

## Index

### **a**

acidic glycoproteins 296  
 actin filament 153  
 actin linking module 156  
 actin polymerizing module 156  
 $\alpha$ -actinin 153  
 activated osteoblast 288  
 activity 247  
 adhesion complex 150  
 adhesion signalling module 156  
 adhesion strength 160  
 adhesome 150  
 alginate 23, 331  
 alginate gel  
 – anisotropic 331  
 – diffusion-reaction mechanism 333  
 alkaline phosphatase (ALP) 350  
 allogenic cell 166  
 allosteric protein 37, 115  
 amyloid fibre 380  
 $\beta$ -amyloid polypeptide (A $\beta$ ) 402  
 amyloid- $\beta$  precursor protein (APP) 380  
 antibody 109  
 antifreeze proteins (AFPs) 240  
 antigen 109  
 aptamer 88, 111  
 archaeobacteria 367  
 astaxanthin bioreactor 228  
 Au nanoparticle-based colorimetric sensor 88  
 Au nanoparticles for intracellular biosensing 142  
 autocatalytic cluster growth 309  
 autologous cell 166  
 autotrophic organism 1  
 Avogadro's number 246

### **b**

bacterial spore 214  
 bacteriophage 20  
 basic multicellular unit (BMU) 288  
 bend persistence length 29  
 bifunctional virus 126  
 bilayer 392  
 bioaccumulation 223  
 bioadsorption 216, 223  
 bioaffine immobilization 121  
 bioartificial organ 230  
 bio-bar-code amplification (BCA) 90  
 bio-bar-code test for protein detection 140  
 biocer 207  
 bioimprinting 216, 230  
 biointerfacing 51  
 biologically controlled mineralization 255, 267  
 biologically induced formation of ice crystals 263  
 biologically induced mineralization 255, 260  
 biologically mediated mineralization 255  
 bioluminescent bacterial assays 190  
 biomineralization 213  
 bio-palladium nanoparticles 307  
 – ferromagnetic 311  
 biorecovery of precious metals 307  
 biosensor  
 – heterogeneous 129  
 – homogeneous 129, 139  
 Biosil process 212  
 – cell-based bioreactor 228  
 biotemplating 213  
 biotransformation 213, 216, 226  
 bone balance 288  
 bone modelling 287

bone morphogenetic proteins (BMPs) 342  
 bone proteoglycans 297  
 bone remodelling 287  
 bone sialoprotein (BSP II) 350  
 budding-fission-fusion events 395

**c**

cadherine 155  
 canaliculi 286  
 cancellous bone 284  
 capsid 18  
 carbohydrate 20  
 carbonatogenic yield 355  
 carboxysome 306  
 cationic dipeptide nanotubes (CDPNTs) 405  
 cell adhesion 149  
 cell fate 155, 160  
 – regulated by nanostructure 172  
 cellulose 22  
 chaperone 42  
 chaperonin 42  
 chemical nose 102  
 chemical potential 245  
 chemoautotrophic organisms 2  
 chemokine 341  
 chemotactic interaction 347  
 chiral nematic phase 397  
 chitin and chitosan 23  
 cholesteric nematic phase 397  
 chondrocyte 285  
 chondroitin sulfate 297  
 cingulin 200  
 circular dichroism 43  
 circular birefringence 43  
 co-condensation 207  
 coenzyme 48  
 cofactor 48  
 co-hydrolysis 207  
 collagen 176  
 collagen type I 292  
 collagen-based biosilicification 202  
 cooperative FJC model 38  
 cooperativity 37  
 – parameter 38  
 corneal transplantation 180  
 cortical bone 284  
 Crane principle 113  
 critical packing parameter 393  
 critical radius 251  
 crosstalk 352  
 cytokine 290, 341  
 – immobilized 171  
 cytoskeleton 150

**d**

dentin matrix protein 1 (DMP1) 339  
 deoxyribonucleic acid (DNA) 4  
 diatom 199  
 diphenylalanine  
 – nanobead 402  
 – nanotube 402  
 diphenylalanine core motif 381  
 diphenylalanine nanotubes  
 – electron transport 407  
 disaccharides 21  
 dissimilatory reduction 307  
 DNA  
 – A-, B-, Z-DNA 9  
 – electrical detection 89  
 – electroless metallization 79  
 – electronic properties 69  
 – end-specific immobilization 56  
 – melting point 10  
 – metallization 71  
 – nanorobot 67  
 – nanotube 400  
 – origami 67  
 – structure 7  
 – surface-enhanced Raman spectroscopy detection 90  
 – tile model 65  
 DNA melting transition 46  
 DNA-based “nanocrystal molecules” 87  
 DNA-based protein assemblies 93  
 DNA-conjugated nanoparticles 87  
 double crossover (DX) molecules 399  
 double-diffusion technique 314  
 driving force for precipitation 248

**e**

ECM  
 – cell-triggered proteolysis 344  
 – Young’s moduli 154  
 ECM binding module 156  
 Einstein polymer 374  
 ELISA  
 – competitive 116  
 – indirect 116  
 – sandwich 116  
 ellipticity 43  
 endochondral ossification 285  
 enzyme 46  
 enzyme entrapped in silica gel 221  
 enzyme kinetics 49  
 enzyme-linked immunosorbent assay (ELISA) 116  
*Escherichia coli* 4  
 eubacteria 367

extracellular matrix (ECM) 149  
extremophile 371

**f**

fatty acids 26  
ferritin 18, 269  
ferritin-like Dps 270  
fibre-reinforced biocers 209  
fibronectin 150  
filamentous M13 phage 19  
fluorapatite-gelatine nanocomposite 314  
fluorescent silica nanoparticle 139  
focal adhesion kinase (FAK) 158, 161  
fracture toughness 303  
freely jointed chain model 27  
freeze avoidance 240  
freeze drying  
– mineralized collagen scaffolds 329  
freeze gelation 210  
freeze tolerance 240  
fructose 21

**g**

galectin 204  
Gibbs-Thomson effect 250  
Gla proteins 295  
glucose 21  
glucose sensor 223  
glycocalyx 22  
glycolipids 24  
glycoproteins 24  
glycosaminoglycan chains (GAGs) 297  
glycosaminoglycans (GAGs) 346  
glycoconjugates 21  
green fluorescent protein (GFP) 184  
greigite 237  
growth factor 288, 341

**h**

haemoglobin 18, 37, 114, 430  
hapten 111  
Haversian canal 286  
heat shock protein 42  
helix-coil transition 43  
hemopoietic cell 285  
heterogeneous nucleation 252  
heterotrophic organisms 1  
homogeneous nucleation 251  
host cell display 121  
hyaluronan 176  
hyaluronic acid 23, 346  
hybridization 10  
hydrogenase 307

hydrophilic-hydrophobic silica interface 223  
hydroxyapatite 292, 294

**i**

ideal solution 246  
immunoglobulin G (IgG) 109  
implant coating 217  
integrin 112, 157  
intracellular carbon-concentrating mechanism (CCM) 305  
intracellular delivery of DNA 405  
intracellular mineralization 267  
intrafibrillar crystallization 295  
intramembranous ossification 285  
invadopodia 156  
inverse microcontact printing 424  
ion exchange materials 313  
iron ore  
– deposited by cyanobacteria 232

**k**

keratan sulfate 297

**l**

lacuna 286  
lateral flow test 118  
LCST- Lower Critical Solution Temperature 177  
leather 176  
lectin 25  
leucine zipper domain 339  
Lineweaver-Burk equation 50  
lipase entrapped in silica xerogel 223  
lipid 26  
lipid bilayers  
– in-plane movement 396  
– real structure 393  
– transbilayer movement 396  
lipopolysaccharide 24  
liquid crystal (LC) 396  
long-chain polyamines (LCPAs) 277  
Luciferase 189  
lyogel 207

**m**

M13 virus 397, 433  
macrophage colony stimulating factor (MCSF) 288, 352  
magnetic tweezer 32  
magnetite 237  
magneto-aerotaxis 237  
magnetosome 237  
magnetotactic bacteria 237  
maleic anhydride copolymer 151

- maleic anhydride copolymer platform 168
  - maltose 22
  - marginally compact phase 40
  - M-DNA 71
  - mechanotransduction mechanism 150
  - membrane-bound silica deposition vesicle (SDV) 277
  - mesenchymal stem cell 288
  - mesocrystal 320
  - messenger RNA (mRNA) 5
  - metamaterial 417
  - micelle 392
  - Michaelis constant 49
  - Michaelis-Menten mode 47
  - microbial reduction of Fe(III) 262
  - microbially induced carbonate precipitation (MICP) 355
  - microcontact printing 196
  - mineralized collagen 286
  - molecular combing 59
  - molecular lithography 83
  - monoclonal antibody 109
  - monosaccharide 21
  - multifunctional nanostructure 126
  - multipotent 165
  - multiwall nanotube 381
  - myosin motor 153
- n**
- Nanoplotter 196
  - nanosol 206
  - nanotherapy 100
  - nanowire-based biosenor 136
  - natural amino acids 12
  - nematic LC 396
  - niche 166
  - nucleic acids 4
  - nucleotide 5
- o**
- one-dimensional biosensor array 136
  - open reading frame 186
  - optical tweezer 31
  - ORMOCER 207
  - orthosilicic acid 206
  - osteoblast 285
  - osteoclast 285
  - precursor 288
  - osteconductivity 338
  - osteocyte 286
  - osteogenic effectors 349
  - osteogenicity 338
  - osteinductivity 338
  - osteon 286
  - osteopontin 297
  - osteoprogenitor cell 285
  - osteoprotegerin (OPG) 288
  - Ostwald ripening 250
  - Ostwald step rule 258
  - overstretching transition 34
  - oxic-anoxic transition zone (OATZ) 237
- p**
- panning technique 121
  - parathyroid hormone (PTH) 288
  - patterned immobilization 194
  - peptide nanotubes 400
  - based enzymatic electrode 407
  - photoluminescence 405
  - peptide quantum dot (PQD) 404
  - persistence length 27
  - phage display technique 124
  - phage-based piezoelectric generator 436
  - pheromone 187
  - photoautotrophic organism 2
  - photosynthesis of algae 262
  - plasmonics 417
  - pluripotent 165
  - PNIPAAm
  - copolymerization 178
  - podosome 156
  - poly(ethylene glycol) (PEG) 175, 343
  - poly(*N*-isopropylacrylamide) (PNIPAAm) 177
  - polyclonal antibody 109
  - polyhistidine tag 121
  - polymer-induced liquid precursor (PILP) 274, 299
  - polymerization
  - active 374
  - passive 374
  - polypeptide 12
  - polysaccharides 21
  - precious metal clusters
  - catalysts for PEM-FC 311
  - precipitation of ZnO 256
  - promoter 186
  - activator 186
  - repressor 186
  - prosthetic groups 430
  - protein
  - artificial 100
  - chemical immobilization 99
  - functional 11
  - piezoelectricity 16
  - primary structure 12, 16
  - quaternary structure 18
  - secondary structure 16

- structural 11
  - tertiary structure 17
  - protein A 121
  - protein adsorption 97
  - protein G 121
  - protein ice nucleators (PINs) 240
  - proteoglycans 24
- r**
- RANKL 352
  - RANK receptor 288
  - reaction transition state 47
  - regulatory genes 188
  - relative supersaturation 248
  - reporter gene 188
  - reporter protein 186
  - reporting cells 184
  - responsive osteoblast 288
  - restoration of damaged ornamental stone 355
  - ribonucleic acid (RNA) 4
  - ribosome 5
- s**
- scanometric assay 89
  - self-assembly 372
    - by controlled peptide folding 431
    - by peptide-metal coordination 430
  - self-healing concrete 356
  - self-organization 372
  - semiflexible polymer 29
  - semiflexible polymer chain
    - load-extension diagram 31
  - S-form DNA 34
  - silacidins 200, 277
  - silaffins 200, 277
  - silica deposition vesicle (SDV) 199
  - silica sol-gel process 205
  - silicatein 203
  - silicified collagen 217
  - silicon acid transporter (SIT) 199
  - silk protein 381
  - simultaneous fibril assembly and mineralization 325
  - single molecule detection 136
  - S-layer 367
    - e-beam induced cluster growth 425
    - fusion proteins 410
    - growth modes 383
    - growth of nanoclusters 418
    - kinetic Monte Carlo simulation 385
    - nanometer lithography 418
    - nucleation rate 387
    - recrystallization 382
  - supported lipid bilayers 413
  - tube formation 390
  - tube radius 391
  - wet chemical nanoparticle synthesis 420
  - smectic C\* phase 397
  - smectic LC 396
  - sol-gel entrapment of the biocomponent 208
  - solid-sandwich immunoassay 130
  - solubility product 249
  - spider silk 396
  - starch 22
  - stationary nucleation rate 251
  - stem cell
    - adult 165
    - controlled quiescence 169
    - embryonic (ES) 165
    - epithelial 165
    - hematopoietic blood 165
    - induced pluripotent (iPS) 165
    - mesenchymal 165
    - tissue-specific foetal 165
  - stimuli-responsive polymers (SRP) 176
  - stromal cell-derived factor 1 $\alpha$  (SDF-1 $\alpha$ ) 347
  - stromatolite 304
  - sugar code 25
  - surface plasmon resonance (SPR)
    - measurement 134
  - survival rate 212
- t**
- T cell receptor 109
  - TEOS 206
  - TGF- $\beta$  291
  - THEOS 206
  - thermophile 371
  - tile structure 399
  - tobacco mosaic virus (TMV) 19, 397, 433
  - transfer RNAs (tRNAs) 5
  - transforming growth factor (TGF- $\beta$ ) 342
  - treadmilling 380
  - tree of life 1
  - triple crossover (TX) molecules 399
  - tunable scaffold 343
  - two-component model of the organic matrix 272
- u**
- ultrafiltration membranes (SUMs) 410
  - uncommitted osteoblast progenitor 288
  - uncommitted osteoclast progenitor 288
- v**
- vascular endothelial growth factor (VEGF) 347

vascular tissue 181  
vesicle 392  
vesicle-mediated transport 395  
virus-based energy harvester 437  
virus-based self-assembly structures 433

**W**

weak interactions 39  
weighted activity product 250  
whole-cell sensor

– amplification 193  
– dinoflagellates 183  
– marine bacteria 183  
– two-colour assay 191  
– yeast cells 190  
Wolff's law 291  
worm-like chain model 27

**X**

xerogel 207