

Contents

<i>Preface</i>	ix
<i>Acknowledgements</i>	xi
<i>Synopsis</i>	xiii
1 Introduction	1
1.1 Cell Culture: Historical Perspective	1
1.2 Cell Culture: 2D vs. 3D	3
2 Significance of Tissue-Specific Extracellular Microenvironment (ECM)	13
2.1 Introduction	13
2.1.1 What Is ECM?	15
2.1.2 Tissue Specificity of ECM	20
2.1.3 Essential/Representative Components of ECM	22
2.1.3.1 Collagens (fibrillar and structural)	27
2.1.3.2 Elastin (elastic)	36
2.1.3.3 Microfibril associated macromolecules (fibrillar)	38
2.1.3.4 Laminin (adhesive)	43
2.1.3.5 Fibronectin (adhesive)	45
2.1.3.6 Matricellular (anti-adhesive)	49
2.1.3.7 Matrikines and matricryptins	52
2.1.3.8 Proteoglycans	53
2.1.3.9 Glycosaminoglycans (GAGs)	61
2.1.3.10 Hyaluronan (hyaluronic acid)	61
2.2 Cell-Cell Interaction	64
2.3 Cell-Effector Interaction	65
2.4 Cell-ECM Interaction	66
2.4.1 Protrusive Contacts	66

2.4.2	Contractile Contacts	70
2.4.3	Mechanically Supportive Contacts	70
2.5	ECM Related Disorders	74
2.6	Conclusion	79
2.6.1	Classification	79
2.6.2	Inter & Intramolecular ECM Interactions	80
2.6.3	Implications	81
3	ECM Mimicking for 3D Cell Culture	103
3.1	3D Cell Culture (Introduction)	103
3.1.1	Significance of ECM Mimicking	104
3.1.2	ECM Mimicking/Reconstitution	107
3.1.2.1	Physical mimicking	108
3.1.2.2	Biochemical mimicking	110
3.1.2.3	Mechanical mimicking	110
3.1.2.4	ECM mimicking through organ/tissue decellularization	113
3.1.3	Need for Compatible Cell-Types	114
3.2	Models for 3D Cell Culture	115
3.2.1	Spheroids	115
3.2.2	Hydrogels	116
3.2.3	Scaffolds and Matrices	118
3.3	Materials for 3D Cell Culture	119
3.3.1	Natural	120
3.3.2	Synthetic	121
3.3.3	Hybrid	122
3.3.3.1	Physical blends	123
3.3.3.2	Chemical blends	125
3.4	Methods of Creating Scaffold/Matrices for 3D Culture	125
3.4.1	Conventional Techniques	126
3.4.1.1	Solvent casting/melt molding	126
3.4.1.2	Extrusion	126
3.4.1.3	Molding with particle leaching	127
3.4.1.4	Gel casting and freeze drying	127
3.4.1.5	Thermally induced phase transition/gas foaming	128
3.4.1.6	Fiber bonding	128

3.4.1.7	Microsphere sintering	128
3.4.1.8	Micro-contact printing	128
3.4.2	Advanced Techniques	128
3.4.2.1	Electrospinning	129
3.4.2.2	Rapid prototyping or solid free form fabrication	130
3.4.2.3	Emulsion templating	132
3.4.2.4	Micromolding	133
3.4.2.5	Photoplatting/photolithography	133
3.4.2.6	Designed self-assembly	134
3.5	Applications of 3D Scaffolds/Matrices	138
3.5.1	In Research and Development	138
3.5.2	Diagnostics	139
3.5.3	Cell-Based Sensors	140
3.5.4	High Throughput Screening	141
3.5.5	Biotech Industry	141
3.5.6	Drug Delivery	142
3.5.7	Biochemical Replacement	142
3.5.8	In Tissue Engineering (TE)	142
3.5.8.1	Ex vivo organ model	143
3.5.8.2	Tissue explants	144
3.5.8.3	In vivo tissue regeneration	144
3.5.9	Human-Organoid Models for Physiology	145
4	Scaffolds/Matrices for 3D Cell/Tissue Culture	159
4.1	Introduction	159
4.2	Non-specific in vitro 3D Culture	165
4.3	Tissue Engineering	165
4.4	Regenerative Medicine	167
4.4.1	In situ	167
4.4.2	Ex situ	167
4.5	Available Technologies	168
4.5.1	Matrigel	170
4.5.2	Alvetex®	171
4.5.3	3D-Biotek®	172
4.5.4	AlgiMatrix® 3D Cell Culture System	172
4.5.5	PuraMatrix®	173
4.5.6	Integra®	174

4.5.7	PriMatrix	176
4.5.8	Hyalubrix®/Hyalgan	176
4.5.9	Extracel™	177
4.5.10	Mebiol	178
4.5.11	UpCell™	179
4.5.12	BioVaSc-TERM®	180
4.5.13	Corgel®	180
4.5.14	Opsite, Biobrane and Oasis® Wound Matrix	181
4.5.15	Cyto-Matrix	182
4.5.16	AmnioGraft®	182
4.5.17	Artiss/Tisseel	183
4.5.18	ECM Analog®	185
4.6	Future Trends/Challenges Ahead	187
<i>Recommended Reading</i>		197
<i>Glossary</i>		199
<i>Index</i>		203