



# Index

- ablate cancer cells 17, 52
- ACL *see* anterior cruciate ligament
- active targeted drug delivery 235, 237, 276, 279
- AD *see* Alzheimer's disease
- AFM *see* atomic force microscope
- albumin nanoparticles 275, 279
- ALD *see* atomic layer deposition
- aldehydes 255–256
- alpha methyl tryptophan (AMT) 137, 152
- Alzheimer's disease (AD) 118, 120–121, 138, 151–152, 154
- amino groups 67
- AMT *see* alpha methyl tryptophan
- amyloid precursor protein (APP) 120
- anterior cruciate ligament (ACL) 104
- antibodies 57, 59, 67, 235, 276, 287–288, 299, 306–307
- antigens 57, 59, 74, 235–237, 279, 282, 288, 296, 299, 321
- apoptosis 62–63, 125, 152, 169, 193, 196, 258
- APP *see* amyloid precursor protein
- aptamers 63–64, 66, 73–74, 243, 276
- arc discharge 8, 11, 41, 43
- artificial intelligence 420, 425
- atom relay 398–399, 423
- atom relay switch 398, 401, 425–426
- atomic force microscope (AFM) 27, 29–30, 42–44, 191, 195, 354
- atomic layer deposition (ALD) 3, 5, 41, 43, 118
- avidin 68
- bacteria 66, 128, 173, 177–180, 198, 235, 295, 389, 407–408
- BBB *see* blood-brain barrier
- BBMEC monolayers 142–143
- BBMECs *see* bovine brain microvessel endothelial cells

- binding 24, 51, 57, 64–67, 71, 111, 157, 181, 236–237, 269, 288, 316, 323  
    silver nanoparticle 181, 194  
binding affinity 57, 74, 133  
binding sites 60–61, 210  
bio-materials 156  
biocompatibility 83–84, 90, 96, 113, 156, 162, 177, 195–196, 209–210, 215, 230, 240, 277  
biological environment 50, 53, 79, 145, 156–158, 168, 177, 201–203, 229, 306  
biomimicry 156, 195–196, 202  
bionanotechnology 36, 42, 44  
biotin 68, 70  
blood 106, 125, 127, 129, 136, 150–151, 294, 301, 308, 406, 416  
blood-brain barrier (BBB) 118, 120, 125, 127–128, 130–133, 135–140, 149–153, 234, 320  
BMMs *see* bone marrow macrophages  
bone 54, 79, 83, 86, 90, 100, 102–103, 164, 168, 193  
bone growth 165, 168–169, 193, 196  
bone marrow macrophages (BMMs) 147, 149, 152  
bovine brain microvessel endothelial cells (BBMECs) 140  
bovine serum albumin (BSA) 22, 110, 181  
brain 38, 54, 85, 118, 120, 125, 127, 131–132, 135, 137–138, 140, 149–151, 153, 320, 323  
brain tissue 138  
breast cancer 234, 342  
BSA *see* bovine serum albumin  
buckminsterfullerenes 145, 147  
buckyballs 8–10, 41, 259, 278, 280  
buckyosomes 260, 262, 279  
cancer 17, 19, 39, 45–46, 51, 53–55, 73, 75, 131, 151, 153, 236, 276, 337–338, 386–387, 411  
cancer cells 11, 17, 20, 40, 49, 52–54, 56, 58–59, 61, 64–66, 73–75, 236, 253–254, 276–278, 297, 410–411  
    killing of 49, 73  
    nanoparticle-mediated thermal ablation of 38, 50  
    neck 304–305  
    prostate 237, 242, 244  
cancerous phenotypes 297, 354  
cantilevers 30, 295–296, 321  
carbon nanofibers 79, 91–93, 113, 115, 124, 208–210  
carbon nanotube grid 121–122  
carbon nanotubes 3–4, 7–9, 11–17, 41, 46–47, 49–52, 67–71, 73, 150, 263–264, 278, 306–307, 359–360, 363–364, 383–384, 394  
    golden 306–307, 309, 322  
    single-walled 8, 11–13, 16, 41  
carbon nanotubes (CNTs) 3–4, 7–9, 11–17, 28, 41, 46–47, 49–52, 67–71, 73, 263–264, 278, 306–307, 359–360, 363–364, 383–384, 394  
cartilage 79–80, 85, 100, 102  
catalase 149, 153  
CED *see* convection-enhanced delivery  
cell culture 113, 187, 197–205, 208, 210, 212, 221, 229–232  
cell culture system 204, 232  
cell surface 55–56, 59, 66, 111, 135, 192, 235, 238, 255–256, 268

- cell surface receptors 55–56, 95, 202, 229, 235
- cells 52–55, 77–80, 85–86, 110–111, 124–126, 142–145, 183–186, 190–192, 198, 200–205, 217–219, 225–229, 258–259, 276–278, 293–294, 297–300
- cancerous 45, 325
- eukaryotic 25, 181, 203, 298
- glioma 133–134
- host 181
- human 192, 327, 343, 354
- individual 190, 297, 419
- live 90, 123, 126, 256
- living 126, 191, 197, 332, 347, 391
- manipulation of 190, 200
- neural 85, 126
- normal 236, 317, 322
- single 188, 203, 297
- spinal cord 118, 150
- targeted 59, 63
- unwanted 21, 71, 169
- cellular death 62
- cellularization 219–221, 231
- CeO<sub>2</sub> 143–145
- ceramics 156, 163, 165–166, 169, 192
- cerium oxide 143, 152, 154
- chemical vapor deposition (CVD) 3, 8–9, 41, 43, 161, 193
- chitin 81, 83, 213
- chitosan 78–81, 84, 113, 115, 213–214, 269
- chitosan nanoparticles 269, 278
- chondrocytes 79–80, 85, 102–103, 217
- chromosomal material, unwanted 409–410
- chromosomal replacement therapy (CRT) 409, 424
- circulating tumor cells (CTCs) 308
- cisplatin 116, 266, 277–278
- clottocytes 406–407, 425
- cluster science 3–4, 43
- CMC *see* critical micelle concentration
- CNTs *see* carbon nanotubes
- coating 101, 131, 156, 163–167, 171, 307
- nanostructured hydroxyapatite 163–165
- coating material 167
- collagen nanofibers 79, 81, 86, 113, 210–211, 230, 232
- composites 15, 156, 166, 169, 192, 241
- compressive strength 101–102
- computed tomography (CT) 26, 304–305, 312, 322, 324–325
- confocal slices 191
- connective tissue 79, 81, 103
- controlled drug delivery 110–111, 114
- convection-enhanced delivery (CED) 131, 151–152
- covalent bonds 50, 66–67, 75
- critical micelle concentration (CMC) 26, 43–44
- CRT *see* chromosomal replacement therapy
- CT *see* computed tomography
- CTCs *see* circulating tumor cells
- cultured cells 150, 200, 229
- CVD *see* chemical vapor deposition
- dead cells 90, 123, 229
- delivery vehicles 150–151, 267, 269
- gene 259, 269, 278
- dendrimers 23–25, 42–43, 118, 131, 133, 136, 151, 252–253, 255–256, 277, 280, 355

- dermis 105, 115
- desorption 110, 114–115
- diagnostics 19, 21, 38, 131, 135, 257,  
282, 320–321, 323, 325, 337–338,  
344, 350, 358, 383, 389  
nanotechnology-based 350,  
381–382  
whole-genome 411, 424–425
- diamond 7, 48, 159, 161, 163–164,  
192, 196
- disease 17, 36, 39, 71, 119–120, 138,  
147, 155, 257, 280–281, 287, 321,  
332, 343, 410–411
- disease site 42, 71–72, 257
- DNA 36–38, 42, 125, 129, 134, 136,  
141, 150, 259–260, 269–270,  
284–285, 393, 401–402, 412, 414
- DNA sequences 285, 411, 413–414
- double helix 36–37
- drug delivery 22, 25, 42, 50, 90,  
127–128, 130–131, 137, 153,  
233–234, 238, 240, 252, 276–277,  
279–280, 320
- drugs 24, 74, 110, 131, 146–147, 151,  
236–240, 244–245, 249–251,  
263, 266–268, 272, 277–279, 287,  
318–320, 357
- dsDNA 261
- EE *see* encapsulation efficiency
- EGF *see* epidermal growth factor
- EGFR *see* epidermal growth factor  
receptor
- EGFP *see* enhanced green fluorescent  
protein
- EGFR *see* epidermal growth factor  
receptor
- elasticity 30, 81, 83, 105, 108
- elastin 79, 86, 88–89
- electrodes 190, 283, 290, 292  
parallel plate 170  
sensing 289
- electrons 7, 15–16, 21, 28, 67, 395,  
403
- electrospinning 81, 93–94, 98,  
104–105, 113–115, 173, 205, 219,  
231
- electrospraying 93–94, 115–116,  
222
- encapsulation efficiency (EE)  
270–271, 280
- endothelial cells 89, 107, 127, 137,  
238, 308
- energy 15–16, 20, 68, 183, 186, 301
- engineering 35, 42, 77–78, 89, 91–92,  
97, 100, 102, 105, 108, 113–114,  
122, 168, 197, 205, 354
- engineering applications 80, 85, 100,  
113, 222
- enhanced green fluorescent protein  
(EGFP) 269, 273
- environment 68, 105, 202–203, 217,  
226, 229, 355, 359, 363, 366,  
368–369, 373–374, 376–377, 383,  
385
- epidermal growth factor (EGF) 63,  
105, 174, 236, 253, 266, 273, 291
- epidermal growth factor receptor  
(EGFR) 62–63, 236, 253, 266,  
273, 278, 280, 291, 293
- epidermis 105, 115
- ER *see* estrogen receptor
- ERE *see* estrogen response element
- estrogen receptor (ER) 234, 236, 299
- estrogen response element (ERE) 299,  
324
- evolution 3, 422, 424, 426

- external fields 15, 41, 45–46, 49,  
53–54, 58, 68, 71–72, 75, 169,  
263, 304
- FDA *see* Food and Drug  
Administration
- Ferrari, Mauro 337, 339, 342
- Feynman, Richard 2, 41, 403
- fibers 78, 83, 87, 92–95, 104, 139, 173,  
203, 223
- fibroblasts 84, 104, 113, 200
- fibroin 83, 113, 115
- flank tumor 311
- Food and Drug Administration (FDA)  
6, 62, 71, 356–357, 359, 361, 383
- Food and Drug Administration  
Nanotechnology Task Force  
356, 386
- free methotrexate 254, 257
- free radicals 138, 144–145, 152
- fullerenes 3–4, 7–10, 19, 23, 41, 43, 68,  
118, 144, 146–148, 152, 259, 355
- fullerenols 147, 152–154, 260
- functional groups 122–123, 150–151,  
177
- Gannon's group 52
- GCR *see* glucose consumption rate
- gelatin 78–79, 82–84, 88–89, 113, 115,  
222, 272
- gelatin nanoparticle dispersions 273,  
278
- gelatin nanoparticles 272–274, 278
- gene expression 130, 132, 187, 207
- GFP *see* green fluorescent protein
- glucose consumption rate (GCR)  
227–228, 231
- glutamate 144–145, 148
- gold 17, 20, 28, 46, 254–255, 304, 325,  
394, 411
- gold nanoparticles 18–20, 42, 46–47,  
69, 290, 304, 325, 411
- functionalized 299, 322
- gold nanoshells 19–21, 42, 46, 49, 304,  
306, 322
- graphene sheet 11–14
- green fluorescent protein (GFP) 136,  
269, 273
- HaCaT cells 227
- HAECs *see* human aortic endothelial  
cells 212, 230
- HCASMCs *see* human coronary artery  
smooth muscle cells
- healing 90, 172–173, 269
- health 40, 330, 333, 360–361, 363,  
367–369, 372, 374, 377–378, 382,  
384–385
- human 1, 329, 365–366, 368, 373,  
376, 381
- HEPM *see* human embryonic palatal  
mesenchymal
- HSE *see* human skin equivalent
- human aortic endothelial cells  
(HAECs) 212, 230
- human coronary artery smooth  
muscle cells (HCASMCs) 212,  
230
- human embryonic palatal  
mesenchymal (HEPM) 86, 88
- human skin equivalent (HSE) 105,  
175
- hyaluronic acid 78–79, 81, 96, 115,  
269
- hydrophobic nanoparticles 316

- hydroxyapatite 159, 164, 192–193, 195–196, 214
- hydroxyapatite nanoparticles 156–157
- hyperlens 417, 419, 424–426
- IBAD *see* ion beam-assisted deposition
- imaging agents 137, 151, 277–278, 337
- immunization 274
- industrial nanomaterials 373, 385
- inflammation 170, 267–269
- injection 54, 72, 107, 130, 132, 244, 257
- intravenous 71–72, 74–75, 138
- localized 52, 71–75
- single intratumoral 244, 254
- instrumentation 3–4, 32–33, 182, 321
- intracellular nanosurgery 181, 194–195
- ion beam-assisted deposition (IBAD) 166–167, 195
- iron oxide nanoparticles 278, 310
- keratinocytes 105, 113, 115
- kinetic energy 390, 396, 426
- laser 30, 173–174, 182–184, 186, 190, 194–196, 221, 298
- laser ablation 8, 10, 41, 43, 231
- laser Doppler vibrometer (LDV) 296, 324
- laser nanosurgery 184, 190, 194–195
- ultrafast 184, 186–188, 194–195
- LCST *see* lower critical solution temperature
- LDV *see* laser Doppler vibrometer
- ligands 59, 64–65, 68, 137, 229, 235, 276, 279, 308, 312
- light scattering 5, 297, 411
- lipo-PEG-peptides (LPPs) 319–320
- liposomes 24–26, 39, 42–43, 59, 118, 130–132, 151, 153, 267, 278, 315–318, 320, 323, 325, 359
- localization 132, 138, 246
- lower critical solution temperature (LCST) 213, 231
- LPPs *see* lipo-PEG-peptides
- lymphatic system 106, 307, 316
- macrophages 130, 147, 152–153, 255–256, 279–280
- magnetic cationic liposomes (MCLs) 226, 231
- magnetic field 21–22, 52–53, 190, 226, 231, 320
- magnetic fluid-loaded liposome (MFL) 320, 324
- magnetic iron oxide nanoparticles 22, 190
- magnetic nanoparticles 21, 39, 53, 226, 232, 258, 307–308, 310, 320, 323
- magnetic resonance imaging (MRI) 22, 131, 304, 307–308, 310–313, 315, 317, 323
- magnetism-engineered iron oxide (MEIO) 309, 324
- mass spectroscopy (MS) 299, 302, 322, 324
- materials 3–4, 7, 27–29, 32–33, 71, 94, 121, 125, 150, 156–157, 161–163, 166, 168–169, 171–173, 364, 384–386
- metalloceramic 166–167, 193

- nanocrystalline 171
- nanotechnology-based 356
- MCLs *see* magnetic cationic liposomes
- mechanical nanocomputers 4, 398, 400, 423, 425–426
- mechanism of action 46–47, 49–50, 63, 137, 180, 186, 253
- medical applications 11, 18, 23, 38–39, 46, 49, 390
- medical research 4, 65, 343, 352–353, 381, 383
- MEIO *see* magnetism-engineered iron oxide
- mesenchymal stem cells (MSCs) 101, 210–211, 222, 232
- metal nanoparticles 46, 75, 302, 315
- metalloceramics 159, 166, 192–193, 195
- methotrexate 152, 253–254, 256–257, 279
- MFL *see* magnetic fluid-loaded liposome
- mice 58, 135–136, 147–149, 170, 244, 252, 265, 268, 270, 274–275, 278, 280, 306, 314, 319–320
- microbivores 407–409, 425–426
- microenvironment 107–108, 121, 202, 204
- microfibers 203, 219
- microfluidics 187–188, 195–196, 295
- microglia 120, 147, 152
- micromotors 190–191, 195
- mineralization 96, 101, 162, 165, 215
- MION-labeled cells 228
- MIONs *see* monocrySTALLine iron oxide nanoparticles
- molecular beacons 285
- molecular planetary gear 396–397, 425–426
- molecular relay, refined 398–400, 425
- molecular shuttle switch 398–399, 423, 425
- monoclonal antibodies 56–57, 59, 61–62, 74, 132, 235, 238, 267, 314
- monocrystalline iron oxide nanoparticles (MIONs) 227–228, 231
- Moore's Law 30–31, 42–44, 420
- motors 190, 392, 394, 396
- mouse model 147–148, 254
- MRI *see* magnetic resonance imaging
- MS *see* mass spectroscopy
- MSCs *see* mesenchymal stem cells
- multi-walled carbon nanotubes 11, 13–15, 41, 50, 69, 394
- MWNTs 12, 14–15, 50, 69, 394
- nanobiochip 282, 324
- nanobiosensors 281–282, 285, 287, 315, 321, 324–325
- nanobiotechnology 36, 44, 299, 348–349, 382
- nanocoatings 156, 159, 168, 177, 192, 194–196
- nanocomputers 396–397, 404, 423, 425–426
  - electronic 397–398, 423, 425
- nanodevices 253–254, 332, 398
- nanofiber-based bandages 173, 196
- nanofiber scaffolds 79–81, 84, 86, 97, 114, 174, 212, 219, 224
  - natural 209, 230, 232
- nanofibers 78–79, 81, 84–86, 89, 93, 96–97, 100–102, 104, 108, 111, 113–115, 205, 207, 211, 219, 221
  - aligned PU 104

- nanofibrous foams 98–99
- nanofluidics 282, 284–285, 321, 324, 342
- nanofoms 359, 373, 383, 385
- nanogels 118, 139–143, 149, 151, 153
- nanolaser scanning confocal spectroscopy 322, 324
- nanomaterial carriers 147
- nanomaterial characterization 358, 388
- nanomaterials 4, 6–7, 40–41, 43–44, 108, 117–118, 147, 150, 152–153, 158–159, 240–241, 358–360, 368–375, 377–378, 380, 383–388
  - environmental impacts of 368, 385
  - pre-clinical characterization of 357, 383
  - quantification of 372–373
- nanomaterials regulation 380, 386
- nanomaterials science 38, 161
- nanomedicine 4, 39–41, 44, 140, 327–328, 330–331, 334, 339, 342–343, 346–347, 349–352, 354–355, 371–372, 381–383, 386–387, 389
- nanomotors 390–391, 393–396, 423, 425–426
- nanoneedle 191–192, 195
- nanoparticle-based systems 224, 240, 277
- nanoparticle ingredients 367
- nanoparticle types 144
- nanoparticles 7, 17–19, 21–23, 43–45, 52–54, 66–68, 71–75, 143–145, 150–152, 240–243, 267–269, 271–273, 276–277, 307–310, 312, 367
  - application of 36, 45
  - biocompatible 23
  - composite 247, 255
  - delivery of 71, 238
  - ferrimagnetic 51–52
  - fluorocarbon 351–352
  - inorganic 7, 18
  - iron oxide 257–258
  - liposomal 267–268, 319
  - monodisperse 143, 247
  - polylactide 245, 280
  - stabilized 267, 278
  - targeted 118, 241
  - targeting 54, 66, 73
  - users of 364, 384
  - using 53, 168, 344
  - using titanium 224, 232
- nanopores 284–286, 291, 321, 324, 413, 426
- nanopulses 169, 193, 195–196
- nanorobots 389–390, 398, 404, 407, 423, 425
- nanoscaffolds 217–219, 230–231, 342
- nanoscale materials 156, 356–357
- nanoscience 1–2, 39, 44, 329, 365–368, 388
- nanoshells 20–21, 44, 307
- nanosilver 177, 179–180, 194, 196
- nanospheres 207–208, 230–232
- nanostuctured diamond 161–163
- nanotechnology 1–6, 36, 38, 41–44, 155, 281–282, 327–330, 336–341, 343–345, 351, 353–355, 357, 359–361, 363–373, 375–389, 420–422
  - application of 197, 228, 281, 337
  - deterministic 5, 43
  - emerging field of 328, 357
  - governance of 369, 385



- nucleic acid 36, 44
- potential environmental
  - implications of 359, 383
- products of 365, 384
- regulatory control of 367, 385
- regulatory oversight of 357, 373
- stochastic 4–5, 43
- nanotechnology-based research
  - strategies 366
- nanotechnology materials 356, 383
- nanotechnology patents 362, 384
- nanotechnology regulation 355, 365, 372–373, 375, 383
  - broad-based active governmental 378, 386
- nanotechnology research 44, 329, 334, 336, 344, 366, 381–382
- nanotools 27, 42–43
- nanotubes 47, 121, 125, 150, 264, 283–284, 321, 367
- nanowires 283, 285, 287, 291, 321
- nanozyme 149
- narrow-band imaging (NBI) 305–306
- NBI *see* narrow-band imaging
- nerve cells 147, 187
- networks 210, 284, 329, 402
- neurodegenerative diseases 118, 121, 150
- neurodegenerative disorders 120–121
- neuronal signaling 38, 40, 121–122, 415
- neurons 97, 117, 120–123, 127, 146–148, 198, 415–416
- neuroprotection 143–144, 146–147, 152–154
- nodes 32, 420
- nucleic acids 22, 36, 42–43, 64, 141, 200, 269, 278, 285, 293, 393
- nucleotides 36–37, 412–413
- nucleus 66, 107, 132, 134, 182, 184, 201, 299, 409–410
- nude mice 244, 258, 270, 279, 307–310
- one-dimensional structures 15–16
- oral nanorapamycin 252
- oxygen 127, 143, 145, 149, 254, 307, 394–395, 405
- PA *see* peptide-amphiphile
- PA-based nanofibers 96–97
- Parkinson's disease (PD) 120–121, 152
- payloads 59, 62, 74, 147, 280
  - contrast agent nanoparticle 315, 323
- PBMCs *see* peripheral blood mononuclear cells
- PCL nanofiber mesh 221
- PCL nanoparticles 247
- PCR *see* polymerase chain reaction
- PD *see* Parkinson's disease
- PEG *see* polyethylene glycol
- penicillin 177, 194, 249, 251
- penicillin molecules 177
- PEO *see* poly ethylene oxide
- peptide-amphiphile (PA) 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 47, 49, 51, 96, 238–276, 306–307
- peptide microenvironment 107
- peptide scaffold 85
- peptides 51, 56, 64–66, 73–75, 106, 110, 120, 128, 158, 174–175, 216, 235, 276, 308
- perfluorocarbons 18, 42, 44, 310, 312, 323, 325
- perfluorohexane 18

- peripheral blood mononuclear cells (PBMCs) 245
- PET *see* positron emission tomography
- PFC nanoparticles 312, 325
- phase separation 93, 98–99, 114–115, 205
- pi electron stacking 69, 75
- PLGA *see* poly(D,L-lactic-co-glycolic) acid
- PLGA nanospheres 207–208
- PLGA surfaces 160
- poly ethylene oxide *see* PEO
- poly(D,L-lactic-co-glycolic) acid (PLGA) 78, 89, 102, 113, 115, 203, 241–242
- polyacrylate 249–250, 277
- polyacrylate nanoparticles 280
- polycarbonate wall 415
- polyethylene glycol (PEG) 58, 131, 141, 152, 177, 240–241, 256, 277, 299, 306, 308, 318–319
- poly ethylene oxide (PEO) 81, 223, 247
- polymer concentration 99
- polymer nanotubes 284
- polymer surface 177–178
- polymerase chain reaction (PCR) 290, 295, 303, 321
- polymers 59, 78, 81, 99, 125, 156, 169, 177, 192, 223–224, 243, 245, 283
- linear 24
- polymersomes 284, 321, 324
- porosity 99–100, 108, 114–116
- positron emission tomography (PET) 78, 137, 309, 319
- proboscis 409, 424–425
- prostate-specific membrane antigen (PSMA) 236–237, 243, 276
- proteins 2, 22, 57, 59, 64–65, 78–79, 82–84, 95, 120, 125, 129, 141, 150, 157, 159, 174
- PSMA *see* prostate-specific membrane antigen
- QD *see* quantum dot
- quantum dot (QD) 4, 19, 255, 294–295, 299–300, 312–314, 323, 325, 355, 398–399
- quantum nanocomputers 402–403, 423, 425
- radiofrequency waves 46–47, 49, 52–54, 73, 263
- rapamycin 251
- RB *see* rhodamine B
- RBCs *see* red blood cells
- reactive oxygen species (ROS) 144–145, 153, 186, 259
- red blood cells (RBCs) 107, 275, 405–407, 423, 426
- regional ion sensitive field effect transistors (RISFETs) 288–289, 321
- RES *see* reticuloendothelial system
- research 4–6, 33, 36, 53–55, 57, 78, 90, 172–173, 333–334, 336–339, 341–345, 347–348, 350–352, 360–363, 367–370, 379–383
- basic 327
- nanomedical 328, 349–350, 352, 387
- nanomedicine-related 339, 350, 382
- nanotechnological 6, 27, 36, 41, 328, 381
- nanotechnology-based 327, 337

- respiratory syncytial virus (RSV) 314, 323
- respirocytes 405–406, 423, 425–426
- reticuloendothelial system (RES) 130, 136, 151–152
- RF field 47–48
- RF waves 17, 41–42, 49, 53, 73, 75
- rhBMP-7 208
- rhodamine 134, 309
- rhodamine B (RB) 134, 284, 309
- risk assessment 365–366, 370, 384
- ROS *see* reactive oxygen species
- RSV *see* respiratory syncytial virus
- safety research 360–361, 378
- SAR (Specific Absorption Rate) 52–53, 74–75
- scaffolds 38, 40, 81, 83–84, 86, 90–92, 101–102, 104–106, 113, 118, 169, 205, 208, 219, 221–223
- scanning tunneling microscope (STM) 3–5, 27–30, 35, 42–43, 400
- scarring 172–174, 193
- SERS *see* surface-enhanced Raman scattering
- serum albumin nanoparticles 275
- signal intensity 303, 315, 317, 323
- silver nanoparticles 22–23, 42, 179, 181–182, 194
- SiNW transistors 291–292
- smooth muscle cells 108, 222
- SPIO *see* superparamagnetic iron oxide
- SPIO nanoparticles 307, 309, 325
- SPR *see* surface plasmon resonance
- stem cells 40, 101, 108–109, 224, 310, 323, 333, 346, 382
- embryonic 199–200
- neural 118, 122
- STM *see* scanning tunneling microscope
- strain 86, 89, 100, 113, 115
- stress 7, 86, 89, 100, 113, 115
- oxidative 138, 143–144, 151–152, 154
- superparamagnetic iron oxide (SPIO) 307, 323–324
- surface-enhanced Raman scattering (SERS) 300–301, 303–304, 322, 324–325
- surface plasmon resonance (SPR) 46–47, 73–75, 300, 322, 324
- surfactant molecules 24–26
- surgery 40, 155, 169, 193, 195
- surgical procedures 155, 172, 176
- sutures 108, 172–173, 193, 195
- synthesis 2, 4, 11–12, 36, 65, 93, 113–114, 133, 163, 193, 205, 209–210, 217, 222, 230, 267
- convergent 24, 42–43
- TAAAs *see* tumor-associated antigens
- target cells 71, 235, 237, 319
- mechanical damage of 411, 424
- target nanoparticles 153, 320
- targeted drug delivery 234–235, 237–238, 276, 279–280, 340, 350, 382
- targeting agents 56, 66–68, 71, 75, 135, 142, 235, 238, 259, 276, 278
- targeting cancer cells 55
- targeting moieties 45, 64, 68, 71, 73–74, 252, 273, 276
- theranostics 410–412, 425
- therapeutics 22, 43, 45, 56, 82, 133, 141, 151, 243, 269–270, 273, 276, 278

- thermal ablation 15, 22, 44–45,  
53–55, 73, 75
- thermal ablation of cancer cells 73,  
276, 410
- thermal emission 17, 46–47, 49, 51
- tissue culture 170, 198, 202, 226, 231,  
310
- tissue culture techniques 199–200
- tissues 17, 40, 77–78, 81–82, 85,  
91–92, 100, 113–114, 125, 172,  
186, 194, 197–198, 205, 276,  
346–347
- cancerous 49, 54
- cartilage 86, 89, 100, 102
- epileptogenic 137–138
- surrounding 54, 71, 103, 156
- tumor 52, 72, 134, 237–238
- total joint replacement 166–167
- toxins 59, 74
- tropoelastin 86–87, 89, 115
- tropoelastin fibers 87
- tumor-associated antigens (TAAs)  
236, 276
- tumor cells 67, 70, 169–170, 200, 238,  
297, 306
- tumor volume 134, 254, 256–257,  
272
- tumorigenesis 73, 135, 308, 315
- tumors 17, 49, 52–54, 58–59, 73–74,  
124, 131, 134, 170, 193, 238–239,  
241, 253–254, 265, 274, 305–306
- wild-type B16 274
- ultrasound 11–12, 258, 278, 311, 323
- vasculature 102, 106, 108, 268
- water 48, 50, 70, 81, 83, 98, 106, 127,  
149, 162–163, 173, 177, 240, 243,  
249, 313
- white blood cells 53, 407
- worms 184, 189
- wound 105, 172–173, 176, 180, 194
- wound healing 84, 86, 90, 114, 151,  
172, 175–176, 193–194, 242
- xenografts 252



## About the Author

Rob Burgess is a scientist, entrepreneur, businessman, and author who switched scientific disciplines in 2006 at the age of 38 to take a chance on nanotechnology. It changed his life forever. He has held numerous academic and industry-related positions, including research fellow at the University of California, San Diego; founding scientist at Lexicon Genetics Inc.; co-founder and president at Genome Biosciences Inc.; vice president, research and development, at Zyvex Corporation; and vice president, business development, at Stem Cell Sciences, LLC. Dr. Burgess is currently co-founder and chairman of the board at Medical Nanotechnologies Inc. and an adjunct professor in the Department of Molecular and Cell Biology at the University of Texas, Dallas. He holds a bachelor's degree in biochemistry from the University of Texas, Austin, and a PhD in molecular biology from the University of Texas M. D. Anderson Cancer Center, Houston. He grew up in Silsbee, Texas, and currently resides in the Dallas area with his wife, Jane, daughter, Zoie, and seventeen-year-old dog Carmy.

[www.understandingnano.org](http://www.understandingnano.org)

