

Index

- acetylmethyl protons 42
- ACI, *see* autologous chondrocyte implantation
- ADH, *see* adipic dihydrazide
- adhesion 7, 21, 27, 42, 62, 96, 117, 119
 - maintaining 120
- adhesion efficacy 118
- adhesion rates 111, 113, 119
- adhesion strength 118–119
- adipic dihydrazide (ADH) 20, 42, 61–62
- adipose tissue 7, 19
- agarose 22, 44
- agglomeration 109
- aggregated bough-shaped structure 50
- aggregated homogeneous multicellular structure 87
- aggregated joints 25
- aggregated multicellular structure 46–47, 65
- aggregated smooth bossing 47
- air bubbles 100
- amines, primary 62
- angiogenesis 19
- anti-apoptotic 19
- anti-microbial 19
- Apligraf 4
- architectures
 - 3D 40
 - biological 60
 - tubular 29
 - vascular 78
- articular cartilage 5
 - injured 5
- artificial cartilage repairing approaches 5
- artificial constructs 1
- artificial scaffold 2, 6
- atherosclerotic lesions 18
- attachment, cellular 18
- autocatalytic production 81
- autocatalytic reaction 49
- autologous chondrocyte implantation 2
- autologous chondrocyte implantation (ACI) 2, 5
- autologous stretching 107
- bioactive signals 21
 - patterned 21
- biochemical factors 2
- biochemical induction 118
- biochemical interactions 80
- biochemical technology 2
- biocompatibility 61, 78, 96–97

- biodegradability 9
- biological compatibility 29
- biological tissues, damaged 17, 59
- biology
 - molecular 4
 - synthetic 1
- biomaterial interactions 98
- biomechanics 4
- biomedical field 95
- biomedical research, fundamental 18
- biophysical phenomenon 71
- biosignals 40, 80
- biosynthetic kinetics 89
- bis-cysteine 21, 42, 62
- blood supply 8
- blood vessels 1, 89
- BMP-4, *see* bone morphogenetic protein-4
- bone 1, 5, 7
 - subchondral 5
 - trabecular 40
- bone cells 19
- bone marrow 5
- bone morphogenetic protein 2
 - (BMP-2) 19, 47–54, 80–81, 91
 - exogenous 47, 52
- bone morphogenetic protein-4 (BMP-4) 47, 49–50, 80
- bovine serum albumin (BSA) 22, 43, 103
- bovine vascular endothelial cells (BVECs) 61
- branching morphology 65, 89
- branching process 46, 65
- branching structures 64
- bright field imaging 103
- BSA, *see* bovine serum albumin
- burn injuries 4
- BVECs, *see* bovine vascular endothelial cells
- carbodiimide hydrochloride 20, 42, 61
- cartilage 1, 3–6, 19
- cartilage defects 2, 5
- cartilage grafts 4
- cartilage repair 1, 4, 6
- cell adhesion 97–98, 113, 119, 121
- cell adhesion peptides 21, 42, 62
- cell aggregation 120
- cell-based therapeutic methods 59
- cell-based therapy 19
- cell-based tissue-engineered product 4
- cell-based tissue engineering methods 1
- cell biology 78
- cell chemotaxis 82
- cell clumps 108, 115
- cell clusters 43, 50–51, 82–83
- cell culture 19–21, 28, 33, 41, 43, 45, 60–61, 96, 100
 - long-term 45
 - three-dimensional 17–18, 20, 22, 24, 26, 28, 30, 32, 34
- cell culture protocol 91
- cell growth 20, 41, 96–97
 - regulating 96
- cell-hydrogel constructs 78
- cell implantation 3, 5

- cell membrane 96
- cell migration 9, 23–24, 78, 82
- cell proliferation 27, 81
- cell seeding 2, 45–46
- cell self-organization 18
- cell-transforming genes 29
- cell viability 32
- cells
 - 3T3 fibroblast 123
 - dendritic 5
 - hepatic endoderm 40
 - heterotypic 81
 - mesenchymal 4
 - multipotent 45
 - multipotent progenitor 18
- cellular adhesion 7, 96, 124
- cellular alignment 78
- cellular collective behaviors 115, 122
- cellular communication 60, 80
- cellular contraction 119
- cellular contraction force 120
- cellular cytoskeletons 117
- cellular growth behaviors 98, 124
- cellular interactions 60
- cellular membrane 29
- cellular self-assembly 59
- cellular self-organization 9, 18–19, 40, 53, 60, 78, 91, 97–98
 - spontaneous 79
- chemotactic coefficient 81, 84
- chemotactic effect 50, 84
- chemotactic motion 50
- chemotaxis 81–82, 84
- collagen 78
- collective cell behaviors 97
- complex organs 2, 7
- complex shear strain 102
- concentric-stellate-tip electrode array 6
- confocal laser-scanning microscope/microscopy 64, 68
- covalent binding 21
- crosslinker-apportion 124
- crosslinkers
 - degradable 21
 - thiol-containing 98–99
- crosslinking peptides 21
- cultures
 - hydrogel-based 47
 - monolayer 18
- cytokines 19–20, 41, 71, 117–118
- cytomembrane 118
- cytoskeletal staining 110
- cytoskeletal structures 119
- cytoskeletons 117
- cytotoxicity 28–29
- cytotoxicity assay 97

- DAPI 22, 43, 48, 69, 103–104
- DAPI staining 103–104, 109–110
- decellularization 7–8
 - perfusion-based 8
- dextran 96–97, 99, 106, 111, 120
- dextran-based biomaterial 117
- dextran hydrogel 30–31, 97–101, 105–118, 120–122
 - clustered 116
 - elastic 117

- homogenous 32, 106
- dextran polymer 118, 120
- dextran polymer chains 121
- dextranase 98, 104
- dialysis 20, 42, 61–62
- diffusion 29, 33, 49, 71, 80, 82
 - cellular 50
 - cytokine 118
 - molecular 118
- diffusion coefficients 49, 81
- donor organs 2, 8–9
- donor sites 1, 4–5
- donor tissue 2
 - autologous 2, 5
 - decellularized 7
- drug responsiveness 18
- durotaxis 123

- ECM, *see* extracellular matrix
- encapsulated cell behaviors 21
- endothelial cells 4, 29, 78
- extracellular matrix (ECM) 2–3, 8, 18–19, 25, 40–41, 59–60, 71, 78, 96, 116, 121
 - architectures 79
 - artificial 17
 - engineered 6, 59, 78
 - hydrophilic 116
 - interactions 96
 - natural 40, 60
 - naturally-derived 8
- F-actins 22, 43, 45, 48, 64–66, 69–71, 97, 103–104, 109–110, 122
 - cellular 66
 - morphology of 114
- FBS, *see* fetal bovine serum
- fetal blood 19
- fetal bovine serum (FBS) 20, 41, 43, 99
- fibrin clots 43, 51
- fibrin gel clots 43
- fibroblasts 4, 29–30, 106, 116
 - embryonic 29
- filopodia 103, 108–109, 117

- gene expression 18, 29
- Gierer and Meinhardt kinetics 49, 80

- heart 1, 7–8, 54, 71, 91
- heterogeneous stiffness 123
 - molecular-scaled 123
- homeostasis 60, 80
- human artery wall 18
- human umbilical vein 40, 78
- human umbilical vein endothelial cells (HUVECs) 40, 78
- humid hood 62
- HUVECs, *see* human umbilical vein endothelial cells
- hyaluronic acid 61, 96
 - acrylated 19–20, 41, 61
- hyaluronic acid hydrogels, modified 91
- hyaluronic acid modification 20
- hyaluronidases 61
- hydrogels
 - 3D mal-dextran 124

- cell-encapsulated 89
- micro-patterned 123
- quick-forming 98
- semisynthetic 97
- synthetic 3, 96

- immunogenicity 3, 9, 61
- immunological incompatibilities 3
- immunological rejection 4
- innate regenerative capabilities 9, 39, 59, 77
- intracellular cytoskeleton 96
- intracellular microfilaments 111

- keratinocytes 4
- kidneys 7–8, 54, 71, 77, 91

- L-connected C2C12 113, 115
- lamellipodia 103, 108–109
 - cellular 108
- laser scanning confocal microscope (LSCM) 104, 109
- liver 1, 7–8, 19
- liver organ buds 40
- LSCM, *see* laser scanning confocal microscope
- lungs 7–8, 54, 71, 77, 91
- lymph vessels 77, 89
- lyophilization 42, 62

- macromolecules, local dextran 121
- maleimide-dextran hydrogel 97
- mammary gland 7, 60
- marrow stroma 18

- mathematical model 3, 51, 79–82, 89, 91
- melanocytes 5
- mesenchymal stem cells (MSCs) 5, 18–20, 32, 40
 - transplanted 19
 - vascular 33
 - vascular-derived 19
- metalloproteinase 120
- Michael addition 21, 42, 62
- microenvironments
 - biomechanical 96
 - extracellular 29
 - native physiological 7
- microfabrication, tailored 3
- morphogen pairs 33, 48, 79
- morphogenesis 81
 - organ 3
 - tissue/organ 3
- morphogens 19, 33, 48–49, 71, 79–80, 82, 84
 - dimensionless diffusion coefficients of 81–82
 - mechanism of reaction and diffusion of 33, 49
 - molecular signaling of 33, 49
- morphologies, hybrid multicellular 52
- motility 97, 118–119
 - cell directional 123
 - cytokinetic 49, 80
- MSCs, *see* mesenchymal stem cells
- multicellular aggregation 24, 46, 65
- multicellular architectures 7, 32, 40, 48, 51–52

- multicellular morphology 47, 53, 68
 - evolutionary 97
- N-acryloxysuccinimide 42, 62
- native skin appendages 5
- native tissues 2–4, 6, 32, 40, 77, 82, 89, 95
- neotissue 3, 5
- Noggin 47–48, 50–52
- noggin
 - concentration of 52–53
 - exogenous 50
- organogenesis, balanced 40
- organoid morphogenesis 8
- osteoarthritis 5
- osteoblasts 19, 29
- osteochondral transplantation
 - techniques 2
- PBS, *see* phosphate-buffered saline
- penicillin 20, 41, 61, 99
- periosteum 19
- PERV, *see* porcine endogenous retrovirus
- phalloidin 22, 43, 48, 64, 66, 69, 103, 111, 113
- phosphate-buffered saline (PBS) 22, 43–44, 99, 102–104
- polyethylene glycol peptide conjugate 98
- polymers
 - clustered 120
 - thiol-reactive 98
- porcine endogenous retrovirus (PERV) 3
- porcine organs 2
- porous scaffolds 7, 9
 - synthetic 2
- pro-survival Akt expression 32
- quantitatively tunable components 32
- re-cellularized organ 2
- reaction-diffusion 19, 40
- reaction-diffusion-advection 71
- regenerative cartilages 5
- regenerative medicine 3, 9, 32, 77
- regenerative processes 4
- RGD (cell adhesion peptides) 21, 28, 42, 62, 67, 69, 101, 106–107, 111–116, 120–122
- RGD binding 120
- RGD-clustered dextran hydrogel 111, 116, 118, 120–121
- RGD-clustered hydrogel 97, 119, 124
 - fabrication 100
- RGD-clustered mal-dextran hydrogel 124
- RGD-clustering dextran hydrogels 111, 113, 116
 - cell-adhesive efficacy of 111
- RGD-clustering hydrogels 121, 124
- RGD-clustering induced stiffness-heterogeneity 123

- RGD distributions in hydrogels
 - 120
- RGD-functionalized dextran hydrogel 100
- RGD-homogenous dextran hydrogels 106–107, 121
- RGD-homogenous hydrogel 97
 - fabrication 100
- RGD peptides 27, 30, 42, 44, 62, 96–100, 105, 116, 118–121, 123–124
 - clustered 119–121, 124
 - spatial distribution of 97, 118
 - thiol-containing 98
- rheology measurement 62, 102

- scaffolds
 - exogenous 2
 - physical 87
 - structural 18
- scanning electron microscope 97
- selective plane illumination microscopy (SPIM) 22, 43–44
- self-formed multicellular structure 84
- self-organization 18, 23, 79–80, 87, 95–96, 98, 100, 102, 104, 106, 108, 110, 112, 116, 124
- SPIM, *see* selective plane illumination microscopy
- stem cell differentiation behaviors 60
- stem cells 29, 32, 71
 - culturing 61
 - embryonic 87
 - human mesenchymal 40
 - muscle 33
 - myogenic 29
 - vascular mesenchymal 18
- stiffness-clustering 120
- stiffness-heterogeneity 123–124
- streptomycin 20, 41, 61, 99
- sweat glands 5

- TCPS, *see* tissue culture polystyrenes
- TGF, *see* transforming growth factor
- thioglycerol 98–101
- tissue
 - aneural 5
 - biological 6
 - damaged 6, 39
 - diseased 19
 - engineered 39
 - injured 77
 - natural 2, 40, 60–61, 71
 - scaffold-based 3
 - skin-equivalent 4
 - soft 116
 - vascular 19
- tissue culture polystyrenes (TCPS) 31, 100
- tissue development 78
- tissue-engineered skin constructs 4
- tissue engineering 1, 3
- tissue grafting, traditional 3–5
- transforming growth factor (TGF) 33, 49

- transplantation
 - allograft 5
 - autologous osteochondral 5
- transplanted organs 8
- trauma 4
 - musculoskeletal 32
- trauma repairs 19, 32
- Turing, Alan 32, 48, 50, 79
- Turing instability 79–80
- Turing-type activator-inhibitor models 50
- Turing-type mechanism 19, 32, 48, 51, 53, 71, 84, 91
- Turing's diffusion-reaction theory 71
- Turing's reaction-diffusion frame 77
- Turing's reaction-diffusion mechanism 79
- UV exposure 8
- vascular graft 87
- vascular mesenchymal cells (VMCs) 20, 23–24, 26–27, 40–41, 43–46, 48–49, 54, 61, 63–64, 67, 71, 80–81, 87, 91
- vascular networks 2, 7–8
- vascularization 5
- vasculature 5, 77
- vasculatures, injured 54, 71, 91
- vertebrates 33, 48
- viscoelasticity 106
- viscosity 98, 105
- VMCs, *see* vascular mesenchymal cells
- water 20, 42, 61–62, 98, 100
 - deionized 42
- wound healing 80