

Index

a

A β aggregation 156, 161, 167, 169, 171, 173, 174, 176, 179, 180
 actin filaments 239, 240, 243, 245
 aggregation processes 34, 180
 aluminium/copper oxide (Al/CuO) system 20
 aminated hyaluronic acid (AHA) 96
 amino acid sequence 195
 amphiphilic ligand 16
 amyloid aggregation
 gene mutations 153
 impaired protein synthesis and environmental stress 153
 improper protein folding 153
 inhibition of 154
 non-peptide-based small molecules
 macrocyclic inhibitors 179–181
 quinones/polyphenols/natural compounds 175–179
 peptide-based small molecules
 α,β -dehydro amino acids 158
 amyloid- β (A β) sequence 156
 A β binding capacity 156
 A β -derived inhibitors 157
 A β oligomers and fibrils 158
 β -sheet breaker peptides 161–165
 cyclic peptides amyloid inhibitors (CPAIs) 171
 D-amino acids 165
 α -helical state 165–167
 KLVFF recognition site 156
 metal ion scavenging peptides 161
 peptides NF11 and NK9 162
 peptidomimetics 167, 169, 171, 172

amyloid fibril formation 206, 220
 amino acid sequence 195
 aromatic residues 196
 CNT 205
 individual amyloid subunits 195
 kinetics of 196
 $\pi\text{-}\pi$ interactions 196
 protofilaments 195
 size range of structures 196
 amyloid fibrils 153, 177, 204
 amyloidogenicity 220, 221
 amyloidoses 195, 201, 220
 amyloid precursor protein (APP) 155
 amylopectin 46, 47
 amylose 47
 anisotropic assemblies 17
 arc-discharge technique 205
 Arg-Gly-Asp (RGD) sequences 231
 atomic force microscopy (AFM) 102, 158, 209
 autonomous self-assembly approach 103

b

bacterial cellulose 47, 48, 80
 bilayer-to-nobilayer phase transitions 122, 130
 bin-amphiphysin-rvs (BAR) domains 125
 biodegradable engineered proteins 97
 biomimicry 103
 biomolecular detection 19
 biomolecules 44
 bio-orthogonal crosslinking 100
 biopolymers 43, 48, 65
 biotin-streptavidin complex 19
 biotin/streptavidin grafting protocol 24

- bottom up 3D hydrogel preparation method
autonomous self-assembly approach 103–104
biomimicry 103
mini-tissues approach 104
soft lithography 100–102
3D bioprinting 102–105
bovine aortic smooth muscle cells (BSMCs) 94
- c**
- cadherin functions 244
cadherins 239, 241
cadherin subtype 244
Caenorhabditis elegans model 165
calcium binding osteopontin 244
carbon/graphene quantum dots 211–213
carbon nanotubes (CNTs) 93
biological applications 203
graphene 202
multi-walled carbon nanotubes (MWNTs) 203–204
physical properties 202
purification of 203
single-walled carbon nanotubes (SWNTs) 202, 204–205
cartilage tissue engineering 99
catalysis 20
cell adhesion 242, 257
cell migration guidance 242
cell-to-cell interactions 240–241
molecules 238–240
receptors 238–240
signaling 241–243
3D tissues and organs 238
tissue-specific cell adhesion molecules 242
cell adhesion molecules (CAMs) 238, 242, 256
cell behavior 246
cell junctions 240–241
cell membrane 123, 125, 201, 241, 258, 262
cell polarity 241
cell surface receptors 232, 255, 257
cell-to-cell interactions 240–241, 243
cellular differentiation 52
cellulose 45, 46
central nervous system (CNS) 155
- charged laponite nanoparticles 100
chemical vapor deposition (CVD) 207
chitin 49–51
chitin nanocrystals 50
chitin nanofibers 50
chitosan 51, 52
chondroitin sulfate 54, 55
circular dichroism 158
classical mechanosensory signaling 255, 256
coding sequence 29
collagen 53, 54, 98, 232
 C_{60} peptide interactions 206
crowded proteins 125
cryogelling 99
cryogels 98–100
crystallinity 250
crystallization 16
cubic membranes (CM) 132–135
curcumin 176
cyclic peptides 174
cyclic peptides amyloid inhibitors (CPAIs) 171
 β -cyclodextrin dimers 180
cyclodextrins 179
cytoskeletal associated proteins 241
cytoskeleton 258, 263
- d**
- D-amino acid containing peptides 166
D-amino acids 165
 θ -defensins 173
deposition procedure 22
dermatan sulfate 54, 55
dextran 48, 49
diclofenac sodium salt (DS) 96
differential scanning calorimetry (DSC) 32
1,2-(dimethoxymethano)fullerene 206
disaccharides 43
disordered domains 46
DNA coding sequence 29
DNA-directed assembly 36
of Al and CuO nanoparticles
DNA/alumina interaction evaluation 22–24
DNA coding sequence 29–32
DNA hybridization efficiency 27
DNA surface density 26–28
exothermic oxidation/reaction process 21

- functionalization protocol and
colloidal characterization 24–26
streptavidin surface density 26
structural and energetic properties
32–35
biomolecular detection 19
catalysis 20
crystallization of heterogeneous
systems 16–19
high-order crystalline structures
12–16
optical and plasmonic devices 20
primary functionalization strategies
12
- DNA/nanoparticle assembly
antigen/antibody interactions 12
biotin/streptavidin interaction 12
oxidation of metallic nanoparticles 12
self-assembly 12
- DNA nanotechnologies
automated computer design strategy
10
characteristics 6
complementary and non-complementary DNA strands 11
DNA folding and associated staples 10
emergence of 8
two-dimensional DNA origami 10
two-dimensional networks 8
- DNA origami technique 10
drug delivery 100
 α -tryptophan-based insulin aggregation
inhibitor 167
 α -tryptophan-containing peptides 165
Duchenne muscular dystrophy (DMD)
255
dynamic light scattering (DLS) 25
- e**
elastin 234
elastin like polymers (ELPs) 97
elastin-like recombinamers (ELRs) 76
electromagnetic radiation (EMR) 91
endoplasmic reticulum (ER) 234
epithelial cells 232
extracellular matrices (ECMs) 89, 233
Arg-Gly-Asp (RGD) sequences 231
cell polarity 241
cell-to-ECM interactions 243
chemical properties 237
collagen 232, 234
elastin 234
fibronectin 234
functions 235–237
glycosaminoglycans (GAGs) 235
growth factors 235
laminins 234–235
mechanical functions 231
mechanical properties 238
molecules 44
physical properties 237
proteins of 232–235
- f**
fibroblast growth factor (FGF) 55
fibroblast growth factor- 2 (FGF-2) 45
fibronectin 234
FltTrx 78
FltTrx gold-binding sequence 80
focal adhesion kinase (FAK) 241, 259
cytoskeleton 258–263
Raf-MEK-ERK signaling cascade
258
focal adhesions 241
force transduction 253
Fullerenes-C₆₀ 205–207
fusion peptide domains 129
- g**
gap junctions 240, 241
gelatin 91, 98
gelatinization 46
gelatin methacrylamide synthesis 92
GelMA hydrogels 92, 93
genetically modified polymers
bacterial cellulose 80
elastin-like recombinamers (ELRs) 76
inorganic binding peptides 78
production 77
glycoproteins
chondroitin sulfate and dermatan
sulfate 54–55
collagen 53–54
heparin and heparan sulfate 54
keratan sulfate 55–56
mucins 52–53
glycosaminoglycan (GAG) 44, 235
glycosidic linkages 44
glycosyltransferases 44
gold nanoparticles 14, 16, 20, 216–219
gold surface functionalization technique
12

- graphene 207
 graphene oxide (GO) 93
 growth factors (GFs) 232, 235
- h***
 head-head-tail (HHT) 167
 hemagglutinin (HA) protein 133
 heparan sulfate 54
 heparin and heparan sulfate 54
 homofermentative method 73
 human embryonic stem cells (hESCs)
 104
 human insulin (HI) 180
 human serum albumin 98
 human umbilical vein endothelial cells
 (HUVECs) 97
 hyaluronan (HA) 44
 hyaluronic acid (HA) 52
 hydrogels
 biofabrication techniques 90
 clinical application 89
 mechanical and degradation properties
 90
 modification and functionalization
 bovine aortic smooth muscle cells
 (WSMCs) 94
 human platelet free plasma (PFP)
 95
 methacrylation 90–93
 PNIPAM conjugated hydrogels
 95–96
 volumetric muscle loss (VML) model
 95
 natural and synthetic hydrogels 90
 recombinant polymers 96–98
 3D hydrogel preparation
 bottom-up approach 100–105
 cryogels 98–100
 4-hydroxybutyrate (4HB) 71
 3-hydroxydecanoate (HD) 70
- i***
 immunoglobulins (Igs) 239, 240
 inorganic binding peptides 78, 79
 inorganic nanoparticles 220
 integrin family proteins 258
 integrin-mediated binding 239
 integrins 257
 interconnected 3D network 99
 interlamellar attachments (ILA) 130,
 132
- intermediate filaments 260
 inverse temperature transition (ITT) 77,
 97
- ion mobility spectrometry (IMS) 181
 iron-based nanoparticles (INPs)
 212–214
- isolated chitin 50
- k***
 keratan sulfate 55, 56
 kosmotropes 130
- l***
 laminins 234
Leuconostoc mesenteroides 49
 Lewy bodies (LB) 155
 linear peptides 173
 lipid membrane
 biological cubic membranes 132–134
 membrane fusion 125–132
 and membrane organization 117–120
 phase transitions and instabilities
 120–123
 lysine 234
- m***
 macrocyclic inhibitors 179
 mechanobiology 253
 mechanotransduction 253, 255
 membrane fusion 125
 membrane invagination 125
 membrane-linking pores (MLP) 121
 membrane shape deformations 124
 mesenchymal stem cells (MSCs) 97
 methacrylated hyaluronic acid (MeHA)
 93
 methacrylation 90, 91, 93
 methacrylic anhydride (MA) 91
 microbial polyhydroxyalkanoates (PHAs)
 66
 microelectromechanical systems (MEMS)
 fabrication techniques 21
 microfibrils 45
 microfilaments 260
 β_2 -microglobulin 195
 micrometric-sized nanoparticles 18
 micro-patterning technique 104
 microtubules 260
 mini-tissues approach 104
 mirror phage method 165

- modern genetic engineering techniques 78
- molecular dynamics (MD) simulations 127, 133, 204, 206, 209
- molecular shape concept 117, 119
- molecular weight (MW) 44
- monosaccharide 43
- mucins 52, 53
- multi-walled carbon nanotubes 203–204
- n**
- nanobiocomposite 34
- nanocrystals 50
- nanodiamond functionalized with octadecylamine (ND-ODA) 75
- nanodiamonds (NDs)
- detonation ND 201
 - direct binding of 201
 - influence of 201
 - physicochemical properties 201
- nanomaterials 197
- bottom-up approaches 198
 - classification of 198
 - electronic components 198
 - exposure pathways for 200
 - top-down approaches 198
- nanoparticles 197
- metals/metalloids 218, 220
 - preparation techniques of 199
 - toxic effects of 200
- nanotechnology 197, 199
- nanothermites 21
- native cellulose fibers 46
- N*-deacetylase/*N*-sulfotransferase 44
- nerve stem cells (NSCs) 75
- neurites 155
- non-degradable films 48
- o**
- oligomeric aggregation 179
- oligomers 153
- oligopyridylamides 169
- oligosaccharides 43
- 1D arrangement of nanorods 17
- one-dimensional nanomaterial 197
- p**
- peptide–peptide interactions 206
- peptidomimetics 167, 169, 171, 172
- phase transitions and instabilities 120
- photocrosslinking 97
- photopolymerization 91
- planar metal oxide semiconductor (MOS) transistor 3
- polar lipid molecules 117
- poly(3-hydroxybutyrate) (P3HB) 70
- poly(3-hydroxybutyrate-*co*-3-hydroxyvalerate) 67, 71–72
- poly(3-hydroxybutyrate-*co*-hydroxyhexanoate) 67
- poly(4-hydroxybutyrate) 71
- poly(D-lactic acid) 75
- poly(DL-lactic acid) (PDLLA) 75, 76
- poly(L-lactic acid) (PLLA) 73, 75
- chemo-process 73
 - homofermentative method 73
 - macrophages phagocyte 73
 - poly(D-lactic acid) 75
 - poly(DL-lactic acid) (PDLLA) 75–76
 - 3D printing applications 73
- poly(*N*-isopropyl acrylamide) (PNIPAAm) 95
- polyethylene glycol (PEG) 18
- polyhydroxyalkanoates (PHAs) 68
- medium-chain-length polyhydroxyalkanoates 67–70
 - poly(3-hydroxybutyrate) 70
 - poly(3-hydroxybutyrate-*co*-3-hydroxyvalerate) 71–72
 - poly(3-hydroxyvalerate) 71
 - poly(4-hydroxybutyrate) 71
 - tissue engineering and regenerative medicine 67
 - in vitro* synthesis of 66
- polymer composites 46
- polysaccharides 56
- bacterial cellulose 47–48
 - cellulose 45–46
 - chitin 49–51
 - chitosan 51–52
 - dextran 48–49
 - hyaluronic acid (HA) 52
 - pullulan 48
 - starch 46–47
- porosity 249
- prion protein 155
- pristine chitin 50
- proline 234
- protein adsorption 123, 124
- protein aggregation diseases 155
- protein interaction sites 156
- protein-mediated vesicles fusion 131

protein misfolding 220
 proteoglycans (PGs) 44
 proteolytic enzymes and
 glycosaminoglycans 196
Pseudomonas strains 67
 pullulan 48

q

quantum dots (QDs) 20, 209, 211
 carbon/graphene quantum dots 211–213
 semiconductor quantum dots 211
 quinones/polyphenols/natural compounds 175, 176, 179

r

reactive monosaccharides 44
 reactive oxygen species (ROS) 205
 recombinant elastin 77
 recombinant polymers 76, 96–98
 recombinant protein technology 52
 recombinant spider silk 98
 regenerative medicine 247
 retro-inverse (RI) peptides 155, 171
 retro-inverso (RI) peptides 171–172

s

scaffold proteins 126
 scanning electron microscopy 25
 selectins 240
 self-assembly 3–5, 12, 16
 semiconductor quantum dots 211
 shear stress 46
 β -sheet breaker peptides 161
 silk-elastin-like polymers (SELPs) 98
 single core protein 44
 single-walled carbon nanotubes 204, 205
 skin tissue engineering 93
 small-angle X-ray scattering (SAXS) 120
 SNARE transmembrane domain 129
 soft lithography 100, 101
 soft tissue reconstruction 93
 solid-binding peptide sequences 79
 split-pool method 167
 spontaneous lipid assembly 117
 starch 46, 47
 stiffness 250
 streptavidin 12, 25, 26

substrate and tissue engineering
 biochemical properties 251–252
 crystallinity 250
 form of 248
 mechanical properties 252
 porosity 249–250
 roughness 249
 stiffness 250
 surface charge 251
 surface wettability 251
 3D cell culture 248
 3D substrates 245, 247
 topography 248
 sulfation 55
 surface charge 251
 surface functionalization 12, 51, 206
 surface wettability 251
 synchrotron SAXS method 121
 synchrotron X-ray diffraction (XRD) 120
 synthetic polymers 90

t

tailor inorganic-binding peptides 79
 taurine residues 165
 temperature-responsive behavior 96
 thermal decomposition 46
 thermal resistance 46
 thermites 20
 thermoplastic starch (TPS) 46
 3D bioprinting 93, 98, 102–105
 3D microenvironment 247, 255
 ThT fluorescence assay 158
 tight junctions 240
 time-resolved synchrotron SAXS measurements 120
 tissue engineering 75, 91, 99, 247
 titanium dioxide nanoparticles 214–216
 T lymphocytes 240
 “top-down” approaches 3
 transforming growth factor (TGF) 55

v

vascular endothelial growth factor (VEGF) 45
 Vroman effect 201, 221

x

X-ray diffraction experiments 129
 Xylose 67