Contact "Library Services" : info@dss.go.th

Contents

Pre Lis	face t of C	Contributors	xiii xv
1.	Prot Aza	tocols for Biomaterial Scaffold Fabrication adeh Seidi and Murugan Ramalingam	1
	1.1	Introduction	1
	1.2	Scaffolding Materials	4
		1.2.1 Naturally Derived Materials	4
		1.2.2 Scaffolds Based on Synthetic Polymers	7
	1.3	Techniques for Biomaterial Scaffolds Fabrication	7
		1.3.1 Solvent Casting	8
		1.3.2 Salt-leaching	8
		1.3.3 Gas Foaming	11
		1.3.4 Phase Separation	12
		1.3.5 Electrospinning	13
		1.3.6 Self-assembly	15
		1.3.7 Rapid Prototyping	16
		1.3.8 Membrane Lamination	18
		1.3.9 Freeze Drying	18
	1.4	Summary	19
	Ack	cnowledgements	20
	Refe	erences	20
2.	Cer Sey	amic Scaffolds, Current Issues and Future Trends ed-Iman Roohani-Esfahani S.I and Hala Zreigat H	25
	2.1	Introduction	25
	2.2	Essential Properties and Current Problems	
		of Ceramic Scaffolds	27
	2.3	Approaches to Overcome Ceramic Scaffolds	
		Issues for the Next Generation of Scaffolds	30
	2.4	Silk – a Bioactive Material	35
	2.5	Conclusions and Future Trends	35

	Ack	nowledgements	36
	Ref	erences	36
3.	Pre	paration of Porous Scaffolds from Ice Particulate	
	Ten	nplates for Tissue Engineering	47
	Gu	oning Chen and Naoki Kawazoe	
	3.1	Introduction	48
	3.2	Preparation of Porous Scaffolds Using Ice	10
	0.2	Particulates as Porogens	48
	3.3	Preparation of Funnel-like Porous Scaffolds	
		Using Embossed Ice Particulate Templates	51
		3.3.1 Overview of Protocol	51
		3.3.2 Preparation of Funnel-like Collagen Sponges	51
		3.3.3 Preparation of Funnel-like Chitosan Sponges	54
		3.3.4 Preparation of Funnel-like Hyaluronic	
		Acid Sponges	55
		3.3.5 Preparation of Funnel-like	
		Collagen-glycosaminoglycan Sponges	55
	3.4	Application of Funnel-like Porous Scaffolds	
		in Three-dimensional Cell Culture	56
	3.5	Application of Funnel-like Collagen Sponges	
		in Cartilage Tissue Engineering	57
	3.6	Summary	60
	Refe	erences	60
4.	Fab	rication of Tissue Engineering Scaffolds Using	
	the	Emulsion Freezing/Freeze-drying Technique and	
	Cha	uracteristics of the Scaffolds	63
	Naz	nin Sultana and Min Wang	
	4.1	Introduction	64
	4.2	Materials for Tissue Engineering Scaffolds	65
	4.3	Fabrication Techniques for Tissue	
		Engineering Scaffolds	68
	4.4	Fabrication of Pure Polymer Scaffolds via	
		Emulsion Freezing/Freeze-drying and	
		Characteristics of the Scaffolds	70
	4.5	Fabrication of Polymer Blend Scaffolds via	
		Emulsion Freezing/Freeze-drying and	
		Characteristics of the Scaffolds	78
	4.6	Fabrication of Nanocomposite Scaffolds via	
		Emulsion Freezing/Freeze-drying and	
		Characteristics of the Scaffolds	80

	4.7	Surfa	ce Modification for PHBV-based Scaffolds	85
	4.8	Concl	uding Remarks	87
	Ack	nowled	Igements	87
	Refe	erences	-	88
5.	Elec	trospu	n Nanofiber and Stem Cells in Tissue	
	Eng	ineerii	ng	91
	Sus	an Liac	o, Seeram Ramakrishna and	
	Mut	rugan I	Ramalingam	
	5.1	Introc	luction	92
	5.2	Biode	gradable Materials for Tissue Engineering	93
	5.3	Nano	fibrous Scaffolds	97
		5.3.1	Technologies to Fabricate Nanofibers	98
		5.3.2	In Vitro and In Vivo Studies of Nanofibrous	20
		0.012	Scaffold	103
	54	Stem	Cells: A Potential Tool for Tissue	100
	0.1	Engin	eering	108
		541	Stem Cells in Tissue Engineering	100
		0.1.1	and Regeneration	108
		542	Effect of Stem Cells on Electrospun	100
		0.1.4	Nanofibrous Scaffolds	111
	55	Prosn	erts	113
	Ack	nowlea	lgement	115
	Refe	erences		115
6	Mat	oriale	at the Interface Tissue-Implant	110
0.	Ant	eria D	at the interface fissue-inipiant	117
	Ant	Unio Po	luction	120
	6.1	Decer	inclion	120
	0.Z	Descr	iption of the fissue-implant interface	121
	0.3	Expec	ted Function of the Materials at the	100
			Can and their Evaluation and Selection	123
		6.3.1	General Purpose Non-biological	107
		())	Materials	127
		6.3.2	General Purpose Natural Materials	100
		(and Biopolymers	128
		6.3.3	Other Regenerative Biomaterials	120
		621	Entre Ammonthes	129
	61	0.3.4 Eve	Future Approaches	129
	0.4	Exper	intental lechniques for the lissue-implant	120
	65	Interf		130
	0.3 D.f	Concl	usion	133
	Kete	erences		133

7.	Mes	senchy	mal Stem Cells in Tissue Regeneration	137		
	Kalj	pana S	. Katti, Avinash A. Ambre,			
	and	Dines	h R. Katti			
	7.1	7.1 Introduction				
	7.2	Meser	nchymal stem cells (MSCs)	140		
		7.2.1	Self-renewal of MSCs	142		
		7.2.2	Heterogeneity of MSCs	143		
		7.2.3	MSCs from Different Types of Tissues	144		
		7.2.4	MSCs, Progenitor Cells and Precursor Cells	144		
		7.2.5	Differentiation Potential of MSCs	145		
		7.2.6	Dedifferentiation and Transdifferentiation			
			of hMSCs	146		
	7.3	Unde	rstanding the Mesenchymal Stem			
		Cells	(MSCs)	147		
		7.3.1	Integrins and Their Role in Mesenchymal			
			Stem Cells (MSCs)	147		
		7.3.2	Mesenchymal Stem Cell (MSC) Niche	149		
		7.3.3	Immunomodulatory Effect of MSCs	150		
	7.4	Meser	nchymal Stem Cell (MSC) Culture	150		
		7.4.1	Mesenchymal Stem Cell (MSC) Isolation	151		
		7.4.2	Mesenchymal Stem Cell (MSC) Expansion	151		
		7.4.3	Media for Inducing Osteogenic			
			Differentiation in MSCs	152		
	7.5	Chara	acterization of MSCs	153		
		7.5.1	Microscopy Techniques	154		
		7.5.2	Differentiation and Cell Proliferation			
			Assays for MSCs	155		
	7.6	MSCs	in Bone Remodeling, Fracture Repair and			
		Their	Use in Bone Tissue Engineering Applications	156		
	7.7	Influe	ence of External Stimuli on MSC Behavior	157		
		7.7.1	Role of Mechanical Stimulus on hMSCs	158		
		7.7.2	Role of Electrical Stimulus on MSCs	159		
	7.8	Persp	ectives on Future of hMSCs in Tissue			
		Engin	leering	159		
	Refe	erences		160		
8.	End	ochon	dral Bone Tissue Engineering	165		
	San	ne K. B	Both, Fang Yang, and John A. Jansen			
	8.1	Introc	luction	165		
	8.2	Tissue	e Engineering and Stem Cells	169		

		8.2.1	Tissue Engineering	1	169
		8.2.2	Stem Cells	1	170
		8.2.3	Bone Tissue Engineering	1	171
		8.2.4	Bone Tissue Engineering via the		
			Endochondral Pathway	1	172
	8.3	Scaffe	olds	1	173
		8.3.1	General Requirements of Scaffolds]	173
		8.3.2	Scaffolds for Endochondral Tissue		
			Engineering	1	175
			8.3.2.1 Hydrogels]	176
			8.3.2.2 Synthetic Polymer Woven St	ructure 1	177
			8.3.2.3 Calcium Phosphate (CaP) Ce	eramics 1	178
	8.4	Sumn	nary	1	179
	Refe	erences	2	1	180
_					
9.	Prir	iciples,	Applications, and Technology of	_	
	Cra	niofaci	al Bone Engineering		183
	Mo	na K. M	larei, Mohamed A. Alkhodary,		
	Ran	ia M. I	Elbackly, Samer H. Zaky, Ahmed M. E	Eweida,	
	Mul	hamma	d A. Gad, Naglaa Abdel-Wahed and		
	Yas	ser M. 1	Kadah		
	9.1	Introc	luction	1	184
		9.1.1	Anatomy and Physiology of		
			Craniofacial Bone	1	185
		9.1.2	Functional Characteristics		
			of Craniofacial Tissues	1	190
			9.1.2.1 Bone Strength	1	190
			9.1.2.2 Effect of Forces	1	191
			9.1.2.3 Angiogenesis in Bone Physic	ology 1	192
		9.1.3	Prevalence of Craniofacial Congenita	1	
			Anomalies and Acquired Defects	1	192
			9.1.3.1 Congenital Anomalies	1	192
			9.1.3.2 Acquired Defects	1	193
	9.2	Road	Map for the Application of Tissue Eng	ineering	
		and R	egenerative Medicine for Craniofacial	Bone	
		Reger	ieration	1	195
		9.2.1	Vascularization and Its Strategies	1	197
	9.3	Stem	Cell-based Craniofacial Bone Engineer	ing 1	199
		9.3.1	The Stem Cell Concept: Recreating the	Local	
		Tissue	Microenvironment	2	200

		9.3.2	Applied	d Stem Cell-based Craniofacial Bone	
			Engine	ering	201
		9.3.3	Additic	onal Viable Stem Cell Sources	
			for Cra	niofacial Bone Engineering	204
	9.4	Bioma	aterial-ba	ased Therapy in Craniofacial	
		Bone	Engineer	ring	206
		9.4.1	Surface	Biomimetism	210
	9.5	Princi	ples of I	maging in Craniofacial	
		Bone	Regenera	ation	212
		9.5.1	Modeli	ng of, Preparation for, and Planning	
			Tissue l	Engineering	212
		9.5.2	Image (Guided Design	215
		9.5.3	Follow-	up and Assessment	216
		9.5.4	Medica	l Imaging Techniques for Craniofacial	
			Bone Er	ngineering	218
			9.5.4.1	Plain X-rays	218
			9.5.4.2	Computed Tomography (CT)-based	
				Methods	218
			9.5.4.3	Magnetic Resonance Imaging	219
			9.5.4.4	Future Methods: High Frequency	
				Ultrasound Imaging	220
	9.6	Curre	nt Clinic	al Application and Future Direction	
		in the	Field of	Craniofacial Bone Engineering	220
		9.6.1	Current	t Treatments of Bone Defects	220
		9.6.2	Moderr	n Treatment of Bone Defects	221
		9.6.3	Some E	xamples of Tissue Engineering	
			Materia	ls and Clinical Trials	223
	9.7	Futur	e Prospe	cts	225
	9.8	Econo	mics and	l Marketing	225
	9.9	Concl	usions		226
	Refe	erences			226
10	Erre	- 1 :	In Cash	d Biominatia Magazlar Crafta (ar	
10.	Fun	ctional	Tissue D	ed blomimetic vascular Grafts for	02E
			Tissue K	Next 1 K We have	233
	<i>vinc</i>	by Ino	mas ana	rogesn K. vonra	000
	10.1			n Vegenden Tigene En sin geninge	230
	10.2	App	roacnes 1	n vascular fissue Engineering	237
	10.3		JStructur	eu Scanolus for vascular fissue	220
			neering	popping for Producing	239
		10.3.	I Electi	ister Eihere	041
			ECM	-like fiders	241

		10.3.2	Biomim	etic Electrospun Vascular	
			Scaffold	S	244
	10.4	Function	onally-Gr	aded Tubular Scaffolds	247
		10.4.1	Graded-	Tissue Design in Native	
			Vessels		247
			10.4.1.1	Biomimetic Multi-layered	
				Tubular Scaffolds	249
			10.4.1.2	Mechanical Properties of	
				Trilayered Tubular Grafts	251
		10.4.2	Biodegra	adation Characteristics	
			of Trilay	rered Grafts	255
		10.4.3	In Vitro	Cell Interactions and In Vivo	
			Perform	ance	260
	10.5	Summ	ary and F	uture Outlook	266
	Ackr	lowledg	ements		267
		List of	Abbrevia	tions Used	268
	Refe	rences			269
11	x 7				
TT.	vasci	ular Enc	lothelial	Growth Factors in Tissue	
11.	Vasci Engi	ular Enc neering	lothelial (Challen;	ges and Prospects	
11.	Vasci Engi for T	ular Enc neering herapeu	lothelial Challen itic Angio	ges and Prospects ogenesis	275
11.	Vasci Engi for T Ekat	ular Enc neering herapeu <i>erina</i> S.	lothelial : Challen itic Angio <i>Lifirsu, N</i>	Growth Factors in Tissue ges and Prospects ogenesis <i>Aurugan Ramalingam</i> ,	275
11.	Vasci Engi for T Ekat and Z	ular Enc neering herapeu <i>erina S.</i> Ziyad S.	lothelial : Challen itic Angio <i>Lifirsu, N</i> Haidar	Growth Factors in Tissue ges and Prospects ogenesis <i>Aurugan Ramalingam</i> ,	275
11.	Vasci Engi for T Ekat and 2 11.1	ular Enc neering herapeu <i>erina S.</i> Ziyad S. Introdu	lothelial : Challen utic Angio <i>Lifirsu, N</i> Haidar uction	Growth Factors in Tissue ges and Prospects ogenesis <i>Aurugan Ramalingam,</i>	275 276
11.	Vasci Engi for T Ekat and 2 11.1 11.2	ular End neering herapeu <i>erina S.</i> Ziyad S. Introdu VEGF	lothelial : Challen itic Angio <i>Lifirsu, N</i> <i>Haidar</i> iction and Angio	Growth Factors in Tissue ges and Prospects ogenesis <i>Aurugan Ramalingam,</i> ogenesis	275 276 276
11.	Vasci Engi for T <i>Ekat</i> <i>and 2</i> 11.1 11.2 11.3	ular End neering herapeu erina S. Ziyad S. Introdu VEGF	lothelial Challen Itic Angio <i>Lifirsu, N</i> <i>Haidar</i> Iction and Angio Family	Growth Factors in Tissue ges and Prospects ogenesis <i>Murugan Ramalingam</i> , ogenesis	275 276 276 277
	Vasci Engi for T <i>Ekat</i> <i>and 2</i> 11.1 11.2 11.3 11.4	ular Enc neering herapeu erina S. Ziyad S. Introdu VEGF VEGF	lothelial Challen <i>Lifirsu, N</i> <i>Haidar</i> action and Angie Family Therapy	Growth Factors in Tissue ges and Prospects ogenesis <i>Aurugan Ramalingam,</i> ogenesis	275 276 276 277 279
	Vasci Engi for T <i>Ekat</i> <i>and 2</i> 11.1 11.2 11.3 11.4 11.5	ular Enc neering herapeu erina S. Ziyad S. Introdu VEGF VEGF VEGF	lothelial Challeng tic Angio <i>Lifirsu, N</i> <i>Haidar</i> action and Angio Family Therapy Delivery S	Growth Factors in Tissue ges and Prospects ogenesis <i>Aurugan Ramalingam,</i> ogenesis Systems	275 276 276 277 279 280
	Vasci Engi for T <i>Ekat</i> <i>and Z</i> 11.1 11.2 11.3 11.4 11.5 11.6	ular Enc neering herapeu erina S. Ziyad S. Introdu VEGF VEGF VEGF Soft ve	lothelial Challeng Itic Angio <i>Lifirsu, N</i> <i>Haidar</i> Iction and Angio Family Therapy Delivery S rsus Harc	Growth Factors in Tissue ges and Prospects ogenesis <i>Aurugan Ramalingam,</i> ogenesis Systems I Tissues	275 276 276 277 279 280 282
11.	Vasci Engi for T <i>Ekat</i> <i>and Z</i> 11.1 11.2 11.3 11.4 11.5 11.6 11.7	ular End neering herapeu erina S. Ziyad S. Introdu VEGF VEGF VEGF Soft ve Conclu	Iothelial Challen Itic Angio Lifirsu, M Haidar Iction and Angio Family Therapy Delivery S rsus Harc Iding Ren	Growth Factors in Tissue ges and Prospects ogenesis <i>Aurugan Ramalingam,</i> ogenesis Systems I Tissues harks	275 276 276 277 279 280 282 282 287
11.	Vasci Engi for T <i>Ekat</i> <i>and 2</i> 11.1 11.2 11.3 11.4 11.5 11.6 11.7 Refer	ular Enc neering herapeu erina S. Ziyad S. Introdu VEGF VEGF VEGF Soft ve Conclu	lothelial Challeng tic Angio Lifirsu, M Haidar action and Angio Family Therapy Delivery S rsus Harco iding Ren	Growth Factors in Tissue ges and Prospects ogenesis <i>Aurugan Ramalingam,</i> ogenesis Systems I Tissues harks	275 276 276 277 279 280 282 287 290

Index

295