac.uk
giorgio.terenghi@manchester.ac.uk

Chapter 23

A. E. Bishop* and H. J. Rippon
Stem Cells & Regenerative Medicine
Section on Experimental Medicine &
Toxicology
Imperial College Faculty of Medicine
Hammersmith Campus
Du Cane Road
London W12 0NN
UK
E-mail: a.e.bishop@imperial.ac.uk
hj.rippon@imperial.ac.uk

Chapter 24

D. A. J. Lloyd* and S. M. Gabe
St Mark's Hospital
Northwick Park
Harrow HA1 3UJ
UK
E-mail: dajl@btinternet.com
s.gabe@imperial.ac.uk

Chapter 25

A. Fritsch and L. Dormieux
Laboratory for Materials and
Structures
Ecole Nationale des Ponts et
Chaussées (LMSGC-ENPC)
Marne-la-Vallée
France

C. Hellmich*

Vienna University of Technology
Karlsplatz 13/E 202
1040 Wien
Austria
E-mail:
christian.hellmich@tuwien.ac.at

J. Sanahuja
Lafarge Research Center
San-Quentin Fallavier
France

Chapter 26

J. E. Gough
Materials Science Centre
School of Materials
University of Manchester
Grosvenor Street
Manchester M1 7HS
UK
E-mail: j.gough@manchester.ac.uk

Introduction

J E GOUGH, University of Manchester, UK and
A R BOCCACCINI, Imperial College London, UK

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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