

Contents

Preface

Part 1 Fundamentals of Cell Engineering

Chapter 1	Introduction to Cell Engineering	3
1.1	Bioengineering	3
1.2	Cell Engineering	7
Chapter 2	Cell Engineering Basics	14
2.1	Composition of Cells	14
2.2	Cell Cycle & Division	20
2.3	Cell Apoptosis & Cytoclasia	23
2.4	Differentiation & Dedifferentiation	24
2.5	Tissue & Organ	26
2.6	Reproduction & Development	26

Part 2 Plant Cell Engineering

Chapter 3	Plant Tissue & Organ Culture	35
3.1	Plant Tissue Culture	35
3.2	Plant Embryo Culture	48
3.3	Hairy Root Culture	49
Chapter 4	Artificial Seeds & Virus-Free of Plants	55
4.1	Artificial Seeds	55
4.2	Virus Elimination of Plants	57
Chapter 5	Plant Cell Culture & Preparation of Secondary Metabolites	62
5.1	Plant Cell Culture and Its Characteristics	62
5.2	Plant Cell Culture Techniques	63
5.3	Production of Secondary Metabolites by Plant Cell Culture	73
Chapter 6	Protoplast Culture & Mutagenesis	80
6.1	Protoplast Culture	80
6.2	Protoplast Mutagenesis	83
Chapter 7	Cell Fusion & Somatic Cell Hybridization	85
7.1	Cell Fusion	85
7.2	Somatic Hybridization	90

Chapter 8	Polyloid and Haploid Plants	94
8.1	Chromosome Engineering	94
8.2	Polyloid Plants	94
8.3	Haploids and Homozygous Diploid Plants	98
Chapter 9	<i>In Vitro</i> Fertilization	104
9.1	Plant <i>in Vitro</i> Fertilization	104
9.2	<i>In Vitro</i> Pollination	105
9.3	<i>In Vitro</i> Fertilization	105
Chapter 10	Transgenic Techniques	108
10.1	Transgenic Plants	108
10.2	Genetically Modified Plants	113
10.3	Biopharmaceutical Transgenic Plants	114
10.4	Safety of Transgenic Plants	115

Part 3 Animal Cell Engineering

Chapter 11	Animal Cell Culture & Preparation and Expression of Medicinal Proteins	119
11.1	Animal Cell Culture	119
11.2	Characteristics of Animal Cell Culture	120
11.3	Culture Tools and Conditions	123
11.4	Growth of <i>in Vitro</i> Cultured Cells	128
11.5	Cell Line/Strain and Preservation	132
11.6	Small-Scale Animal Cell Culture Methods	135
11.7	Large-Scale Animal Cell Culture	137
11.8	Animal Cell Culture Bioreactors	141
11.9	Factors of Large-Scale Animal Cell Culture	143
11.10	Preparation of Pharmaceutical Proteins with Animal Cells	146
Chapter 12	Hybridoma Technology and Monoclonal Antibody	160
12.1	Hybridoma Technology	160
12.2	Monoclonal Antibody	161
12.3	Humanized Monoclonal Antibody	167
Chapter 13	<i>In Vitro</i> Fertilization & Animals Cloned by Nuclear Transfer	170
13.1	Embryo Technique	170
13.2	IVF Animals	170
13.3	Test-Tube Baby	176
13.4	Animals Cloned by Nuclear Transfer	179
13.5	Cryopreservation Technique	185
13.6	Mammalian Sex Control	190

Chapter 14	Polyploid and Transgenic Animals	194
14.1	Polyploid Animals	194
14.2	Transgenic Animals	196
Chapter 15	Stem Cells	202
15.1	Characteristics of Stem Cells	202
15.2	Embryonic Stem Cells	203
15.3	Adult Stem Cells	209
Chapter 16	Tissue Engineering	213
16.1	Tissue Engineering and Its Three Elements	213
16.2	Technical Routes of Tissue Engineering	217
16.3	Tissue Engineering Bioreactors	218
16.4	Tissue Engineering Products	219
Index		221

*Fundamentals of Cell
Engineering*