

INDEX

- 1,1-bis-(2-acryloyloxyethoxy)-[4-methoxy-phenyl]methane), 133
2,2-bis(N-maleimidoethyloxy)propane, 133
3,3-dithiopropionimide
dihydrochloride, 133
3T3-L1-cells, 59
4-(4'-dimethylaminophenylazo) benzoic acid (Dabcyl), 273
5-(N-ethyl-N-isopropyl)amiloride (EIPA), 59
- A431 cells, 130
A459 lung epithelial cells, 236
Accessory protein-2, 366
Accumulation, subcellular, 4
Acid sphingomyelinase (ASM),
recombinant, 460
Acid/base strength, 195
Acidic endosome, 64
Acidity constant, 387
Actin
disruption, 452
-driven invagination, 479
filaments, 290
flow, 339
polymerization, 36
and active transport, 339
Acute ischemic stroke, gold
nanoparticle-based assessment of, 100
Acute lung injury, 457
AD. *See* Alzheimer disease
Adeno-associated virus, 209
single particle tracking of, 169
Adenocarcinoma MCF7 cells, 78
Adenovirus, 209
- Adsorptive endocytosis, 196
Albumin-mediated polyplex clearance, 216
Aldehyde fixation, 184, 187
Alexa fluor 568-phalloidin dye, 536
Alexa 488-R8 peptide, 274
Alexa 488-streptavidin, 276
Alexa Fluor 488, 186
Alginate chitosan polyplexes, 126
Allotopic expression, 394
ALS. *See* Amyotrophic lateral sclerosis
Alzheimer disease (AD), 105
Amebas, 21
Amiloride, 107, 266, 326, 452, 455, 460
Amines, protonable, 129
Amine-terminated G4 PAMAM, 235
Ammonium telluride, 78
Amphipatic peptide-based nanocarriers, 325
Amphiphilic index, 387
Amphiphilicity index, 195
Amyotrophic lateral sclerosis (ALS), 105
Anionic lipoplexes, 544
Anisotropy, time-resolved, 39
Antennapedia protein, 276
Antibodies, QD-tagged, 555
Anti-CAM, 454
CAM nanocarriers, epitope controlled
subcellular destination of, 462
catalase conjugates, 458
elliptical disks, 465
nanocarriers, 456
Antigen delivery by cell penetrating
peptides, 405
Antigenomic peptide nucleic acids
(PNAs), 492

- Anti-ICAM, 454
 - ASM/carriers, 460
 - nanoconjugates, 457
- Antioxidants, 457
 - replacement enzymes, 457–459
- Anti-PECAM, 454
 - catalase, 458
 - monoclonal, 465
 - SOD, 458
- Anti-Stokes scattering, 517
- Antiviral immune response, 375
- Apoptosis, 6
 - and mitochondria, 385
- Archaeal lipids, 390
- Arenavirus, eGP defined receptor
 - specificity and cell tropism of, 363
- Arginine, role for CPP, 23
 - rich peptides, 483
 - rich protein transduction domains, 23
 - role for CPP, 23
- Artificial chaperones, 104–109
- Asialoglycoproteins, 482
- ASM. *See* Acid sphingomyelinase, recombinant
- Astrocytes, 95
- ATPase- H^+ pumps, 248
- Au nanostructures, TPL activities of, 516
- Auger ionization, 541
- AuNP. *See* Gold nanoparticles
- Autofluorescence, 95
- Avidin-biotin
 - affinity, 276
 - interactions, 495
- Azomethine ylides, 147

- Bacteriochlorin, 313
- Bafilomycin A1, 129
- Bioactivity, 2
- Bioavailability, 2
- Biodegradable esters, 133
- Biodistribution, 2
- Bioluminescence resonance energy transfer (BRET), 537, 555
- BioPORTER[®], 324
- Block copolymers, micellization of QDs, 542
- Blood-brain barrier, 105
- Bodipy-LacCer, 58

- Bola-amphiphiles, 390
- Bola-lipids, 390
- Branched PEI, 215
- BRET. *See* Bioluminescence resonance energy transfer
- Brownian motion, 168
- Brownian particles, 39
- Brust method, 83
- Brust-Schiffrin one- and two- phase systems, 76
- Bulk viscosity, 38
- Bunyavirus, eGP defined receptor
 - specificity and cell tropism of, 363
- BV-2 microglial cells, 242

- C60 fullerene derivatives, localization of, 200
- Caco-2 cells, 44
 - and dendrimers, 239
- Calcium channels, L-type, 442
- CAM. *See* Cell adhesion molecule
- CAM-mediated endocytosis, 454–457
- CAM-targeted carriers, 460
- CAM-targeted drug delivery, 454
- Cancer treatment, 85
- Capillary endothelium, 438
- Capping ligand, 74
- Carbon nanotubes (CNT), 143–159
 - functionalization of, 145–147
 - intracellular trafficking of, 143–159
 - membrane receptor-mediated uptake of, 143–159
 - subcellular distribution of, 151–153
 - water-soluble, 151
- Carboxyl-terminated G1.5 PAMAM dendrimers, permeability of, 239–240
- Cardiac capillary barrier, 438
- Cardiac myocytes, 433–447
 - delivery of cerium oxide nanoparticles to, 438
- Cardiac Troponin I, 443
- Cardiac vascular permeability, 437–439
- Cardiolipin, 388
- Carrier degradation, 218
- Carrier geometry controlled intracellular trafficking, 463–466
- Catalase, 110, 458
 - conjugated to anti-CAM, 458
 - immunoconjugates, 459

- Cathepsin D, 183
- Cationic dendrimere, 123
- Cationic G2 PAMAM dendrimers,
permeability of, 239–240
- Cationic lipids, 480
in virosomes, 372
- Cationic polymer coated QDs, 546
- Cationic polymers, 480
- Caveolae, 56, 265, 479
-dependent endocytosis, 40
-dependent pinocytosis, 537
-mediated endocytosis, 98, 124, 366–
369, 439, 451–453, 479
-mediated process, 198
- Caveolin proteins, 537
- Caveolin-mediated endocytosis, 366–369
- Caveolins, 479
- Caveosomes, 126, 479
- CBN. *See* Conjugated bond number
- CCI. *See* Clathrin, and caveolin-
independent endocytosis
- CCP-induced lactate dehydrogenase
leakage, 330
- CCVs. *See* Clathrin, coated vesicles
- C-dots, superbright, 18
- CdSe quantum dots passively coated
with ZnS, 542
- CdTe quantum dots, mercaptoacetic acid
coated, 544
- Cell(s)
apical pole of, 59
basolateral pole of, 59
dividing, 42
non-dividing, 42
nonmitotic, 48
surface markers, 28
surface ruffling, 479
viability assays, 27
- Cell adhesion molecule (CAM), 5
cytosolic domain, tyrosine
phosphorylation of, 455
endocytosis, 454–457
epitopes, carrier binding of, 461–463
targeted carriers, 460
targeted drug delivery, 454
- Cell entry mechanism, 5
- Cell fixing, artifacts, 270
- Cell-penetrating peptides (CPP), 22,
263–268, 324, 403–432
antigen delivery, 405
attachment to proteins, 274–278
carriers for cargo, 404–410
carriers for nucleic acids, 407–410
chimeras with targeting ligands,
410
combination with drug delivery
systems, 404–432
definition of, 267
derivatization with acyl chains, 419
disulfide-linked conjugates of, 409
endocytosis of, 414
endosomal escape of, 414–417
fluorophores, 278–279, 405
fusion proteins, 278–279
intracellular trafficking of, 417–418
liposomes, 410–412
magnetic nanoparticles, 410–412
mechanism of cell internalization,
412–418
-mediated toxicity, 277
mimetics, 275–276
particulate drug delivery systems,
410–412
peptide-based immunotherapy, 407
peptide and protein delivery, 406
peptide-protein chelates, 278
peptides and proteins, 406
polymeric micelles, 410–412
protein complexes, 277–278
quantum dots, 410–412
side effects of, 421–422
siRNA, 408
toxicity of, 421–422
transduction of, 417
- Cellular distribution, assessment of by
quantum dot labeling, 535–567
- Cellular entry, barriers to, 537–539
- Central nervous system, 95
- Ceramide
Gb3 receptor, 64
incorporated in STPP liposomes,
395
- Cerebral ischemia, 110
- Cerium oxide nanoparticles,
cardioprotective effect of, 443
- Cetyltrimethylammonium bromide
(CTAB), 508
-coated GNRs, 510
-depleted GNRs, 514
toxicity of, 512

- Chaperones, 186
 artificial, 104–109
 polymeric artificial, 93–121
- Charge density oscillations, 99
- Charge-reducing polycations, 220
- Chariot™, 327
- Chemical libraries, 2
- Chemisorptive coatings, 511–512
- CHEMS. *See* Cholesteryl hemisuccinate
- Chitosan, 123
 -based carriers, packaging efficiency of, 215
- Chlorin, 313
- Chloroquine, 129
- Chlorpromazine, 59, 266, 481
- CHO cells, proteoglycan-deficient mutant, 124
- CHO-K1 cells, 106
- Cholera toxin B, 5
- Cholesterol
 -bearing pullulans (CHPs), 105
 -dependent CME, 481
 depletion experiments, 126
 -GALA peptide, 489
- Cholesteryl hemisuccinate (CHEMS), 490
- Chondroitin sulfate, 124
- Chondroitinase ABC, 345
- CHP nanogels, 106
 cationic derivatives of, 106
 HER2 tumor antigen incorporation, 108
- CHP-HER2
 CD4⁺ and CD8⁺ T-cell response, 108
- CHPNH₂. *See* CHP nanogels, cationic derivatives of
- CHPNH₂-FITC-Bovine serum albumin, 106
- CHP-quantum dots, 106
- CHPs. *See* Cholesterol, -bearing pullulans
- Chromosomal DNA, role in unpacking, 217
- Ciliates, 21
- Cis-acting nuclear DNA import, 135
- Cis-Golgi, 185
- Clathrin, 56
 and caveolae-independent (CCI) endocytosis, 124, 440, 451–453
 -coated pits, 57, 149, 366
 -coated structures, 264
 -coated vesicles (CCV), 265, 478
 -dependent pinocytosis, 537
 -dependent endocytosis, 148
 -independent endocytosis, 148, 440
 -mediated endocytosis, 98, 124, 167, 366–369, 439, 451–453, 477–478
 -mediated endocytosis, inhibition of, 107
- Click bioconjugation, 509
- CMC. *See* Critical micelle concentration
- CME. *See* Endocytosis, clathrin-mediated
- CNT. *See* Carbon nanotubes
- Coated pits, 478
- Coelenterazine, 555
- Collagenase degradable linker, 546
- Collisional interaction, 39
- Colloid chemistry, 194
- Colloidal gold, treatment of rheumatoid arthritis, 100
- Compartments, subcellular, 4
- Confocal reflectance microscopy, 515
- Congestive cardiomyopathy, 441
- Conjugated bond number (CBN), 195, 387
- Convection currents, 35. *See also* Cytoplasmic diffusion
- Convictional drift, 165
- Copper acetate, 77
- Core-shell particles, 18
- Coronavirus, eGP defined receptor specificity and cell tropism of, 363
- Cos-7 cells, 106
- CPP fluorophores, 278–279
- CPP fusion proteins, 278–279
- CPP-mediated toxicity, 277
- CPPs. *See* Cell-penetrating peptides
- Cremophor EL, 392
- Critical micelle concentration (CMC), 251, 371
- Crosslinker degradation, 221
- CTAB. *See* cetyltrimethylammonium bromide
- Cutinase suicide inhibitor, 546
- Cutinase, 546
- Cyclodextrin, 452
- Cylindrical polymer particles, 464

- Cysteine capping of quantum dots, 61
- Cytochalasin D, 25, 59, 266, 326, 343, 452, 455
- Cytoplasm, 4
- Cytoplasmic diffusion, 35
 - coefficients, 290
- Cytoplasmic dynein, 292
- Cytoplasmic meshwork, 49
- Cytoplasmic radius, 41
- Cytoplasmic viscosity, 386
- Cytoprotection, 111
- Cytoskeletal filaments, 292
- Cytoskeletal motors, 292–293
- Cytosolic delivery of biomacromolecules, 403–432
- Cytosolic mobility of gene delivery vehicles, 213
- Cytostatica, specific targeting of, 64
- Cytotoxic T lymphocytes, 405

- Dabcyl, 273
- Darkfield microscopy, 515
- Delivery
 - technique, mechanical, 19
 - technique, membranar, 19
 - intracellular, 19
 - liposomal, 22
 - nanosensor, 19
 - systems using virus envelope glycoproteins, 369
- Delocalized lipophilic cations, 388
- Dendrimer(s), 35–54
 - actin interaction, 44
 - adhesion, 42
 - cationic, 123
 - cellular entry dynamics, 233
 - cellular trafficking of, 231–246
 - DNA complex, *see* Dendriplexes
 - generation number, 231
 - PCI-mediated drug delivery, 317
 - photosensitizers, 317
 - polydispersity indices of, 231
 - polylysine sixth generation, 37
 - rate of uptake, 236
 - self-fluorescent, 36
 - surface-engineered, 40
 - therapeutics, 233
- Dendrimer structures
 - carbohydrates, 231
 - nucleic acids, 231
 - poly(aryl ethers), 231
 - polyamidoamines, 231
 - polyamines, 231
 - polyesters, 231
- Dendriplexes, 35–54
 - hydrodynamic diameter, 47
 - zeta potential, 36, 47
- Dendritic architecture, 231–233
- Dendritic cells, 405
- Dendritic poly(L-lysine), 217
- Dequalinium chloride, 6
- Dequalinium derivatives, 201
- Dextran, 18
- DHPE, 254
- Dichotomous decision rules, 195
- Didodecyldimethylammonium bromide, 77
- Diethylaminommodified dextran, 123
- Diffusion
 - coefficient, 38, 41
 - hindered, 4, 386
 - intracellular, 4, 386
 - net solute translational, 38
- Dihydrolipoic acid capping of quantum dots, 61
- Dihydrolipoic acid, disulfide linkage with ZnS coating, 542
- Dimethyl amiloride hydrochloride, 349
- Diphtheria toxin, 64
- Distribution, intracellular, 4
- DNA
 - carrying nanodelivery systems, intracellular trafficking of, 475–506
 - complexation, 209
 - delivery to mitochondria via DQAsomes, 6, 390–394
 - polyplex dissociation, 132–134
 - tagged with QDs, 537
 - transport, barriers to, scheme, 211
- Dodecanethiol, 77
- DOPE/CHEMS, 491
- DOTAP, 58
- DOX release from VM nanogels, 256
- DOX-induced multidrug-resistant ovarian carcinoma cell lines, 254
- Doxorubicin release from mixed micelles, 251

- Doxycycline, 442
- DQApexes, 492. *See also* DQAsome/
DNA complexes
- DQAsome/DNA complexes, 391–392
- DQAsomes, 6, 201, 390–394, 492
conjugated with folic acid, 393
Monte Carlo computer simulations of,
391
- Drosophila Antennapedia
homeoprotein, 22
- Drug carriers, intracellular delivery of,
449–451
- Drug delivery
to mitochondria via DQAsomes,
390–394
nanoparticle-based, 85
role of carrier geometry, 463–466
- Drug disposition, 3, 4
- Drug release, photothermally activated,
523
- Drug targeting, 3
- Drug therapy, 1
- Drugs, mitochondriotropic, 6
- Drugs, tagged with QDs, 537
- Dual-color total internal reflection
fluorescence (TIRF) microscopy, 63
- Dynamain, 452
- Dynein
binding peptides, 338
dominant negative mutant, 59
mediated transport, 171
motors, 292, 338
single motor parameters of, 297
- Early endosomal antigen 1 (EEA1), 181,
368
immunolabeling of, 182
- Early endosomal marker, 64
- Early endosome(s), 181–182, 248, 368,
478
subpopulations of, 367
- Ebola virus, EM of, 358
- EEA1. *See* Early endosomal antigen 1
- EGF receptor. *See* Epidermal growth
factor receptor
- EGF-PEG-PEI, cell binding, cell entry
and intracellular trafficking, scheme
of, 128
- EGF-QDs, 63
- eGP. *See* Envelope glycoproteins
- eGP-coated nanoparticles, 370
- eGP-mediated delivery, 361–362
- Ehrlich, Paul, 1
- EIPA, 59
- Electric charge Z, 195
- Electroporation, 20
- Ellipsoidal dendrimers, 232
- Elliptical disks, 464
- Endocytic markers, 277
- Endocytic organelles, markers of,
180–186
- Endocytic pathways, 177–192, 264–266,
537–539
inhibitors of, 266
- Endocytosis, 5, 148, 232, 248, 264–266,
365–369
adsorptive, 196
Arf6-mediated, 56
CAM-mediated, 450
caveolin-assisted, 5
caveolin-dependent, 40
caveolin-mediated (CME), 98
Cdc-42-mediated, 56
cell adhesion molecule-mediated,
450
clathrin-dependent, 5, 40, 64
clathrin-independent, 56, 57
clathrin-mediated, 56, 98
lipid raft associated, 5
nonselective, 480
peptide-mediated, 65
Rho-A-mediated, 56
- Endocytotic pathways, scheme of, 478
- Endolysosomal network, escape from,
272–273
- Endolysosomal system, 5
- Endolysosomolytic materials, 248
- Endolysosomolytically active
nanotechnology, 247–262
- Endoplasmic reticulum, 186
- Endoplasmic reticulum to Golgi
intermediate compartment
(ERGIC), 185
- Endosomal acidification, 365
- Endosomal compartments,
destabilization of, 248–250
- Endosomal disruptors, 415
- Endosomal escape, 213, 488–491, 538

- Endosomal release, photoinduced, 130–131
- Endosomal rupture, 248
- Endosome(s), 5
 - acidic, 64
 - lysosome fusion, 25
 - movement of, 294
 - transport of along microtubule, 128
- Endosomolytic polymeric gene nanocomplexes, 258–259
- Endothelial CAM-mediated endocytosis, 451
- Endothelial cells, 56, 64, 450
- Endothelial junction, inflammation of, 438
- Endothelial targeting of drugs, 454
- Endothelial transmembrane glycoproteins, 454–457
- Endothelium
 - capillary, 438
 - venular, 438
- Enhanced permeability and retention (EPR) effect, 3, 212
- Envelope glycoproteins (eGP), 358–360
 - conformation changes of, 364–365
 - delivery systems, 369
 - as environmental sensors, 364–365
 - targeting to endocytic pathways, 365–366
- Enveloped viruses, 358–359
- Environment, intracellular, 15
- Ephrin receptors EphA3, 67
- Epidermal growth factor, 63
- Epidermal growth factor (EGF) receptor, 368, 511
 - biotinylated, 63
- Epilepsy, 110
- Epithelial cells, 56
- Epitope controlled subcellular destination of anti-CAM nanocarriers, 462
- EPR effect. *See* Enhanced permeability and retention effect
- ER tracker, 536
- ERGIC. *See* Endoplasmatic reticulum to Golgi intermediate compartment
- Escort, 22
- Ethidium bromide, 82
- Ethidium thiol, structure of, 81
- Excitation energy, dissipation of, 85
- Ezrin, 456
- Ezrin/radixin/moesin protein family, 456
- f-CNT. *See* Functionalized carbon nanotubes
- FCS. *See* Fluorescence correlation spectroscopy
- FG motif. *See* Phenylalanine glycine motif
- Fibroblasts, 56
- Fick's law of diffusion, 195
- Fick–Nernst–Planck model, 388
- Filipin, 58, 148, 452
- Filopodia, 337
- Filovirus, eGP defined receptor specificity and cell tropism of, 359, 363
- FISH. *See* Fluorescence in situ hybridization
- FITC. *See* Fluorescein isothiocyanate
- FITC-dextran, 536
- Fixation of cells, 186–189
- Flavivirus, eGP defined receptor specificity and cell tropism of, 363
- Flotillin, 57
- Flotillin-1-dependent pathway, 265
- Flow cytometry, 27
- Fluid phase
 - endocytic capture, 184
 - endocytic pathways, 349
 - endocytosis, 196
 - uptake, 265
 - viscosity, 4, 38, 386
- Fluorescein diacetate, 27
- Fluorescein isothiocyanate (FITC), 106
- Fluorescence correlation spectroscopy (FCS), 162
- Fluorescence energy transfer (FRET), 273, 546
- Fluorescence in situ hybridization (FISH), 134, 544
 - and QDs, 552–554
- Fluorescence recovery after photobleaching (FRAP), 44, 161
- Fluorescence resonance energy transfer, 537
 - and QDs, 552–554
- Fluorescent dyes, 15

- Fluorescent gold nanoparticles, 79
- Fluorescent polystyrene beads,
intracellular trafficking of, 167–168
- Fluorophores, 4, 18
- FM 4–64 FX dye, 536
- f-MWNTs. *See* Functionalized
multiwalled nanotubes
- Folate
conjugated gold nanorods, 519
conjugated InP-ZnS quantum
nanocrystals, 547
folate receptor-mediated pathway, 149
receptors, over expression of, 85
tagged with QDs, 537
- Folic acid, 5
- Folic acid modified DQAsomes, 393
- Formaldehyde, 187
- Formulation charge ratio of lipoplexes,
209
- Forster distance, 552
- Four-wave mixing, 517
- FRAP. *See* Fluorescence recovery after
photobleaching
- FRET. *See* Fluorescence energy transfer
- FRET based quenching of QDs, 546
- Frictional force, molecular motors, 293
- f-SWNTs. *See* Functionalized single-
walled nanotubes
- Fugene, 22
- Functionalized carbon nanotubes
(f-CNT), 146
- Functionalized multiwalled nanotubes,
146
- Functionalized single-walled nanotubes
(f-SWNTs), 146
- Fusogenic lipids, 415, 488
- Fusogenic peptides, 415, 488–489
- G3 PAMAM
dendrimers, cellular uptake
mechanisms, 236
dendrimers, intracellular trafficking of,
238
PEG modification of, 235
- GAGs. *See* Glycosaminoglycans
- GALA, 131, 267, 438
- Gap junctions, 196
- Gene carriers, single particle tracking of,
169–171
- Gene delivery, 123
- Gene guns, 856
bombardment, 19
- Gene packing, methods of, 208–210
- Gene therapy, 475
mitochondrial, 394
- Genistein, 58, 126
- GFAP. *See* Glial fibrillary acidic protein
- GFP. *See* Green fluorescence protein
- GFP protein, 7
- Glial cells, 95
- Glial fibrillary acidic protein (GFAP), 96
- Glutathione
glutaredoxin, 111
peroxidase, 110
S-transferase tags, 110, 270
- Glycine receptors, lateral dynamic of, 63
- Glycosaminoglycans (GAGs), 124, 209
- GNR-based SERS, 519
- GNR-mediated photothermolysis, 521
- GNR-PNIPPAAm hydrogels, 523
- GNRs. *See* Gold nanorods
- Gold
colloids, 73
nanocrystals, 83
nanodisks, 100
- Gold nanoparticles, 75, 93–121
alkanethiolate-coated, 80
assessment of hepatic function, 100
biocompatibility of, 83, 100–103
biodistribution of, 100–103
blood-brain barrier, 102
cellular internalization of, 102
interaction with living cells, 100–103
PEG-stabilized, 85
phosphonium-capped, 82
phosphonium-functionalized, 83
radioactive, treatment of liver cancer,
100
ricin binding, 67
rod-shaped, 99
size and toxicity, 101
tiopronin-coated, 80
toxicity toward red blood cells, 100
tris(hydroxymethyl)phosphine(THP)-
capped, 83
- Gold nanoprisms, 100
- Gold nanorods (GNRs), 100, 507–533
anisotropic functionalization of, 511

- antibody-functionalized, 511
- antibody-labeled, 515
- based SERS, 519
- biocompatibility of, 512–514
- biosensing applications of, 511
- cellular imaging, 514–520
- cellular uptake of, 512–514
- coating, 510–512
- core-shell formation of, 512
- CTAB-stabilized, 510
- detoxification of, 514
- folate-conjugated, 519
- mediated photothermal lysis, 521
- membrane-bound, 522
- multiplex SERRS imaging with, 520
- NIR-absorbing, 508
- nonlinear optical properties, 516–519
- PEG-conjugated, 518
- photothermal agents, 520–522
- polyelectrolyte-coated, 522
- PNIPAAm hydrogels, 523
- silica-coated, 512
- subcellular localization of, 522–523
- surface chemistry of, 508–510
- TPL contrast agents, 518
- TPL intensity of, 516
- Gold nanoshells, 99
- Gold nanostars, 100
- Gold nanourchins, 99, 100
- Gold nanowires, 100
- Gold(III) chloride, reduction of, 75
- Gold-labeled DNA, 481
- Golgi apparatus, 185, 478
- Golgi ribbon, 185
- Golgi-EGFP, 536
- gp-120, 268
- Green fluorescence protein (GFP),
mitochondrial delivery of, 493
- Groove binding, 82
- GTPase dynamin, 56
- GTPase Rab5, 181, 367
- GTPases, rho family, 367
- Heat-shock protein, 186
- HEK293T cells, 126
- HeLa cells, 106
 - digitonin permeabilized, 135
- Hemagglutinin peptide HA2, 131
- Heme oxygenase 1, 110
- Hemolysis, for evaluation of
endolysosomal lysis, 251
- Hemophilia, gene therapy of, 208
- Henderson-Hasselbach equation,
195
- Hep-2 cells, 64
- Hepadnavirus, eGP defined receptor
specificity and cell tropism of, 363
- Heparin sulfate, 124
- Heparan sulfate proteoglycan, 210, 345,
480
- Heparinases, 345
- Hepatic function, gold nanoparticle-
based assessment of, 100
- HepG2 cells, 130
- Herpes simplex virus, 209
- Herpes simplex virus VP-22 protein, 22
- Herpesvirus, eGP defined receptor
specificity and cell tropism of, 363
- HGH6 peptide, 330
- HGH6/caspase-3 complex, 330
- Hierarchical oxidative stress model, 110
- HIV-Tat, 22, 263, 267–268, 272
 - protein, cellular dynamics of, 268–269
 - protein, nuclear entry of, 273
- HIV-Tat-enhanced green fluorescent
protein fusion protein, 269
- hMSCs. *See* Stem cells, human
embryonic mesenchymal
- Hoechst 33342, 42, 536
- HUH 7 cells, 127, 130
- Human adenocarcinoma cells, 127
- Human embryonic kidney HEK293 cells,
258
- Human hepatoma HepG2 cells, 258
- Hyaluronic acid, 124
- Hydrodynamic injection, 247
- Hydrogen peroxide, 457
- Hydrophobically modified glycol
Chitosan polyplexes, 126
- Hydroxyl-terminated G4 PAMAM, 235
- Hydroxyl-terminated G2 PAMAM
dendrimers, permeability of,
239–240
- Hyper-Rayleigh scattering, 516
- ICAM-1 antibodies, 5, 454
- ICAM-1. *See* Intercellular adhesion
molecule-1

- ICP-MS. *See* Inductively coupled plasma mass spectrometry
- ICR mice, 87
- IgG-opsonized particles, 465
- IgorPro software, 41
- Ikarugamycin, 107
- IL-12, 108,
- Imaging technology, 8
- Immunoadhesins, 364
- Immunofluorescent microscopy, 179
- Immunotoxin, intracellular delivery of, 65
- Importins, 135
- In vivo imaging with multicolored QDs, 555
- India ink, 198
- Inducible nitric oxidase synthase (iNOS), 109
- Inductively coupled plasma mass spectrometry (ICP-MS), 101
- Inflammation
caused by metallic nanoparticles, 109
suppression of, 454
- Inflammatory mediators, 439
- Influenza A hemagglutinin, 272
- Influenza X-13 virus, single particle tracking of, 170
- iNOS. *See* Inducible nitric oxidase synthase
- InP-ZnS quantum nanocrystals, folate conjugated, 547
- Integrins, 124, 480
binding domain, 5
- Intercalation, 82
- Intercellular adhesion molecule-1 (ICAM-1), 453
antibodies, 5, 454
- Interendothelial junctions, 438
- Interleukin-2 receptors, 538
- Intermitochondrial contacts, 441
- Interstitial extracellular matrix, 212
- Intracellular
barriers, 386–390
delivery of biologically active proteins, 323–336
distribution, QSAR-based prediction of, 387
drug delivery, 449–474
localization of nanoparticles, prediction of, 193
polymer localization, 177–192
trafficking of DNA, uptake pathways dependent, 475–506
trafficking of viruses, 290–291
trafficking, assessment of by quantum dot labeling, 535–567
trafficking, control by carrier geometry, 463–466
transport, regulation of, 295
- Intranuclear microinjection, 134
- Intranuclear transfer, 213
- Ionophores, optically silent, 16
- IR light, 85
- IRQ-Lip, 487
- Ischemia reperfusion injury, 457
- Isopolar microtubule cytoskeleton, 294
- Jembrane disease virus, 272
- jetPEI, 217
- Jurkat T lymphocytes, 270
- K562 cells, 127
- K8. *See* octalysine
- K8-MEND, 490
- KALA, 131, 267
- Karyoplasm, 135
- Kinase, p21-activated, 58
- Kinesin
-mediated transport, 171
motors, 292, 338
single motor parameters of, 297
- Kinesin-1, 292
- LabelIT® Tracker™ Fluorescein kit, 41
- LacCer. *See* Lactocyl-ceramide
- Lactate dehydrogenase leakage, CCP-induced, 330
- Lactocyl-ceramide (LacCer), 58
- LAMPs, 183
- LAMP1. *See* Lysosome-associated membrane protein
- Largest conjugated fragment, 195, 387
- Laser ablation, 78
- Late endosomes, 182–183, 213, 248, 368, 478
- Latex beads, 58
- Latrunculin A, 455

- Layered double hydroxide (LDH) nanoparticles, 7
- LCG. *See* Largest conjugated fragment
- LDH nanoparticles. *See* Layered double hydroxide nanoparticles
- LDL receptors, 477
- Leader peptide, mitochondrial, 5
- Leader sequence, 4
- Lentivirus, 209
- Lesion development, gold nanoparticle-based assessment of, 100
- Leupeptin, 183, 188
- Libraries, chemical, 2
- Ligand
 - exchange, schematic representation of, 79
 - mitochondriotropic, 5
 - mediated internalization, 482–483
 - nanoparticle bioconjugates, 67
 - subcellular targeting, 4
- Linear PEI, 215
- Linear photoluminescence, 515–516
- Linkers
 - cleavable, 3
 - photocleavable, 26
- Lipfectamin, 214
- Lipid rafts, 124, 148, 271, 367, 452
- Lipid-raft-dependent pathway, 59
- Lipofectamine 2000, 22
 - comparison to dendrimers, 241
 - comparison to R8-MEND, 486
- Lipofectin, comparison to R8-MEND, 486
- Lipoplex(es), 209, 480–482
 - anionic, 544u
 - uptake, 481, 538
- Lipopoly-L-lysine lipoplexes, 481
- Liposomal delivery, 21
- Liposome(s)
 - delivery by CPPs, 410–412
 - double-labeled, 484
 - long-circulating, 3
 - mitochondriotropic, 394–395
 - pH-responsive, Tat-modified, 412
 - QD loaded, 547
 - R8-modified, 483
 - silica-loaded, 547
 - targeted to selectins, 451
- Load force, molecular motors, 293
- Localized surface plasmons, 99
- logP. *See* Octanol-water partition coefficient
- Longitudinal plasmon resonance, 508
- Long-term same-cell imaging, 536
- Long-term trafficking studies, 536
- Low-density lipoprotein, 5, 477
- Luciferase
 - expressing mice, 96–97
 - QD-conjugated, 555
 - transfection, 58
- Lymphocyte function-associated antigen, quantum dot labeled, 546
- Lymphocytic choriomeningitis virus, 369
- Lysosensor green, 536
- Lysosomal enzyme replacement therapy, 459–460
- Lysosomal markers, 64
- Lysosomal storage disease, 278
- Lysosome-associated membrane protein (LAMP) 1, 456
- Lysosomes, 5, 21, 183–185, 478
 - targeting of, 278
- LysoTracker®, 23, 184, 254
- M918 peptide, 329
- Macromolecular crowding, 38
- Macrophages, 56
- Macropinocytosis, 7, 57, 98, 124, 199, 265, 348–349, 368, 439, 451–453, 479–480
- Macropinosomes, 58, 479
- Magic Bullet, 1, 2, 3
- Magnetic nanoparticles, delivery by CPPs, 410–412
- Major histocompatibility complex classes I and II, 405
- MALDI-MS, 84
- Mannose-6-phosphate receptor(s), 5, 182, 278, 460
- Marina Blue-labeled WGA, 186
- Masked thiolate, 83
- Mastoparan, 267
- mCherry fluorescent protein, 273
- Mean squared displacement, 163
- Medial-Golgi. *See* Golgi ribbon
- Melanosomes, traffic of, 295
- Melittin, 131, 267

Membrane

- active peptides, table of, 268
- curvature, 200
- disruptive peptides, 131–132
- disruptive polymers, 416, 489
- fusion, 199
- invagination, 56
- perinuclear, 50
- permeation, QSAR-based prediction of, 387
- ruffling, 57, 349

MEND. *See* Multifunctional envelope-type nanodevice

Mercaptoacetic acid, disulfide linkage with ZnS coating, 542

Mercaptobenzoic acid, 75

Meso-tetraphenylporphine, disulfonated, 130

Metal nanoparticle

- biological response to, 109–111
- DNA assemblies, 80
- photoluminescence of, 515
- synthesis of 74
- therapeutic agents, 85
- toxicology of, 86

Methotrexate (MTX), 242

- functionalized magnetic Fe_3O_4 nanoparticles, 85
- interaction with folate receptor, 85
- resistant Chinese hamster ovary cells, 242
- resistant human acute lymphoblastoid leukemia cells, 242
- sensitive Chinese hamster ovary cells, 242
- sensitive human acute lymphoblastoid leukemia cells, 242

Methylene blue, 27

Methylene glycol, 187

Methyltriphenylphosphonium cations 394

Methyl- β -cyclodextrin, 61, 266

Micelles, 8

- delivery by CPPs, 410–412

Microdomains, 63

Microglia, 95

Microtubule

- dependent active transport, 168, 213
- filaments, 290
- minus end, 293

- organization of, 294
- organizing center, 290
- plus end, 293
- transport system, 128

Microvilli, 337

- apical, 349

Middle Ages, 73

Mie theory, 508

Mitochondria-junctional SR contacts, 441

Mitochondria

- mammalian, 5
- movement of, 294
- targeting of, 83

Mitochondrial accumulation

- complex formation based, 388
- electric potential based, 388
- ion-trapping based, 388
- of xenobiotics, physicochemical features, 389

Mitochondrial delivery

- of green fluorescence protein, 493
- via membrane fusion, 395–396
- MITO-Porter, 494

Mitochondrial

- diseases, 491
- DNA, 385
- DNA delivery, 6
- DNA metabolism, 390
- DNA mutations, 491
- gene therapy, 6, 394
- intermembrane space, 441
- leader peptide, 5, 391
- localization, 201
- network, 385
- targeting, 491–494
- targeting signal (MTS) peptide, 492

Mitochondria-targeted

- drug and DNA delivery, DQAsomes, 390–394
- nanocarriers, 385–401
- polyethylene imine, 394
- therapies, 385

Mitochondriotropic

- compounds, 388
- drugs, 6
- liposomes, 394–395

MITO-Porter, 7, 395–396, 492–493

- mitochondrial delivery, 492

Mitotracker, 536

- Mixed pH-sensitive micelles containing targeting folate (PHSM/f), 253
- MLP. *See* Mitochondrial leader peptide
- Moesin, 456
- Molecular crowding, 386
- Molecular motors, 291–293
 antagonistic motors, 300
 building blocks for nanotechnological applications, 306
 cargo transport, 302–303
 frictional forces, 299
 hydrodynamic friction, 299
 intracellular drug delivery, 289–309
 motility states, 301
 patterns of movements, 301–302
 receptor proteins for, 305
 spatial displacement of cargo particles, 302
 Tug-of-War between, 300–301
- Monensin, 455, 461
- Monocytes, 56
- Monolayer protected clusters (MPC), 74
- Monte Carlo computer simulations of DQAsomes, 391
- Monte Carlo simulations, 166
- Motor protein-guided active transport, 170
- Motor proteins, 338
- Motor velocity, 297
- MPC. *See* Monolayer protected clusters
- MSD. *See* Mean squared displacement
- MSNs. *See* Nanoparticles, mesoporous silica
- mtDNA replication, selective inhibition of, 492
- mtDNA, 491
- MTOC. *See* Microtubule-organizing center
- MTS. *See* mitochondrial targeting signal peptide
- MTS-conjugated PNA, 492
- MTX. *See* Methotrexate
- MTX-resistant Chinese hamster ovary cells, 242
- MTX-resistant human acute lymphoblastoid leukemia cells, 242
- MTX-sensitive Chinese hamster ovary cells, 242
- MTX-sensitive human acute lymphoblastoid leukemia cells, 242
- Multicolored QDs, in vivo imaging, 555
- Multifunctional envelope-type nanodevice (MEND), 476, 486
 IRQ-modified, 487
 tetralamellar, 488
- Murin cadherin, 276
- Murine leukemia virus, eGP of, 367
- Murine leukemia virus, EM of, 358
- Myosin motors, 292, 338
- Myosin V, 295
- myotubes, 440
- N-(2-mercaptophoropionyl)glycine, 82
- N-(fluorescein-5-thiocarbamoyl)-1,2-dihexadecanoyl-sn-glycero-3-phosphoethanolamine (DHPE), 254
- N9 cells, 107
- N-acetyl cysteine, 457
- NADPH quinine oxyreductase, 110
- NaN₃, 148
- Nanocantilevers, 437
- Nanocapacitors, 437
- Nanocarriers
 amphipatic peptide-based, 325
 anti-CAM conjugated, 456
 cell-penetrating peptide-based, 329–330
 distribution, 4
 mitochondria-targeted, 6
 peptide-based, 323–336
 pharmaceuticals, 3
 targeted, 4
- Nanodelivery systems, subcellular fate of, 93–121
- Nanodevices, 437
- Nanoepigenetics, 97
- Nanogels, 104–109
 artificial chaperoning properties of, 105–106
 blood-brain barrier, 105
 drug delivery system, 107
 interaction with A β , 107
 intracellular delivery and fate, 106–107
 neutral, 107
 protein aggregation prevention, 105
 protein refolding by, 105
 tetramethyl rhodamine isothiocyanate-labeled, 107
- Nanomedicine, cytosolic delivery of, 311–322

- Nanomedicine, subcellular, 1–13
- Nano-object(s)
- barriers for their delivery, 436
 - delivery to cardiac myocytes, 433–447
 - diffusion pathways inside myocytes, 434
 - internalization by transmembrane pathways, 439–440
- Nanoparticle(s), 3
- anionic polymeric, 59
 - based drug delivery, 59
 - cationic, 59
 - cellular redox state, 109
 - charged polystyrene, 59
 - distribution in brain, 95
 - DNA assemblies, 81
 - DNA interactions, 80
 - electrochemical synthesis of, 78
 - endocytosis of, 55–72
 - fibrillation of β -amyloid, 106
 - functionalized for biological detection, 84
 - induced injury, 109
 - intracellular active, directed transport, 128
 - K8-modified, 490
 - long-term cumulative exposure to, 93
 - mesoporous silica, 59
 - noble metal, 78
 - QSAR models, 193–206
 - R8-modified, 486
 - size dependence of uptake, 103, 126
 - trafficking of, 55–72
 - ultrabright, nonbleaching, 99
 - uptake by cells, mechanism of, 98
 - virus-envelope coated, 357–383
 - water-soluble cadmium telluride, 78
- Nanopores, 437
- Nanopores, transient, 47
- Nanorods, 7
- Nanoscale particles, active cellular transport of, 337–356
- Nanosensor(s), 15–33
- Calcium-sensitive, 24
 - matrix, 18
 - PEBBLE, 16
 - schematic figure, 17. *See also color insert*
 - TAT-conjugated, 24, 24
 - technology, optical, 15
- Nanotherapeutics, intracellular transport of, 161–175
- Nanotoxicology, 97
- Nanotrucks, cellular, 290
- Naphthalocyanine, 313
- NCE pathway, 368
- Near-infrared (NIR) wavelengths, 507
- Near-infrared laser irradiation, 100
- Near-infrared QDs, in vivo imaging, 554–556
- Nernst-Planck equation, 195
- Neurotransmission, 110
- Neurotransmitters, tagged with QDs, 537
- Neutral red, 27
- Nicotinic acid, 5
- Niemann-Pick disease, 460
- NIH-3T3 cells, 106
- NIR. *See* near-infrared wavelengths
- NIR-emitting quantum dots, 95
- Nitric oxide, 110
- NLS. *See* Nuclear localization sequence
- NO. *See* Nitric oxide
- Nocodazole, 171, 455, 460
- Non endocytic pathways, 537–539
- Non-clathrin-noncaveolar endocytosis, 366
- Non-Newtonian fluid, 38
- Non-specific macropinocytosis, 212
- Nonspecific particle uptake, 198
- Nonspherical carriers, 463
- Non-viral gene delivery vehicles, 209–210
- Nonviral gene vectors, trajectory of, 164
- Nonviral vectors, 475
- NP. *See* nanoparticles
- NPC. *See* nuclear pore complex
- Nuclear localization sequence (NLS), 5, 135, 273, 494
- Nuclear membrane barrier, 495
- Nuclear morphology assay, 393
- Nuclear pore complex, 47, 134, 441
- Nuclear transfer of DNA, 494–497
- Nucleic acid delivery by cell penetrating peptides, 408
- Nucleoplasm, 4
- Nucleus, particle uptake, 47
- Nystatin, 326

- Octaarginine (R8), 7, 274
 - nitritiotriiacetic derivatized, 278
 - role in endosomal escape, 489–490
- Octalysine, 490
- Octanol-water partition coefficient, 195
- Oligomeric propylacrylic acid, 259
- Oligonucleotide-CPP complexes, 409
- Optical traps, 296
- Optochemical sensors, 16
- Optodes, 16
- Optoporation of tumor cell membranes, 521
- Oregon green-labeled poly(ethylene glycol), 189
- Organelle-specific ligand, 395
- Organic dyes, vs. quantum dots, 539–540
- Organic fluorophores, limitations of, 99
- Organometallic complexes, reduction of, 77
- Ornithine transcarbamylase, 6
- Orthomyxovirus, eGP defined receptor
 - specificity and cell tropism of, 363
- Oxidative stress, 457
 - hierarchical model of, 110
 - induction of, 93
- P10C peptide, 328
- P10C/ β -gal complex, 328
- Paclitaxel, 392
- Paclitaxel, DQAsomal encapsulation of, 392–393
- Paclitaxel-induced apoptosis, 392
- PAMAM dendrimere
 - conjugates, ibuprofen, 238
 - dendrimere conjugates,
 - methylprednisolon, 238
 - surface modification, 238
 - methotrexate conjugates, 242
 - ¹²⁵I-labeled, 240
 - tacking with fluoroisothiocyanate, 236
 - transepithelial transport of, 239
- PAMAM. *See* Polyamidoamine dendrimere
- PAMAM-oligonucleotide complexes, 241
- Pancreatic cancer cells, 515
- Paracellular transport, 232
- Paraformaldehyde, 187
- Paramyxovirus, eGP defined receptor
 - specificity and cell tropism of, 363
- Parkinson disease (PD), 105
- Particle uptake, nonspecific, 198
- Partition coefficient, 387
- Parvo viruses, 359
- Passive diffusion, 232
- Patch clamp, 20
- Pathogens, tagged with QDs, 537
- PCI. *See* Photochemical internalization
- PCI-mediated gene delivery, 316
- PD. *See* Parkinson disease
- pDNA decondensation, 132
- PECAM-1
 - antibodies, 454
 - epitopes, 461
- PECAM-1. *See* Platelet-endothelial adhesion molecule-1
- PEG-coated quantum dots, 168
- PEGylated polyplexes, 216
- PEGylated QDs, encapsulation in lipid vesicles, 547
- PEGylated QD-tagged antibody, 555
- PEI. *See* Polyethylene imine
- PEI/DNA nanocomplexes
 - active transport of, 338
 - retrograde transport of, 338
- Penetration, 23, 276, 325, 404
- Pep-1-/cargo complexes, 326
- Pep-1-mediated protein delivery, 326
- Peptide(s)
 - biomaterials, 323
 - cargo interactions, 323
 - mediated endocytosis, 65
 - mediated internalization, 483–487
 - membrane disruptive, 131–132
 - tagged with QDs, 537
- Peptide and protein delivery by CPPs, 406
- P-glycoprotein, 241
- pH targeted delivery, 247
- Phage display library, 328
- Phagocytosis, 21, 56, 98, 124, 196, 232, 451–453, 537–539
- Pharmacokinetic study of QD705
 - quantum dots, 87
- pH-dependent eGPs, 365
- pH-dependent transmittance transition
 - of PHSM, 255

- Phenyl arsine oxide, 59
 Phenylalanine glycine (FG) motif, 50
 pH-insensitive enveloped viruses, 365
 Phosphine oxides, 83
 Phosphines, 83
 tertiary, 74
 Phosphonioalkylthiosulfate zwitter ions,
 structure of, 81
 Phosphoroamidate morpholino
 oligomers, covalent conjugates with
 CPPs, 410
 Photoacoustic tomography, 99
 Photobleaching, 536
 Photochemical delivery of
 macromolecules, 314–317
 Photochemical internalization (PCI),
 130, 311–322
 of dendrimer-based drug delivery, 317
 -mediated gene delivery, 316
 Photodynamic therapy, 312–313
 Photosensitizer, 130, 312–313
 Photostability, 18, 540
 Photothermal therapy, 100
 Photothermally activated drug release,
 523
 Photothermolysis, 520
 Phototoxicity, 317
 pH-sensitive
 copolymers of His and Phe (PHP),
 254
 linear poly(amido amines), 219
 polymeric nanotechnology, 247–262
 polymers, 132–133
 PHSM/f. *See* Mixed pH-sensitive
 micelles containing targeting folate
 Phthalocyanine, 313
 di- and tetrasulfonated aluminium,
 314
 pH-triggered micelle destabilization, 251
 Physiosorptive coatings, 510–511
 Pick disease, 110
 Picoinjection, 20
 Picornaviruses, 359
 Pinocytosis, 21, 56, 232, 537–539
 Plasma membrane, labeling of, 181
 Plasmadesmata, 196
 Plasmalemmal sodium-proton exchanger
 NHE1, 455
 Plasmid DNA delivery by CPPs, 408
 Plasmid DNA polyplexes, intracellular
 fate of, 123–142
 Plasmodium falciparum, 6, 390
 Plasmon resonant light-induced heat
 release, 100
 Plasmon-enhanced emission, 516
 Plasmon-resonant gold nanorods,
 507–533
 Plasmon-resonant light scattering, 515
 Plasmon-resonant nanoparticles,
 photothermal action of, 520–522
 Platelet-endothelial adhesion molecule-1
 (PECAM-1), 453
 Platinum chloride, 77
 PLL. *See* Poly-L-lysine
 PMSA, QD-PEG conjugated, 556
 PNA, 492
 PNIPAAm. *See*
 Poly(N-isopropylacrylamide)
 p-Nitrophenyl phopshonate, 546
 pNPP. *See* p-Nitrophenyl phopshonate
 Point spread function (PSF), 162
 Poly(His-co-Phe), 254
 Poly(L-histidine), 250
 -based micelles, 250–254
 Poly(L-histidine-co-L-phenylalanine)-
 based micelles, 254–256
 Poly(N-isopropylacrylamide), 523
 Poly(N-vinylpyrrolidone-co-maleic
 anhydride) copolymere, 240
 Poly(-aminoesters), 219
 Polyacrylamide, 15
 Polyamidoamine dendrimere (PAMAM)
 -oligonucleotide complexes, 241
 superfect, 126
 Polyamidoamine dendrimers, 232
 Polyarginine (R₉), cholesterol-
 conjugated, 419
 Polycations, NLS-modified, 495
 Polydispersity indices of dendrimers, 231
 Polyethylene imine (PEI), 6, 58, 123,
 213, 482
 branched, 125
 /DNA nanocomplexes, 338
 linear, 125
 single particle tracking of, 170
 PolyHis, acid-base titration curves of,
 252–253
 PolyHis. *See* Poly(L-histidine)

- PolyHis-b-poly(ethylene glycol), 250
 - acid-base titration curves of, 252–253
 - fusogenic characteristics of, 253
 - proton buffering characteristics of, 253
- Poly-L-lysine, 123, 482
 - histidylated, 482
- Polymeric delivery systems, 104
- Polymeric nanoparticles, 93
- Polymers, pH-sensitive, 132–133
- Poly-N-isopropylacrylamide-co-acrylamide co-polymer, 78
- Polyplex(es), 123, 209, 482
 - adhesion to syndecans, 124
 - cell entry of, 123
 - cytoplasmic trafficking of, 123
 - disassembly, 214
 - endolysosomal escape of, 123, 129–132
 - extracellular unpacking, 216–217
 - intracellular reducible, 133–134
 - intracellular routing, 127–129
 - intracellular unpacking, 217
 - nuclear import of, 134–136
 - packing, 215
 - self-assembly, scheme of, 208
 - targeting ligands for, 127
 - uptake pathways, schematic illustration of, 125
- Polystyrenesulfonate (PSS), 510
- Polyvinylpyrrolidone
 - copolymer, 240
 - nanoparticles, 372
- Pore slit model, 47
- Porphin, 313
- Porphyrins, 312
- Potassium depletion, 483
- Poxviruses, 359
- Pre-fixation methodologies, 188
- Proapoptotic peptide, His₆ tagged, 278
- Probes encapsulated by biologically localized embedding, 16
- Probes, intracellular, 18
- Pro-Jet™, 324
- Prostate specific antigen, 511
- Protamine, 496
- Protease labile linkers, 546
- Protein delivery into cells, 266–267
- Protein kinase C, 58
- Protein sponge effect, 126
- Protein transduction, 22
 - Protein transduction domain (PTD), 23, 267, 324, 403, 477
 - mediated nonendocytic delivery, 477
- Proteins,
 - conjugated to QDs, 546
 - intracellular delivery of, 323–336
- Proteoglycans, 124
 - deficient mutant cells, 481
- Protists, 21
- Proton sponge effect, 129, 248, 489
- Protonable polymers, 249
- Proton-sponge polymers, 213
- PSF. *See* Point spread function
- PSS. *See* Polystyrenesulfonate
- PTD. *See* Protein-transduction domain
- Pulmonary endothelium, 454
- PULSin™, 324
- Pyrenebutyrate, 199
- QD (quantum dot(s)), 8, 93–121
 - anionic dihydrolipoic acid-capped CdSe/ZnS, 62
 - astrocyte response to, 96
 - bioconjugation techniques, 542
 - biodistribution in the whole body, 94
 - CdSe, 60
 - CdTe, 96
 - coating, toxicity, 556–557
 - conjugated Luciferase, 555
 - cytotoxicity of, 556–557
 - delivery by cell penetrating peptides, 410–412
 - DNA conjugates, delivery to blastomers, 555
 - DNA, FISH, 544
 - DNA, Lipofectamine 2000 mediated transfection, 545
 - duplex DNA conjugates, 544
 - encapsulation in lipid bilayers, 547
 - epidermal growth factor receptor, 63
 - epigenetic changes, 97
 - fluorescence in situ hybridization, 552–554
 - fluorescent, 61
 - FRET, 553
 - full-width half-maximum of, 539
 - histone interference, 97
 - in vivo imaging in live animals, 554–556

- QD (quantum dot(s)) (*cont'd*)
- induced cellular damage, 94
 - induction of anti-apoptotic genes, 110
 - induction of pro-apoptotic genes, 110
 - intracellular trafficking of, 168–169
 - intravenous administration, 95
 - labeling, 535–567
 - labeling techniques for therapeutically active molecules, 541–543
 - ligand bioconjugates, 55–72
 - ligand-bound, 63
 - lipophilic, 61
 - loaded liposomes, 547
 - maleimide, 546
 - micellization, 542
 - model drug carriers in SPT studies, 168
 - modification with thiolated siRNA, 546
 - multivalent ligand, 67
 - naked, 94
 - near-infrared, in vivo imaging, 537
 - near-infrared emission, 95
 - nPP, 546
 - oligonucleotide FISH probes, 552
 - PEG-capped, 65
 - PEG-PMSA, 556
 - properties and synthesis of, 540–541
 - renal clearance of, 95
 - ricin B, 65
 - streptavidin-coupled, 63
 - subcellular distribution of, 94
 - tagged with plasmid DNA, 544
 - tagging, 537
 - targeted delivery, 546
 - TAT-peptide-coupled DHLA, 65
 - thioglycolic acid-capped CdTe, 63
 - Toxin-conjugates, 64
 - versus organic dyes, 539–540
 - visualization, 539–540
- QD-based intracellular trafficking of
- antibodies, 548–551
 - DNA, 543–544
 - drugs, 548–551
 - liposomes and polymers, 547
 - neurotransmitters, 548–551
 - oligonucleotides, 544–545
 - pathogens, 548–551
 - proteins and peptides, 546
 - siRNA, 545–546
 - targeting ligands, 547
- QD-siRNA conjugates, 546
- QD-streptavidin, 542
- Quantitative structure-activity relationship (QSAR) models, 386–390
- application to nanoparticles, 200
 - correlational models, 195
 - decision rule models, 195
- Quantum confinement, 541
- Quantum dots. *See* QD
- R8. *See* Octaarginine
- R8 peptides, complexation to DNA, 483
- R8-EGFP, 274
- R8-lip. *See* R8-modified liposomes
- R8-Lip-HD, 485–486
- R8-MEND, 486
- sugar-modified, 496
- R8-modified liposomes, 483
- Rab5, 182, 368
- Radiofrequency radiation, 86
- Radixin, 456
- Rafts, 439
- Raman scattering, surface-enhanced, 5
- Ras-superfamily, 57
- Rat insulinoma RINm5F cells, 258
- Rath peptide, 327
- Rath/cargo complex, 328
- Reactive nitrogen species (RNS), 109
- generation by metallic nanoparticles, 109
- Reactive oxygen species (ROS), 94
- generation by metallic nanoparticles, 109
- Real-time particle tracking, 161–175
- Receptor internalization, 56
- Receptor-mediated DNA delivery, 482
- Receptor-mediated endocytosis (RME), 149, 212, 482
- Receptors bound by eGPs, 362–364
- Recombinant single chain antibody-virus eGP fusion, 364
- Recycling endosomes, 182
- Redox-sensitive transcription factors, 109
- Reducible polyplexes, 133–134
- Reductive degradation, 219

- Resolution, spatial, 17
- Resonant light scattering, 515
- Retrograde motion, 343–344
- Retrograde recruitment system, 337
- Retrograde transport, 64
- Retrovirus, 209
 - eGP defined receptor specificity and cell tropism of, 363
- RGD,
 - targeting ligand, 483
 - tripeptide, 5
- Rhabdovirus, eGP defined receptor specificity and cell tropism of, 363
- Rho-dependent kinase (ROCK), 455
- Riboflavin, 5
- Ribosome inactivating proteins, 185
- Ricin, 64
- Ricin B subunit, 64
- Ricin B:QDs, 65
- RISC. *See* RNA-induced siRNA complex
- RME. *See* Receptor-mediated endocytosis
- RNA-induced siRNA complex (RISC), 545
- RNS. *See* Reactive nitrogen species
- ROCK. *See* Rho-dependent kinase
- ROS. *See* Reactive oxygen species
- RRPs. *See* Arginine-rich peptides
- Ruffling, cell surface, 479

- SAINT-2/DOPE lipoplexes, 481
- Saponin, 188
- SAR. *See* Structure-activity relationship
- Scanning ion conductance microscopy (SICM), 20
- Schizophrenia, 110
- Scrape loading, 21
- Second harmonic generation, 516
- Secretory organelles, markers of, 180–186
- Secretory pathways, 177–192
- Selectins, turnover in endothelium, 451
- Self-unpacking gene delivery scaffolds, 207–230
- Self-unpacking materials, 218–221
- Semiconductor quantum dots, 18, 84. *See also* QD
- SE-model. *See* Stretched-exponential model
- Sendai virus, 369
- Senile plaques, 107
- Sensors
 - fiber-optic, 16
 - intracellular, 18
 - optochemical, 16
 - pulled fiber, 16
- SERRS. *See* Surface enhanced resonance Raman spectroscopy
- SERS-based imaging, 519
- Serum endonucleases, 216
- Serum stability of gene delivery vehicles, 210–212
- Severe combined immunodeficiency, gene therapy of, 208
- Sheets, hexagonal, 7
- Shielded polyplexes, 127
- Shiga toxin, 57, 64, 417
- Short single wall nanotubes, 463–464
- SICM. *See* Scanning ion conductance microscopy
- Signal peptides, 26
- Silica, functionalization of, 512
- Silica sol-gel, 15
- Silica-loaded liposomes, 547
- Silver acetate, 77
- Silver nanoparticles, 76
 - tiopronin-coated, 80
- Single motor parameters for kinesin and dynein, 297
- Single-particle tracking (SPT)
 - analysis, 127, 161, 513
 - of carbon nanotubes, 153–155
- Singlet oxygen, 130, 313
- SiO₂ shell, 512
- siRNA
 - delivery by cell penetrating peptides, 408
 - delivery into cytosol, 266
 - tagging with QDs, 537, 545
 - therapeutics, 241
- si-RNA-TAT conjugates, 409
- SKMES-1 cells, 44
- Small GTPase Tab5, 181
- Small-molecule QSAR models, application to nanoparticles, 200

- Small-molecule xenobiotics
 pattern of localization in live cells, 197
 QSAR models, 193–206
- Smallpox, 359
- Smart stimuli-responsive nanocarriers, 412
- SNARE, 181
- SOD. *See* Superoxide dismutase
- Solute binding, 38
- Solvent fixation, 188
- Sonication, 20
- Sorting endosome, 181–182
- Spatiotemporal image correlation spectroscopy, 128
- Spheres, IgG-coated, 463
- Spherical dendrimers, 232
- Spot photobleaching, 386
- SPT. *See* Single-particle tracking
- Squamous cell carcinoma of head and neck, gene therapy of, 208
- ssDNA tagged with gold particles, 544
- Stains, subcellular, 4
- Starling forces. *See* Transcapillary filtration pressure
- Stearyl triphenylphosphonium (STPP) liposomes, 394
- Stearylated R8, 483
- Stem cells, human embryonic mesenchymal (hMSCs), 27
- Stoeber process, 512
- Stokes-Einstein equation, 37
- STPP liposomes. *See* Stearyl triphenylphosphonium liposomes
- STPP-PEG5000 liposomes, 395
- Streptolysin O, 188
- Stretched-exponential (SE) model, 39
- Stroke, 457
- STR-R8. *See* Stearylated R8
- Structure-activity relationship, 3. *See also* Quantitative structure-activity relationship models
- Subplasmalemmal vesicles, 453
- Sulfadiazine (SDZ), 258
- Sulfadimethoxine (SDM), 258
- Sulfamerazine (SMZ), 258
- Sulfamethizole (SMT), 258
- Sulfonamide oligomers, 258
- Superoxide anion, 457
- Superoxide dismutase (SOD), 110, 458
 conjugated to anti-CAM, 458
- Superresolution microscopy, 29
- Surface chemistry, multi-layer multifunction, 17, 26
- Surface electric charge, 199
- Surface enhanced resonance Raman spectroscopy (SERRS), 76
- Surface plasmon resonance, 76, 83
- Surface-enhanced Raman scattering, 99, 519
- SV40, 57
 internalization of, 479
 T antigen, 274, 494
- SW480 cells, 64
- SWNT. *See* Short single wall nanotubes
- Synaptic plasticity, 110
- Syndecans, 347, 481
- Syndecan-1 clustering, 348
- Syntaxin, 179, 181
- Syntenin, 347
- Synthetic viruses, 124
- T7 RNA polymerase, inhibition of, 82
- Target, molecular, 2, 4
- Targeting, 2
- Targeting ligands, chimeras with CPPs, 410
- Targeting moieties, endocytic, 5
- TAT
 antigen-transduced dendritic cells, 407
 biotinylated, 276
 complexation to DNA, 483
 Cre recombinase assay, 271
 fused to tumor antigen, 407
 fused β -galactosidase, 4–5
 peptide motif, 65
 peptide-coupled DHLA-QD conjugates, 65
 peptide-siRNA conjugates, 409
 protein, 22
- TAT-S-S-asparaginase, FITC-labeled, 275
- T-cell response and CHP-HER2, 108
- Teleostean gelatin, 186
- Tetradocylammonium bromide, 77
- Tetralamellar multifunctional envelope-type nano device (T- MEND), 7, 496

- Tetraphenylporphines, sulfonated, 314
- Texas Red, 186
- Texas Red-labeled wheat germ agglutinin, 181
- Theranostics, 29
- Thermal injury, gold nanoparticle-based assessment of, 100
- Thioglycolic acid, 60
- Thiolates, organic, 74
- Thioredoxin, 111
- Ti:sapphire laser, 517
- Time-lapse multicolor fluorescence imaging, 347
- Tiopronin (N-(2-mercaptopropionyl) glycine), 82
 - gold nanoparticles, 104
- TIRF. *See* Dual-color total internal reflection fluorescence microscopy
- TMA. *See* Trimethyl(mercaptopundecyl) ammonium
- T-MEND. *See* Tetralamellar multifunctional envelope-type nano device
- TNF α . *See* Tumor necrosis factor alpha
- Togavirus, eGP defined receptor specificity and cell tropism of, 363
- TOPO coating. *See* Trioctyl phosphine oxide coating
- Toxicology of metal nanoparticles, 86
- Toxin-quantum dot conjugates, 64
- TPL. *See* Two-photon excited luminescence
- TPP. *See* Triphenyl phosphonium cations
- Trafficking, cellular, 4
- Trans-acting nuclear DNA import, 135
- Transcapillary filtration pressure, 437
- Transendothelial channels, 439
- Transfection efficiency, 123
 - cell cycle dependence of, 134–135
- Transferrin, 5, 127, 477
 - receptor, 63, 182
 - tagged with QDs, 537, 547
- Transgene carrying capacity, 209
- Transgenic reporter mice, 97
- Trans-Golgi network, 185
- Translational diffusion coefficient, 386
- Transmembrane pathways, 439–440
- Transport
 - bidirectional, 294
 - facilitated, 47
 - passive, 47
 - retrograde, 64
- Transportan, 276, 325, 404
- Transverse plasmon resonance, 508
- Trimethyl(mercaptopundecyl)ammonium (TMA), 82
- Trimethylammonium alkylthiol, structure of, 81
- Trioctyl phosphine oxide (TOPO) coating, 542
- Triphenyl phosphonium cations (TPP), 394
 - surface-coated liposomes, 394
- Triphenylphosphonium, 4, 201
- Trojan horses, 403
- Trypan blue, 27
- T-tubules, 440
- Tubulin tracker green, 536
- Tumor border, sensitivity to PDT, 314
- Tumor cell membranes, optoporation of, 521
- Tumor cells, hypoxia conditions, 63
- Tumor immunotherapy, 106
- Tumor necrosis, gold nanoparticle-based assessment of, 100
- Tumor necrosis factor alpha (TNF), 85
- Two-dimensional (2D) particle tracking, 162
- Two-photon excited luminescence (TPL), 99, 513
 - activities of Au nanostructures, 516
- Tyrosine phosphorylation of CAM cytosolic domain, 455
- Ultrashort laser pulses, 516
- Vaccinia virus, 209
- Vascular cell adhesion molecule-1 (VCAM-1), 453
 - epitopes, 453
- Vascular extravasation, 212
- Vasculature, leaky, 3
- Vasodilation, 110
- VCAM-1. *See* Vascular cell adhesion molecule-1
- VDAC, 441

- Vehicle unpacking, 214
- Ventricular cell
 - structure of, 434
 - ultrastructure, changes associated with
 - heart failure, 441
- Ventricular myocytes, 440
- Venular endothelium, 438
- Vero cells, 185
- Vesicle(s)
 - associated membrane proteins, 181
 - cell membrane-derived, 7
 - endosomal, 7
 - acidified, 22
- Vesicular endocytic pathways, 451–453
- Vesicular fusion, 181
- Vesicular stomatitis virus, EM of, 358
- Viral gene delivery vehicles, 208–209
- Viral gene vectors, comparison to polyplexes, 123
- Viral spike proteins, 359
- Viral vectors, drawbacks of, 475
- Virosomes, 370–371
 - FITC-Dx loaded, 372
 - loading of, 371–372
 - reconstitution of, 371–372
- Virus(es)
 - classification, 358–359
 - eGP, preparation of, 371
 - envelope-coated nanoparticles, 357–383
 - envelope glycoprotein-coated polymers, 372–374
 - envelope glycoproteins, recombinant sources of, 374
 - fluorescent labeling of, 169
 - inactivated, 369–370
 - interaction with cell-surface receptors, 362–364
 - intracellular trafficking of, 290–291
 - mimetic (VM) nanogels, 256–257
 - pseudotypes, 369
- Viscosity, 38
 - bulk, 38
 - cytoplasmic, 5
 - fluid-phase cytoplasmic, 38
 - microscopic, 38
- Visible light, 85
- VM nanogels. *See* Virus-mimetic nanogels
- VTW-based amphipatic peptide, 329
- Wheat germ agglutinin (WGA), 181
- Wortmannin, 455
- Wrapping time, 103
- Wr-T peptide, 327
- YTA2 peptide, 330
- Zinc sulfide, 77
- ZnS coating, disulfide linkage of, 542
- ω -thioacetylalkylphosphonium salts, structure of, 81