

Contents

Part A	General Aspects	1
I	General and Ethical Aspects	3
1	The History of Tissue Engineering and Regenerative Medicine in Perspective	5
	<i>U. Meyer</i>	
2	Economic Modeling and Decision Making in the Development and Clinical Application of Tissue Engineering	13
	<i>P. Vavken, R. Doroška, M. Gruber</i>	
3	Ethical Issues in Tissue Engineering	23
	<i>P. Gelhaus</i>	
4	Sourcing Human Embryonic Tissue: The Ethical Issues	37
	<i>C. Rehmman-Sutter, R. Porz, J.L. Scully</i>	
5	Tissue Engineering and Regenerative Medicine. Their Goals, Their Methods and Their Consequences from an Ethical Viewpoint	47
	<i>E. Schockenhoff</i>	
Part B	Biological Considerations	57
II	Tissue and Organ Differentiation	59
6	Control of Organogenesis: Towards Effective Tissue Engineering	61
	<i>M. Unbekandt, J. Davies</i>	
7	Cytokine Signaling in Tissue Engineering	71
	<i>T. Meyer, V. Ruppert, B. Maisch</i>	
8	Influence of Mechanical Effects on Cells. Biophysical Basis	83
	<i>D. Jones</i>	

Part C Engineering Strategies	89
III Engineering at the Genetic and Molecular Level	91
9 Towards Genetically Designed Tissues for Regenerative Medicine	93
<i>W. Weber, M. Fussenegger</i>	
10 Posttranscriptional Gene Silencing	109
<i>V. Ruppert, S. Pankuweit, B. Maisch, T. Meyer</i>	
11 Biomolecule Use in Tissue Engineering	121
<i>R. A. Depprich</i>	
IV Engineering at the Cellular Level	137
12 Fetal Tissue Engineering: Regenerative Capacity of Fetal Stem Cells	139
<i>P. Wu, D. Moschidou, N. M. Fisk</i>	
13 Embryonic Stem Cell Use	159
<i>J. Handschel, U. Meyer, H. P. Wiesmann</i>	
14 The Unrestricted Somatic Stem Cell (USSC) From Cord Blood For Regenerative Medicine	167
<i>G. Kögler</i>	
15 Mesenchymal Stem Cells: New Insights Into Tissue Engineering and Regenerative Medicine	177
<i>F. Djouad, R. S. Tuan</i>	
16 Stem Cell Plasticity: Validation Versus Valedictory	197
<i>N. D. Theise</i>	
V Engineering at the Tissue Level	209
17 Bone Tissue Engineering	211
<i>U. Meyer, H. P. Wiesmann, J. Handschel, N. R. Kübler</i>	
18 Cartilage Engineering	233
<i>J. Libera, K. Ruhnau, P. Baum, U. Lüthi, T. Schreyer, U. Meyer, H. P. Wiesmann, A. Herrmann, T. Korte, O. Pullig, V. Siodla</i>	
19 Muscle Tissue Engineering	243
<i>M. P. Lewis, V. Mudera, U. Cheema, R. Shah</i>	

20 Tendon and Ligament Tissue Engineering: Restoring Tendon/ Ligament and Its Interfaces	255
<i>J. J. Lim, J. S. Temenoff</i>	
21 Neural Tissue Engineering and Regenerative Medicine	271
<i>N. Zhang, X. Wen</i>	
22 Adipose Tissue Engineering	289
<i>T. O. Acartürk</i>	
23 Intervertebral Disc Regeneration	307
<i>J. Libera, Th. Hoell, H.-J. Holzhausen, T. Ganey, B. E. Gerber, E. M. Tetzlaff, R. Bertagnoli, H.-J. Meisel, V. Siodla</i>	
24 Tissue Engineering of Ligaments and Tendons	317
<i>P. Vavken</i>	
25 Tissue Engineering of Cultured Skin Substitutes	329
<i>R. E. Horch</i>	
26 Dental Hard Tissue Engineering	345
<i>J. M. Mason, P. C. Edwards</i>	
27 Mucosa Tissue Engineering	369
<i>G. Lauer</i>	
28 Tissue Engineering of Heart Valves	381
<i>C. Lüders, C. Stamm, R. Hetzer</i>	
VI Engineering at the Organ Level	387
29 Breast Tissue Engineering	389
<i>E. Geddes, X. Wu, C. W. Patrick Jr.</i>	
30 Bioartificial Liver	397
<i>J.-K. Park, S.-K. Lee, D.-H. Lee, Y.-J. Kim</i>	
31 Pancreas Engineering	411
<i>R. Cortesini, R. Calafiore</i>	
32 Tissue-Engineered Urinary Bladder	429
<i>A. M. Turner, J. Southgate</i>	
33 Cell-Based Regenerative Medicine for Heart Disease	441
<i>C. Stamm, C. Lüders, B. Nasser, R. Hetzer</i>	

Part D Technical Aspects	453
VII Biomaterial Related Aspects	455
34 Biomaterials	457
<i>H. P. Wiesmann, U. Meyer</i>	
35 Biomaterial-Related Approaches: Surface Structuring	469
<i>G. Jell, C. Minelli, M. M. Stevens</i>	
36 Mineralised Collagen as Biomaterial and Matrix for Bone Tissue Engineering	485
<i>M. Gelinsky</i>	
37 Hydrogels for Tissue Engineering	495
<i>J. Teßmar, F. Brandl, A. Göpferich</i>	
VIII Scaffold Related Aspects	519
38 Defining Design Targets for Tissue Engineering Scaffolds	521
<i>S. J. Hollister, E. E. Liao, E. N. Moffitt, C. G. Jeong, J. M. Kempainen</i>	
39 Scaffold Structure and Fabrication	539
<i>H. P. Wiesmann, L. Lammers</i>	
40 Prospects of Micromass Culture Technology in Tissue Engineering	551
<i>J. Handschel, H. P. Wiesmann, U. Meyer</i>	
IX Laboratory Aspects and Bioreactor Use	557
41 Laboratory Procedures – Culture of Cells and Tissues	559
<i>C. Naujoks, K. Berr, U. Meyer</i>	
42 Bioreactors in Tissue Engineering: From Basic Research to Automated Product Manufacturing	595
<i>D. Wendt, S. A. Riboldi</i>	
43 The Evolution of Cell Printing	613
<i>B. R. Ringeisen, C. M. Othon, J. A. Barron, P. K. Wu, B. J. Spargo</i>	
44 Biophysical Stimulation of Cells and Tissues in Bioreactors ...	633
<i>H. P. Wiesmann, J. Neunzehn, B. Kruse-Lösler, U. Meyer</i>	
45 Microenvironmental Determinants of Stem Cell Fate	647
<i>R. L. Mauck, W-J. Li, R. S. Tuan</i>	

Part E Transplantation Issues	665
X Functional Aspects in Biological Engineering	667
46 Perfusion Effects and Hydrodynamics	669
<i>R. A. Peattie, R. J. Fisher</i>	
47 Ex Vivo Formation of Blood Vessels	685
<i>R. Y. Kannan, A. M. Seifalian</i>	
48 Biomechanical Function in Regenerative Medicine	693
<i>B. David, J. Pierre, C. Oddou</i>	
49 Influence of Biomechanical Loads	705
<i>U. Meyer, J. Handschel</i>	
XI Immune System Issues	719
50 Innate and Adaptive Immune Responses in Tissue Engineering	721
<i>L. W. Norton, J. E. Babensee</i>	
51 Toll-Like Receptors: Potential Targets for Therapeutic Interventions	749
<i>S. Pankuweit, V. Ruppert, B. Maisch, T. Meyer</i>	
XII Study Design Principles	757
52 Tissue Engineered Models for In Vitro Studies	759
<i>C. R. McLaughlin, R. Osborne, A. Hyatt, M. A. Watsky, E. V. Dare, B. B. Jarrold, L. A. Mullins, M. Griffith</i>	
53 In Vivo Animal Models in Tissue Engineering	773
<i>J. Haier, F. Schmidt</i>	
54 Assessment of Tissue Responses to Tissue-Engineered Devices	781
<i>K. Burugapalli, J. C. Y. Chan, A. Pandit</i>	
Part F Clinical Use	797
XIII Clinical Application	799
55 Evidence-based Application in Tissue Engineering and Regenerative Medicine	801
<i>U. Meyer, J. Handschel</i>	

56 Tissue Engineering Applications in Neurology	815
<i>E. L. K. Goh, H. Song, G.-Li Ming</i>	
57 Tissue Engineering in Maxillofacial Surgery	827
<i>H. Schliephake</i>	
58 Tissue Engineering Strategies in Dental Implantology	839
<i>U. Joos</i>	
59 Tissue Engineering Application in General Surgery	855
<i>Y. Nahmias, M. L. Yarmush</i>	
60 Regeneration of Renal Tissues	869
<i>T. Aboushwareb, J. J. Yoo, A. Atala</i>	
61 Tissue Engineering Applications in Plastic Surgery	877
<i>M. D. Kwan, B. J. Slater, E. I. Chang, M. T. Longaker, G. C. Gurtner</i>	
62 Tissue Engineering Applications for Cardiovascular Substitutes	887
<i>M. Cimini, G. Tang, S. Fazel, R. Weisel, R.-K. Li</i>	
63 Tissue Engineering Applications in Orthopedic Surgery	913
<i>A. C. Bean, J. Huard</i>	
64 Tissue Engineering and Its Applications in Dentistry	921
<i>M. A. Ommerborn, K. Schneider, W. H.-M. Raab</i>	
65 Tissue Engineering Applications in Endocrinology	939
<i>M. R. Hammerman</i>	
66 Regenerative Medicine Applications in Hematology	951
<i>A. Wiesmann</i>	
67 The Reconstructed Human Epidermis Models in Fundamental Research	967
<i>A. Coquette, Y. Poumay</i>	
XIV Clinical Handling and Regulatory Issues	977
68 Regulatory Issues	979
<i>B. Lüttenberg</i>	
Subject Index	983