

Index

- abalone, 19, 157, 174, 184, 500
- abalone foot, 465
- abductin, 66, 88
- acetabular cup, 63
- Achilles tendon, 294, 296
- acid-etching, 409
- actin, 84, 117
- activation energy, 131
- activity coefficient, 129
- adaptation, 31–33
- adaptive-rate pacemaker, 552
- adenine, 55
- adhesion, 117, 452
- adhesives, 318
- AFM, *see* atomic force microscopy
- agriculture, 569
- Agrobacterium*, 569
- alanine, 58
- Al–B₄C laminate, 516
- alligator, 280
- alligator gar, 332
- AlloDerm[®], 575
- aloe vera, 475
- alpha keratin, 81, 83, 392, 482
- alpha keratin IF, 390
- α-chitin, 91
- α-helix, 389
- αβ-transition, 83
- alumina, 142
- amelogenin, 570
- amino acid, 57
- amorphous mineral, 134
- amorphous precursor, 134
- amorphous silica, 53, 137
- amylase, 94
- amylopectin, 94
- aneurysm, 379
- Anolis carolinensis*, 483
- antler, 255–261
- aorta, 381, 383
- aortic valve, 548
- Apis mellifera*, 346
- aragonite, 130, 133, 138, 164
- Araguaia river clam, 210
- Araneus diadematus*, 297
- Arapaimas gigas*, 335, 337
- arginine, 58
- Argon formalism for kinking, 190
- armadillo, 274–278
- Arruda–Boyce equation, 284, 355
- Arruda–Boyce model, 360
- arterial blood, 547
- arteriole, 378
- artery, 378, 383
- arthroplasty, 63
- arthropod, 292, 304
- artificial dialysis machine, 551
- artificial heart valve, 551
- Arzt heptahedron, 8
- Ashby map, 1, 15, 36
- Ashby–Wegst classification, 292
- asparagine, 58
- aspartate, 58
- aspartic acid, 136
- asperity, 195
- asteriscus, 217
- ASTM E399, 243
- astrobiology, 102
- atheriosclerosis, 384
- atomic force microscopy, 112, 560
- ATP, 102
- ATP motor, 498
- ATP synthase, 579
- ATPase, 118
- attachment, 452
- autograft, 574
- Aveston–Cooper–Kelly limit, 218
- baleen, 81
- balsa wood, 448
- bamboo, 346, 400, 412
- bamboo scaffold, 554
- barb, 448
- barnacle, 452
- beak, 328–332
- Becker–Doering theory, 130
- beetle, 315, 480
- bending moment, 121
- beta keratin, 81, 83, 330, 448, 482
- β-chitin, 91
- β-sheet, 58, 389
- bi-leaflet valve, 550
- bioactive materials, 5
- Biobrane[®], 574
- biodegradable, 171
- Bioglass[®], 142, 409, 553
- bioinert ceramics, 142
- bioinert materials, 5

- bioinspiration, 499
- bioinspired armor, 516
- bioinspired materials, 9
- bioinspired scaffold, 554–555
- biological foams (cellular solids), 397–450
- biological valve, 550
- biomimetics, 497
- Bio-Oss[®], 409
- biopanning, 572
- biopolymer film, 581
- bioresorbable metal, 39
- bioresorbable polymer, 378
- biosilica, 158
- biotolerant materials, 5
- bird beak, 332, 420–433
- bird bone, 417–421
- bird skull, 420
- birds, 541
- bivalve mollusc, 88
- Bjork–Shiley valve, 549
- bleach beetle, 343
- blood vessel, 378–384
- blue blood, 556
- Bombyx mori*, 297
- bonding, 453
- bone, 23, 29, 223–255, 400, 499
- bone morphogenetic protein, 409
- bone remodeling, 226
- Bouligand structure, 21, 93, 306–307, 312, 334, 336, 372
- Brånemark, P., 270
- bridge, 278
- brittle-star, 484, 508
- buckling equation, 123
- buckling resistance, 155
- Budiansky equation, 190
- Bufo marinus*, 372
- burr, 453
- burst, 379
- Busyon canaliculum*, 387
- butterfly, 480
- butterfly wing, 527–531
- byssal thread, 384
- cacti, 487
- caiman, 280
- calamus, 435
- Calcarea*, 160
- calcite, 130, 133, 139
- calcium carbonate, 53, 129, 137, 168, 499
- calcium phosphate, 137, 143
- Calliphora vicina*, 453
- canaliculi, 224
- cancellous bone, 224, 401
- cancer, 113
- Cancer magister*, 310
- capillary, 378
- carapace, 278
- Carassius auratus*, 337
- carbon nanotube, 574
- Carcarodon carcharias*, 487
- Carroll–Holt–Torre theory, 407
- cat skin, 365
- catgut, 171
- cell, 102–122, 499
- cellular biomaterials, 410
- cellulose, 53, 66, 89, 93–94, 105, 348
- cellulose microfibril, 411
- cephalopod, 89, 339
- Cephalopoda*, 443
- ceramic biomaterials, 143
- Charnley, J., 63
- chelicerate, 304
- chicken, 440
- chitin, 53, 66, 89–91, 93, 97, 181, 184, 305, 578
- chitin-based exoskeleton, 29
- chiton, 211, 264
- chiton radula, 486, 489
- chitosan, 90, 91, 409, 578
- cholesterol, 95
- chondroblast, 106
- chondrocyte, 110
- Christmas tree, 176, 178, 183
- chromatophore, 483
- clade, 144
- closed-cell foam, 279
- Cloudina*, 144
- coconut fiber, 346
- collagen, 53, 66, 69–80, 95–96, 226, 235, 362, 368, 561, 578
- collagen fiber, 274
- collagen fibrils, 335
- collagen–GAG matrix, 575
- collagen–GAG scaffold, 143
- Colletia cruciata*, 475
- comminuted fracture, 239
- complex crossed-lamellar, 165, 197
- computational fluid mechanics, 560
- computerized tomography, 560
- conch, 157, 196
- conchiolin, 148, 174
- convergence, 33
- copper mining, 4
- coral, 146
- cork, 400
- corneal scarring, 555
- Cortaderia selloana*, 486
- cortex, 439, 448
- cortical bone, 224
- cosmoid, 332
- cotton fiber, 411
- coupled cluster method, 560
- covalent self-assembly, 520
- crab, 21
- crack bridging, 247–248
- crack extension force, 241
- creep, 40
- crocodile, 280
- Crocodylia*, 280–283
- crossed-lamellar aragonite, 144
- crustacean, 304–312
- Cryosomallon squamiferum*, 147
- cuica, 365
- Culex pipiens*, 345

- curaua, 348
- curvature of a beam, 398
- cuticle, 472
- cutting, 486
- cutting edge, 539
- cuttlebone, 146, 443
- cuttlefish, 443, 445
- cyanoacrylate, 318
- cycloid, 35
- cysteine, 58
- cytoplasm, 105
- cytosine, 55
- cytoskeleton, 107–109
- Darwin, C., 568
- Dasypus novemcinctus*, 274
- deflection, 120
- de Mestral, G., 501
- Demospongiae*, 160
- densification, 407
- density functional theory, 560
- dental implants, 273
- dental materials, 273
- dentin, 268, 335, 499
- dentin–enamel junction, 264, 266
- desert beetle, 511
- diastolic, 378
- diatom, 31, 157, 544
- digitorum longus*, 375
- dinosaur, 81
- DNA, 55, 105, 560, 563, 569, 576, 581
- DNA unfolding, 356
- DOPA, 58, 342, 527
- Dosidicus gigas*, 342
- D-period, 72, 77
- dragline, 296
- dragline silk, 297
- drug manufacture, 570
- drug-eluting stent, 385
- dry adhesion, 453
- dynamic light scattering, 560
- Eagle pub, 55
- echinoderm, 484, 545
- Echinoidea*, 213
- ECM, *see* extracellular matrix
- egg shell, 216
- elasmoid, 332
- elastic buckling, 506
- elastin, 53, 66, 83–84, 362, 381, 561
- electrospinning, 409, 554, 581
- elephant tusk, 268
- elytron, 315
- enamel, 262
- enameloid, 489
- end-cap fracture, 415
- endocuticle, 305
- endoplasmic reticulum, 105
- endothelial cell, 84, 106
- entropic effect, 355
- entropy, 84, 390
- environmental constraint, 9
- Epicel[®], 575
- epicuticle, 305, 315
- epidermis, 363
- epithelial cell, 106, 125
- epithelium, 184
- equine hoof, 320
- erythrocyte, 106, 125
- erythrophore, 483
- Escherischia coli*, 563, 570
- eugenics, 570
- eukaryote, 102
- eukaryotic cell, 104
- Euler's buckling equation, 124, 399, 431
- Euplectella aspergillum*, 161, 506
- European starling, 478
- Evans–Charles technique, 264
- evolution constraint, 9
- evolutionary convergence, 34
- exocuticle, 305
- exoskeleton, 292, 304, 307
- extracellular matrix, 79, 113, 119, 553
- extraction of metals, 4
- extrinsic toughening, 248
- Falco sparverius*, 397, 440
- falcon, 440
- fast-twitch, 375
- fatigue, 254–255
- feather, 19, 435–442
- femoral head, 65
- femoral stem, 63
- fiber bridging, 246
- fiber optics, 508
- fiber pultrusion process, 538
- fibril, 79, 368
- fibrin sealant, 318
- fibroblast, 106
- fibroblastic cell, 125
- fibroin, 66, 88, 296
- fibrolamellar bone, 235
- finite element method, 560
- Fischmeister–Arzt theory, 407
- fish, 543–544
- fish otolith, 217–218
- fish scale, 332–339
- fissured fracture, 239
- flagellum, 105
- flexible dermal armor, 34, 81
- flexure formula, 121
- Florence Duomo, 198
- Flory, P. J., 390
- Flory–Treloar equation, 355, 359
- fluorescence spectroscopy, 560
- fluoroapatite, 223
- foliated calcite, 144, 165
- foot pedal, 469
- Fourier transform infrared spectroscopy, 560
- fracture toughness, 185, 241, 246, 250, 263, 415
- freeze casting, 521
- freeze-drying, 409
- friction, 453
- frustule, 157, 545

- functionality, 9
 Fung equation, 355, 361–362

 GAG, *see* glycosaminoglycan
 Galen, 547
Gallus gallus, 440
 γ -chitin, 91
 ganoid, 332
 ganoine, 335
 gecko, 35, 452
 gecko feet, 453, 455–461, 512–513
 gemsbok, 323
 genetic engineering, 576
 genetically engineered peptides for inorganics, 566
 genetically modified organism, 569
 genomics, 498
 GEPIs, *see* genetically engineered peptides for inorganics
 germinative epithelium, 323
 giant clam, 157
 Gibbs free energy, 30
 Gibson–Ashby equations, 402–403
 GIC, *see* glass ionomer cement
 glass ceramics, 143
 glass ionomer cement, 318
 glass transition temperature, 376
 glider, 497
 glutamate, 58
 glutamine, 58
Glyceria, 212
 glycine, 58
 glycoprotein, 301
 glycosaminoglycan, 112
 GMO, *see* genetically modified organism
 goldfish, 337
 Golgi apparatus, 96, 105
 graft, 385
 granulocyte, 106
 great white shark, 487
 greenstick fracture, 239
 greigite, 148
 GRF glue, 318
 Griffith equation, 186
 ground beetle, 344
 growth kinetics, 132
 guanine, 55
 guppy, 337

 hagfish, 390
 hagfish slime, 83, 390
Haliotis rufescens, 168, 174, 185, 465
 Halpin–Tsai equation, 212
 Hamaker constant, 460
 HAP, *see* hydroxyapatite
 HAP-coated implant, 143
 HAPEX, 501
 Harvey, W., 378, 547
 Haversian canal, 224, 226, 248, 254
 Haversian system, 26
 HDPE, *see* high-density polyethylene
 heart-assist device, 550–552
 heart-lung machine, 552

 Heaviside function, 358
 helical fracture, 240
 Helmholtz free energy, 30
 hemicellulose, 66, 105, 348
 hemodynamic performance, 550
 hemorrhagic stroke, 379
 hemostasis, 106
 hexactinellid spicule, 161
Hexactinellida, 160
 hexapod, 304, 312–317
 hierarchical structure, 19–29
 hierarchy, 9
 high-density polyethylene, 5, 63, 376
 Hill equation, 375
 histidine, 58
 hollow bone, 417
 hollow tube, 312
Homarus americanus, 305
 hominid, 1
 hoof, 318
 Hopkinson pressure bar, 258
 horn, 168, 324
 hornbill, 421
 horseshoe crab, 556
 horsetail stem, 539
 Humboldt squid, 342
Hyalonema sieboldi, 163
 hyaluronic acid, 409
 hydration, 9
 hydrocephalitis, 552
 hydrophilic surface, 511, 561
 hydrophobic surface, 511
 hydrophobic wax, 472
 hydroxyapatite, 23, 129, 137, 146, 223, 226, 235, 284, 499
 hydroxyproline, 58
 hypodermic needle, 346, 539
Hypolithium sharaderenium, 486

 Icarus, 499
 ice-templating process, 522
 IF, *see* intermediate filament
 inflammation, 106
 insect antenna, 29
 insect mandible, 342
 insulin-like growth factor, 410
 Integra[®], 575
 integumentary appendage, 448
 interlocking, 453
 intermediate filament, 81, 105, 108, 321, 324, 330, 363, 391
 intervertebral disc implant, 471
 intracuticular wax, 472
 intramedullary pin, 172
 intrinsic toughening mechanisms, 248
 iridescence, 479, 482
 iridescent cuticle, 482
 iridophore, 484
 iron oxide, 53
 iron oxide radula, 264
 isoleucine, 58
 isopidine, 335

- isotropic materials, 276
- Isurus oxyrinchus*, 489
- J curve, 79, 301, 355, 360, 381, 391
- J integral, 241, 254, 259, 319, 321
- Jäger–Fratzl equation, 148, 228, 284
- Jäger–Fratzl model, 228
- Jarvik artificial heart, 552
- Jarvik heart machine, 550
- JKR equation, *see* Johnson–Kendall–Roberts equation
- Johnson–Kendall–Roberts equation, 457, 460, 513
- joint replacement, 65
- Kalanchoe pumila*, 476
- Katz equation, 227
- Kelvin model, 41
- keratin, 53, 66, 81–83, 97, 292, 318, 326, 421, 435
- keratinization, 81
- keratinocyte, 97, 104, 363
- kingfisher, 542
- kinking, 188
- lacunae space, 224, 256
- ladybug, 461
- LAL, *see* limulus amebocyte lysate
- Langer lines, 368
- Langmuir–Blodgett deposition, 520
- lapillus, 217
- law of complexity-conscience, 30
- layered nanocomposite, 515
- LB deposition, *see* Langmuir–Blodgett deposition
- LDPE, *see* low-density polyethylene
- leatherback turtle, 280
- LED, *see* light-emitting diode
- Leonardo da Vinci, 45, 497
- Lepidoptera*, 480
- leucine, 58
- leukocyte, 84, 125
- ligament, 293
- ligamentum flavum*, 293
- ligamentum nuchae*, 84
- ligand, 119
- light-emitting diode, 561
- lignin, 53, 95, 105, 348
- lignocellulosic fiber, 348
- limulus amebocyte lysate, 556
- Limulus polyphemus*, 556
- lipid, 95
- lipid bilayers, 95
- liposome, 555
- lithium-ion battery, 561, 571
- liver dialysis machine, 551
- living fossil, 556
- local buckling, 399–400
- locomotion, 117
- logarithmic spiral, 165
- Loligo*, 341
- lotus leaf, 472–474
- lotus root, 539
- Lotusan, 474
- low-density polyethylene, 5
- Loxorhynchus grandis*, 310
- Lucy, 15
- lustrins, 88
- lysosome, 105
- lysine, 58
- M13 virus, 573
- MA, *see* major ampullate
- macrophage, 104, 106, 125
- magnesium alloy, 38
- magnetic twisting cytometry, 112
- magnetite, 147, 211–212
- major ampullate, 88, 112, 297
- Mako shark, 489
- malaria, 113
- mammalian skin, 29
- manatee, 274
- mantid shrimp, 157, 213
- mantle, 184
- maripod, 304
- marine adhesive, 524
- Mars exploration, 541
- Mars Lander, 563
- maturation and remodeling, 106
- Maxwell element, 44
- Maxwell model, 41
- mechanical valve, 549
- mechatronics, 498
- medulla, 448
- Megarhyssa ichneumon*, 492
- melanin, 437
- melanophore, 483
- MEMS, *see* microelectromechanical systems
- Menippe mercenaria*, 310
- mermaid’s necklace, 387
- Mesembryanthemum crystallinum*, 475
- mesenchymal stem cell, 106
- mesolayer, 175, 210
- messenger RNA, 55, 95
- metachrosis, 482
- metallic stent, 385
- methionine, 58
- microbuckling, 188, 327
- microcracking, 248, 267
- microelectromechanical systems, 42, 579
- microfibril, 72
- microfilament actin, 107
- microfluidic processing, 581
- microlens, 508
- micropipette aspiration, 112
- microtubule, 105, 107, 119
- microvilli, 184
- mild synthesis condition, 9
- Miller–Urey experiments, 102
- mitochondrion, 105
- mitral valve, 548
- mode I fracture, 241
- mode II fracture, 241
- mode III fracture, 241
- molecular dynamics, 301, 362
- mollusc shell, 146
- moment of inertia, 123

- montmorillonite, 517
- Mooney–Rivlin equation, 238, 355, 359
- Morpho* butterfly, 480, 528
- Mosquito airplane, 538
- mother of pearl, 165, 170, 174
- motility, 117–118
- mRNA, *see* messenger RNA
- MTC, *see* magnetic twisting cytometry
- mucous gland, 464
- multifunctionality, 29–30, 110
- muscle, 84, 375–377
- muscle cell, 125
- mussel bivalves, 157, 384, 452
- mussel byssus, 384–388, 524
- myofibril, 86
- myosin, 84, 117
- Mytilus edulis*, 527
- nacre, 144, 165, 499
- nanocrystal, 303
- nanoelectromechanical systems, 579
- nanofibrils, 35
- nanotronics, 498
- natural fibers, 346
- NEMS, *see* nanoelectromechanical systems
- neodermis, 575
- neoplastic transformation, 118
- neuron, 125
- Newtonian viscous materials, 42
- NITINOL, 5, 385–386, 388
- nonabsorbable suture, 171–172
- nonlinear elasticity, 381–383
- nucleation, 129–132
- nucleation rate, 131
- nucleic acid, 55
- nucleotide, 55
- nucleus, 105
- oberhautchen, 482
- oblique fracture, 240
- octopus, 89
- Odontomachus bauri*, 344
- Ogden equation, 355, 359–360, 369
- optical tweezer, 113
- organelle, 104
- origami structure, 531–532
- orthomimetics, 554
- orthorhombic structure, 138
- oryx, 325
- os cornu*, 323
- osseointegration, 270–271
- ossicle, 274
- osteoblast, 104, 106, 226, 271
- osteochondral scaffold, 410, 554
- osteoclast, 104, 226, 271
- osteocyte, 110, 226
- osteoderm, 274, 279, 281, 537
- osteogenesis, 410
- osteon, 26, 224, 256
- ovipositor, 492
- ovipositor drill, 541
- Ovis canadensis*, 327
- pacemaker, 552
- Pagrus major*, 334, 338
- palm, 412
- Pampas grass, 486
- pangolin, 81
- pangolin scale, 332–333
- Papilio blumei* butterfly, 531
- Papilio palinurus* butterfly, 531
- papillary muscle, 75
- parenchyma, 412
- PDMS, *see* polydimethylsiloxane
- peacock, 442
- peacock tail feather, 442
- peccoid scale, 477
- pectine layer, 472
- PEEK, *see* polyetheretherketone
- PEG, *see* polyethylene glycol
- Pelecyphora aseliformis*, 475
- Penaeus mondon*, 310
- peptide, 57
- pericardial valve, 550
- pericardium, 77–78
- Pericharax heteroraphis*, 164
- PET, *see* polyethylene terephthalate
- PGA, *see* polyglycolic acid
- PGSA, *see* polyglycerol sebacate acrylate
- phage, 563
- phage display, 572
- phage-enabled assembly, 563–566
- phase transition, 135
- PHEMA, *see* polyhydroxyethyl methacrylate
- phenylalanine, 58
- phospholipid, 95
- photonic crystal array, 478–481
- Phyllacanthus imperialis*, 213
- physical vapor deposition, 515
- piassava, 346
- pig skin, 368
- pigment, 478
- Pinctada maxima*, 168
- piranha, 337, 487
- piscivorous fish, 489
- PLA, *see* polylactic acid
- placoid, 332
- plant cell, 105
- plant epidermis, 472
- plant stalk, 400
- plasma membrane, 105
- plasma-spraying, 409
- plasticizer, 321
- plastron, 278
- plate, 171
- PLGA, *see* polylactic/glycolic acid
- plywood structure, 197
- PMMA, *see* polymethylmethacrylate
- pneumatic bone, 418
- Poecilia reticulata*, 337
- polydimethylsiloxane, 376
- polyetheretherketone, 376
- polyethylene glycol, 376
- polyethylene terephthalate, 376
- polyglycerol sebacate acrylate, 513

- polyglycolic acid, 578
- polyhydroxyethyl methacrylate, 376–377
- polylactic acid, 578
- polylactic/glycolic acid, 376, 555
- polymer-based scaffold, 409
- polymerization, 117
- polymethylmethacrylate, 318, 376
- polymorph, 134, 139
- polypeptide, 58, 81
- Polyplacophora*, 211
- polypropylene, 376–377
- Polypterus senegalus*, 334
- polysaccharide, 66, 89–94
- polytetrafluoroethylene, 376, 377
- polyvinylchloride, 376, 378
- porcine valve, 550
- porcupine quill, 397
- Porifera*, 160
- power equation, 358
- PP, *see* polypropylene
- Precambrian, 144
- Priacma serrata*, 343
- Prigogine, I., 30
- prismatic, 165
- proboscis, 344
- procollagen, 96
- procuticle, 305
- prokaryote, 102
- proliferative phase, 106
- proline, 58
- ProOsteon[®], 409, 501
- protein, 175, 181, 362
- protein thread, 390
- proteomics, 498
- protocol, 270
- protrusion, 117
- Pseudomonas syringae*, 570
- PTFE, *see* polytetrafluoroethylene
- pulmonary valve, 548
- PVC, *see* polyvinylchloride
- pyrimidine, 55
- pyrite, 148
- R curve, 245–246, 248–249
- rachis, 435, 438–439, 442, 448
- radiolarian, 160
- rain beetle, 461
- Ramberg–Osgood equation, 237–238, 339
- rami, 448
- Ramphastos toco*, 328, 420, 438
- Raoult’s law, 129
- rattan, 539
- red abalone, 465
- red blood cell, 103
- reduction, 171
- regurgitation, 548
- reinforcing strut, 400
- removal torque, 273
- residual stress, 383–384
- resilin, 66, 88, 561
- Reuss model, 226
- rhinoceros skin, 365
- rhombohedral structure, 139
- ribosomal RNA, 55
- ribosome, 105
- RNA, 55, 105
- rodent incisor, 491–494
- sagitta, 217
- SAM, *see* self-assembled monolayer
- sandwich structure, 401, 537
- sarcomere, 75
- Saxidomus purpuratus*, 168, 205
- SAXS, *see* small-angle X-ray scattering
- scaffold, 409
- Scarites subterraneus*, 316
- sclerite, 148
- screw, 171, 273
- Scylla serrata*, 310
- Scynax perereca*, 455, 461
- sea spicule, 29
- sea sponge, 508
- sea urchin, 146, 157, 213–214, 516
- sealant, 318
- self-assembled monolayer, 560–561
- self-assembly, 8, 30–31, 581
- self-assembly structure, 561–563
- self-healing ability, 29
- self-healing capability, 8
- self-healing composite, 532–534
- self-organization, 30–31
- Sepia pharaonis*, 443
- Sepia sepua*, 445
- Sepiida*, 443
- sericin, 296
- serine, 58
- Serrasalmus manueli*, 487
- serrated teeth, 34
- serration, 486–487
- setae, 455, 465, 469
- shark skin, 477–478, 543
- Sharklet[®], 544
- Sharpey’s fibers, 274–276, 282
- sheep horn, 535
- Shinkansen bullet train, 541
- shot-blasting, 409
- shredder, 539
- shrimp hammer, 213–216
- shunt valve, 552
- sickle cell anemia, 113
- silaffins, 158
- silica, 129
- silicatein, 88, 162
- silicon micromachining, 539
- silicon rubber, 376, 378
- silk, 89, 296, 499, 561
- silk fibroin, 409
- silkworm, 88
- SiO₂·*n*H₂O, 159
- sisal, 346
- skin, 362–374
- skin scaffold, 554
- slime, 390
- slow-twitch, 375

- small-angle X-ray scattering, 77
- smashing limb, 213
- soleus*, 375
- solubility product constant, 129
- spatulae, 35, 455, 457–458
- spectrin, 114
- spherulitic crystal, 176, 216
- spider, 88, 296
- spider web, 301
- Spiderman, 459
- spinal cage, 471
- spinal implant, 471
- spinal plate, 471
- spinnerette, 554
- sponge, 400
- sponge spicule, 160–164
- sputtering, 515
- squid, 89
- squid beak, 339–343
- SR, *see* silicon rubber
- standard model, 41
- STAR scaffold, 555
- starling, 437
- Starr–Edwards valve, 549
- steel, 69
- Stegostoma fasciatum*, 489
- Stenocara sp.*, 511
- stenosis, 548
- stent, 385
- sterol, 95
- stratum compactum*, 372
- stratum corneum*, 362
- stress relaxation, 40
- stress–strain curve, 301
- Strombus gigas*, 196, 198
- strut, 418
- Sturnis vulgaris*, 437, 478
- sucker, 342
- suction, 453
- Super Glue, 318
- superhydrophobicity, 473
- suture, 172, 279
- synchrotron, 78
- synchrotron-ray computed tomography, 251
- synthetic foam, 441
- synthetic skin, 576
- systolic heart cycle, 378
- T4 phage, 563
- teeth, 262
- Teilhard de Chardin, P., 30
- telson, 215
- tendon, 293
- tensegrity, 108
- terraced cone, 179
- terrapin, 278
- testudine, 278–281
- Thalassiosira pseudonana*, 158
- Thomas tetrahedron, 7
- three-dimensional printing, 409
- threonine, 58
- thymine, 55
- tissue engineering, 553–554
- tissue engineering scaffold, 553–554
- titanium oxide, 270
- titanium scaffold, 409
- titin, 75
- TKA, *see* total knee arthroplasty
- toad, 372
- Toco toucan, 423, 441
- toe pad, 461
- torsion, 399
- tortoise, 278
- total hip replacement, 63
- total knee arthroplasty, 65
- toucan, 421
- toucan beak, 330, 425
- trabeculae, 422, 429
- transfer RNA, 55
- transforming growth factor, 410
- transgenic mice, 570
- transverse fracture, 240
- trap-jaw ant, 344
- tree, 33
- tree frog, 461
- Treloar equation, 359, 390; *see also* Flory–Treloar equation
- tricuspid valve, 548
- Tridacna gigas*, 202
- triglyceride, 95
- trilobite, 304
- triple helix, 69
- Troyteutes tricinctus*, 274
- tryptophan, 58
- tubule, 263, 266, 307, 320–321, 324, 327
- turbine blade, 546
- turtle, 278
- tusk, 262
- twisted plywood structure, 311, 338
- type I collagen, 333
- tyrosine, 58
- UltraCane, 527
- ultrahigh-density polyethylene, 63
- ultrahigh-molecular-weight polyethylene, 63
- uncracked ligament, 246
- underwater adhesion, 465
- urinary incontinence, 552
- vacuole, 105
- vaginal tissue, 79
- valine, 58
- van der Waals attraction, 455, 460, 464, 470, 512
- vascular channel, 224
- vascular implant, 387
- vascular system, 378
- vascularization, 577
- vaterite, 146, 217
- vein, 378
- VELCRO®, 453, 497
- vena cava, 548
- venous blood, 547
- vent hole, 102

- ventricle, 548
- venule, 378
- Venus flower basket, 161
- vesicle, 555
- virus, 563, 565, 570
- virus–DNA array, 498
- viscid silk, 297
- viscoelastic, 323
- viscoelastic behavior, 369
- viscoelasticity, 40
- Vitallium, 5, 172
- Voigt model, 226, 325
- Volkman’s canals, 224, 256
- Von Lilienthal, O., 497
- vulture wing, 505
- water, 54–55
- water collection, 511–512
- water-jet mechanism, 340
- wave-guiding properties, 509
- wax, 95
- Weibull, W., 45
- Weibull equation, 47
- Weibull modulus, 46
- Weibull statistics, 186, 206
- wet adhesion, 453
- wet spinning, 581
- whale bulla, 274
- whale fin, 546
- whelk egg, 387–390
- wing bone, 400
- wing case, 315
- WLC model, *see* worm-like chain model
- Wolff’s law, 33, 224
- wood, 400, 410–417
- wool, 390
- work of fracture, 184
- worm-like chain equation, 355
- worm-like chain model, 115, 355
- woven composite, 539
- Wulff plot, 132
- X-ray diffraction, 560
- xanthophore, 483
- Z line, 85
- Zayed National Museum, 508
- zebra shark, 489
- zinc phosphate, 318
- zirconia, 142
- zooplankton, 160