Index

A

A-band, 305
AC. *See* Arrhythmogenic cardiomyopathy
ActA, 290
Actin
  abundance, 10
  assembly, 4, 12–14
  binding proteins, 15–16
  capping proteins, 20–21
  cell adhesion role. *See* Cell adhesion
  cell–cell junction roles
    adherens junctions, 291
    myoblast fusion, 291–292
    neuronal synapse, 291
  contraction studies
    nonmuscle cells
      actin–myosin bundles, 294–297
      actin–myosin networks, 297–298
      myosin II, 292–294
    overview, 292
  cross-linking proteins, 21–22
  evolution, 5, 10
  filament-binding proteins, 22
  intermediate filament motility role, 256
  membrane trafficking
    clathrin-mediated endocytosis, 291
    comet tail motility, 290–291
    macropinocytosis, 290
    overview, 290
    phagocytosis, 290
  muscle
    actin–myosin interactions, 308
    thin filaments, 305–306
  nucleation proteins, 17–20
  nucleoskeleton, 208
  nucleotide binding, 12–13
  polymerases, 20
  protrusion role
    lamellipodia and branched network protrusion
      molecular machinery, 289–290
      structure and dynamics, 287–289
    overview, 282–283
    parallel bundle protrusion
      acrosomal processes, 283–284
      leading edge filopodia, 284–286
      microspikes and retraction fibers, 287
      microvilli, 287
      stereocilia, 287
  severing proteins, 16–17
  structure, 2–4, 10–12
Actomyosin, force propagation, 105
ADF, 289–290
Adhesion. *See* Cell adhesion
AIRE, 137
AKAP, 146
Akt, 346
Alexander disease, 149–150, 261
ALK6, 271
α-Actinin
  CH domains, 89–90
  EF hands, 90
  functional overview, 88
  SR domains, 90
  structure, 90
ALS. *See* Amyotrophic lateral sclerosis
Amyotrophic lateral sclerosis (ALS), 151, 173
Angiogenesis, intermediate filament role, 345–346
Anillin, 376
AP-3, 152
APC, 41
Arp1, 10
Arp2, 5, 10, 14, 17–18, 21, 289–292
Arp3, 5, 10, 14, 17–18, 21, 289–292
Arrhythmogenic cardiomyopathy (AC), 188
ASH1, 270
ATF-4, 152
ATM, 123
ATR, 123
Aurora B, 372, 379
Axl, 349
Axoneme. *See* Cilia

B

Bardet–Biedl syndrome (BBS), 244
Basal body, 34, 121–122
BBS. *See* Bardet–Biedl syndrome
Bcl2, 144
Beclin, 347
BICD2, 82
BLOC-1, 147
Blt1, 375
BMP. *See* Bone morphogenetic protein
Bone morphogenetic protein (BMP), 271
BPAG, 192
BPAG1, 93, 137, 192
Brachyury, 142

C

CALK, 246
Calmodulin, 328–329
CapG, 17
CARMIL, 20
Caveolin, 146
CCT, 125
Cdc5, 375–376
Cdc8, 371
Cdc12, 371, 374
Cdc15, 371, 374, 378
Cdc42, 17
CDK1, 357, 361
Cdk5, 346–347
Cdr2, 375
Cell adhesion
  actin
    catenin mediation of cadherin linkage, 99
    E-cadherin colocalization, 98–99
    extracellular matrix interactions, 98
    mediators of extracellular matrix interactions, 98
  adhesion architecture
    assembly and actin polymerization, 103
    morphology and composition, 102–103
    myosin II regulation of adhesion size and maturity, 104–105
    stabilization by actin, 104
  adhesion sensing and transduction of mechanical forces
    actomyosin force propagation, 105
    force sensing molecular mechanisms, 105–107
    mechanosensing, 107–108
  cross talk between extracellular matrix adhesions and cell–cell adhesions, 109
  extracellular matrix adhesions as molecular clutches, 108
  modules
    actin linkage module, 99
    actin regulatory module, 99–101
    compartmentalization in cell adhesions, 101
    signaling module, 101
  overview, 98
  prospects for study, 109–110
CENP-E, 359
CENP-F, 359
Centrosome
  basal body, 121–122
  cell cycle functions, 118, 120
  chaperones in maintenance, 125
  ciliopathies, 122
  endocytic recycling machinery interactions, 122–123
  history of study, 118
  immune response, 124
  microtubule-organizing center, 120–121

Centrosome (*Continued*)
microtubules, 34
prospects for study, 125–126
stress sensing, 123–124
substructures, 119
Charcot–Marie–Tooth disease, 172, 175
Chk1, 123
CHMP4C, 380
Cilia
axoneme
bending regulation
dynein, 325–328
MIA complex, 326
modeling, 328
structure, 318
bending model, 319–320
dynein
dynein regulatory complex
genetic analysis, 329–330
nexin links, 330–331
subunit composition and function, 331–334
inner dynein arm heterogeneity, 318–319, 323
outer dynein arms, 321–322
intraflagellar transport, 241–244, 246
length regulation, 244–247
microtubules, 34
outer doublet microtubule structure, 318–319
prospects for study, 247
radial spoke
heterogeneity, 320, 325
RS2 regulatory complex
calmodulin- and spoke-associated complex, 328–329
dynein regulatory complex, 329–334
structure, 240–241
CLASP, 40, 359
Clathrin-mediated endocytosis, 291
CLIMP63, 41
Clp1, 374
CNK2, 245, 247
Cofilin, 16–17, 289–290
Contractile ring. *See* Cytokinesis
CPEB, 121, 152
Cytokinesis
abscission
ESCRT-III
evolutionary conservation, 379–380
recruitment, 380
midbody remnant fate, 381
regulation, 380–381
context dependence of mechanisms, 381
contractile ring
assembly
fission yeast, 377
membrane association, 377
myosin function, 377–378
RhoA role, 376–377
constriction, 378
septum disposition, 378
overview, 370
prospects for study, 381
reconstitution of contractile apparatus, 378–379
regulation by cellular structures
anaphase spindle, 371
contractile ring and accessory structures, 370–371
yeast accessory structures, 371
spatiotemporal control
budding yeast
bud site selection, 375
temporal control, 375–376
fission yeast
contractile ring positioning, 375
temporal control, 373–374
metazoan cells, 372
overview, 371–372, 376
spindle-dependent division plate positioning, 372
spindle-independent division plate positioning, 372–373

D

Dab2, 267
DCC, 271
Desmin
interactome
chaperones, 147
costamere linkage, 146
intercalated disk linkage, 146
intermediate filament partners, 146
lysosome linkage, 147
mitochondria linkage, 146
nucleus linkage, 146
muscle function
adult muscle maintenance
mechanochemical signaling, 143
membranous organelle linkage, 143–146
development role
myogenic and cardiogenic regulation, 142–143
progenitor cell expression, 142
mutations and disease, 147
Desmocollin (Dsc), 185, 188
Desmoglein (Dsg), 185, 188, 190, 196
Desmoplakin (DP), 84, 137, 185–187, 190
Desmosome
intermediate filament anchorage
functions, 190
membrane attachments and assembly, 185–188
scaffolding and signaling, 188–190
tissue integrity, 184–185
overview, 184
DFNB2, 272
DFNB3, 272
Dip1, 18
DP. *See* Desmoplakin
DRC4, 246
Dsc. *See* Desmocollin
Dsg. *See* Desmoglein
Dynactin, 82
DYNC1H1, 81–82
Dynein
axoneme, 81
biophysics, 82–83
cilia
dynein regulatory complex
genetic analysis, 329–330
nexin links, 330–331
subunit composition and function, 331–334
inner dynein arm heterogeneity, 318–319, 323
outer dynein arms, 321–322
cytoplasm, 81–82
effectors, 82
evolution, 7
intermediate filament motility, 257
intraflagellar transport, 242
microtubule-based transport, 231–232
motor mechanism, 81
structure, 80–81
Dystroglycan, focal adhesion interactions, 196
Dystrophin, 91

E

EB1, 42
EBS. *See* Epidermolysis bullosa simplex
E-cadherin
actin colocalization, 98–99
catenin mediation of cadherin linkage to actin, 99
ECM. *See* Extracellular matrix
Ect2, 372
EDMD. *See* Emery–Dreifus muscular dystrophy
EHD1, 123
EHD8, 123
Emery–Dreifus muscular dystrophy (EDMD), 210–211
EMT. *See* Epithelial-to-mesenchymal transition
Ena, 20, 286, 290
Envoplakin, 137
Epidermolysis bullosa simplex (EBS), 135–136
Epiplakin, 137
Epithelial-to-mesenchymal transition (EMT), 152, 349
Eps8, 272
Erbin, 190
ERM proteins, 286
ESCRT-III
evolutionary conservation, 379–380
recruitment, 380

Extracellular matrix (ECM)
cell adhesion. *See* Cell adhesion
intermediate filaments in remodeling, 347

F

FA. *See* Focal adhesion
FACE1, 206
FAP100, 327
FAP73, 327
FATZ, 310
FERM, 377
Filamen, 310
Filensin, 191
Flagella, microtubules, 34
Focal adhesion (FA)
intermediate filament interactions
functions, 194–196
keratin, 194
vimentin, 193–194
kinase, 196–197
Formin, 18–20
14-3-3, 136–137
Frontotemporal dementia, 173
FtsZ, 6, 10

G

Gef2, 375
Gelsolin, 17, 20
GFAP. *See* Glial fibrillary acidic protein
Glia maturation factor (GMF), 17–18
Glial fibrillary acidic protein (GFAP)
history of study, 147
nervous system function
brain disease
Alexander disease, 149–150
brain tumor, 150–151
reactive gliosis, 150
expression, 147–148
isoforms, 148–149
GLUT1, 197
GLUT3, 197
GLUT4, 267
GMF. *See* Glia maturation factor
Griscelli syndrome, 269–270

H

H-band, 305
Hemidesmosome (HD)
intermediate filament association
functions, 193
proteins, 191–193
overview, 191
HG. *See* Hemidesmosome
HGPS. *See* Hutchinson–Gilford progeria syndrome
Hsp27, 61
Hsp70, 125
Hutchinson–Gilford progeria syndrome (HGPS), 210–211

I

I-BAR, 286
IC138, 327
ICAM-1. *See* Intercellular adhesion molecule 1
Idiopathic pulmonary fibrosis (IPF), 349
IF. *See* Intermediate filament
IFT. *See* Intraflagellar transport
IFT20, 124
Intercellular adhesion molecule 1 (ICAM-1), 344
Intermediate filament (IF). *See also* Keratin intermediate filaments; Neurofilaments
angiogenesis role, 345–346
assembly
kinetics, 58, 60
mechanism, 58–60
overview, 4, 51–55
unit-length filament paradigm, 57–58
cell adhesion and migration function, 341–343
cell growth and survival role, 346–347
desmosome interactions. *See* Desmosome
dystroglycan interactions, 196
evolution, 6, 53–54
extracellular matrix remodeling, 347
focal adhesion interactions. *See* Focal adhesion
hemidesmosome interactions. *See* Hemidesmosome
history of study, 48–49
inflammation and immune response function, 345
lamins, 204–208
mechanical properties
overview, 60–64, 216–217
single-filament mechanics, 217–219
network mechanics
active versus passive systems, 221–222
cross-link effects, 221
rheology, 222–223
strain stiffening, 219–221
cell stiffness measuring, 223–224
prospects for study, 224
mechanical properties
cell stiffness measuring, 223–224
network mechanics
active versus passive systems, 221–222
cross-link effects, 221
rheology, 222–223
strain stiffening, 219–221
overview, 216–217
prospects for study, 224
single-filament mechanics, 217–219
membrane complexes outside desmosome, 190–19
motility
actin filament role, 256
cell migration, 259–260
diseases, 261
functions, 255
keratin turnover role in epithelial cells, 258
microtubule role, 256
motor proteins, 256–257
neuron functions, 259
overview, 254–255, 340–341
pathogenesis, 347–349
prospects for study, 261
regulation
posttranslational modifications, 258
signaling, 258
structural linkers, 257–258
stress effects, 260
types, 255–256
sequence homology classes, 49, 51
structure, 4, 49–50, 54, 132
tetramer formation, 54, 56–57
Intraflagellar transport (IFT), 241–244, 246
IPF. *See* Idiopathic pulmonary fibrosis

J

JIP1, 232

K

Keratin intermediate filaments. *See also* Intermediate filament
assembly, 134
cell growth and survival role, 346
focal adhesion interactions, 194
genes and proteins, 132–134
intermediate filament motility role in turnover in epithelial cells, 258
motility-related pathogenesis, 347–349
noncanonical functions, 136–137
plakin mediation of cytoskeleton interactions, 137
posttranslational modifications, 137–139
properties, 134–135
stress response, 135–136
structure, 132
type III filaments. *See* Desmin; Glial fibrillary acidic protein; Peripherin; Vimentin
wound healing, 343–344
Kinesin
diverse kinesins, 78–79
evolution, 6–7
intermediate filament motility, 257
intraflagellar transport, 241–242, 247
kinesin-1
cargo binding, 78
motor mechanism, 77–78
regulation, 78
structure, 76–77
kinesin-2, 78
kinesin-3, 78–79
kinesin-5, 79
microtubule-based transport, 231, 234

Kinesin (*Continued*)
microtubule regulation, 79
nuclear, 209
Kinetochore, 360–361, 364
KNL1, 359

L

Lamellipodia, branched network protrusion
molecular machinery, 289–290
structure and dynamics, 287–289
Lamins
chromatin functions, 208
diseases, 210–211
history of study, 204–205
isoforms, 205, 207
mitosis changes, 207–208
posttranslational modifications, 206
structure, 205–206
LIC1, 235–236
LIM kinase, 16
LINC, 142, 210
Lis1, 82
Long-term potentiation (LTP), 170
LTP. *See* Long-term potentiation
Lysosome, desmin function, 146

M

MACF1, 92–93
Map2, 41
Map4, 41
MAP65, 41
Matrix metalloproteinases (MMPs), 346
MCAK, 32, 79
Meckel syndrome, 245
MEF2, 142
Melanin-concentrating hormone receptor, 244
Melanosome, microtubule-based transport, 234–235
MICOS complex, 146
Microtubule
assembly, 4, 36
binding proteins
bundlers and cross-linkers, 41
capping proteins, 40–41
classes, 39–40
cytoskeletal integrators, 41
destabilizers, 40
lattice-bnding proteins, 41
minus-end targeting proteins, 42
overview, 38–39
plus-end trafficking proteins, 41–42
stabilizers, 40
dynamics, 34–36
evolution, 5–6
instability mechanism, 36–38
intermediate filament motility role, 256
interphase array, 32–33
mechanical properties
cell stiffness measuring, 223–224
network mechanics
active versus passive systems, 221–222
cross-link effects, 221
rheology, 222–223
strain stiffening, 219–221
overview, 216–217
prospects for study, 224
single-filament mechanics, 217–219
mitotic spindle, 33
neurofilament interactions, 172
nucleation, 32
posttranslational modifications, 32
rigidity, 31
spindle pole body, 34
structure, 28–31
Microtubule-based transport
adapter protein modification and transport regulation, 230
autophagosome maturation in neurons, 232
cellular context regulation, 231–232
compartmentalization of microtubule subpopulations, 230–231
mitochondrial, 232–234
motor proteins, 229
motor–track interactions, 231
overview, 228–229
Microtubule-organizing center (MTOC)
centrosome activity, 120–121
overview, 2, 32–33
structure, 34
Microvillus inclusion disease, 269–270
Mid1, 371, 374–375
Mid2, 375
Midbody, microtubules, 34
Miro, 234
Mitochondria
desmin function, 143–146
microtubule-based transport, 232–234
Mitosis
anaphase chromosome segregation, 363–365
metaphase plate formation, 362
metaphase
initiation and termination, 363
spindle steady state, 362–363
overview, 354–355
prometaphase
chromosome spindle attachment, 359–361
spindle assembly checkpoint, 361
spindle formation pathways, 361–362
prophase
cytoplasmic changes, 357
nuclear changes, 354, 356–357
restructuring importance, 357–358
prospects for cytoskeleton studies, 365–366
spindle structure, 33
telophase, 365
MKLP2, 372
MKP1, 232
MLCK. *See* Myosin light chain kinase
M-line, 308–309
MMPs. *See* Matrix metalloproteinases
motility regulation by physiological stimuli, 232–234
melanosome, 234–235
prospects for study, 236
protein kinase A-dependent cargo switching, 235–236
MreB, 10
MRF4, 142
MTOC. *See* Microtubule-organizing center
Muscle. *See also* Sarcomere
calcium flux in cardiac versus skeletal muscle, 310–311
contraction regulation, 306
evolution, 304
force transmission, 309–310
myosin
actin–myosin interactions, 308
isoforms, 307–308
thick filaments, 306–307
property comparison of mammalian muscles, 313, 315
striated versus smooth muscle contraction, 311–313
thin filaments, 305–306
titin, 305, 308
Myoblast, fusion, 291–292
MyoD, 142
Myogenin, 142
Myosin
cargo binding, 76
cytokinesis function, 377–378
evolution, 6–7
intermediate filament motility, 257
motor mechanism, 72–73
muscle
actin–myosin interactions, 308
isoforms, 307–308
thick filaments, 306–307
myosin II regulation of adhesion size and maturity, 104–105
regulation, 76
structure, 70–72
types and properties, 73–76
Myosin-driven transport
actin bundles, movement along, 271–275
cytoplasmic streaming in plants, 275–277
diseases, 269–270
long-distance transport, 275
overview, 266
RNA, 270–271
transport myosin features, 266–267
vesicles, 267–269
Myosin light chain kinase (MLCK), 311, 313

N

Ncd, 79
Ndc80, 359
Ndr, 374
Nesprin
nesprin-1, 94

nesprin-2, 94–95
nesprin-3, 94–95
nesprin-4, 95
Neurofilaments (NFs)
assembly, 163–164
axonal transport of proteins
motors, 167–168
phosphorylation and axonal transport, 169–170
polymers versus monomers, 167
transported precursors in formation and maintenance of axonal cytoskeleton, 168–169
degradation, 166–167
diseases
neurofilament proteins as markers, 175
primary disorders, 172–174
secondary disorders, 174–175
distribution along axons, 160–162
domain structure, 163
functions
axon radial growth and nerve conduction, 170
synapses, 170–172
overview, 160
prospects for study, 175–176
subunits
composition, 160–161, 163
expression, 164–165
interactions with organelles and proteins, 172
posttranslational modifications, 165–166
Nexin, 330–331
NFs. *See* Neurofilaments
NHE3, 274
Nkx2.5, 142
NLRP3, 349
NOP-1, 373
Nucleus
actin, 208
cytoskeleton connections, 209–210
lamins, 204–208
motor proteins, 209
nuclear pore complex, 209
nucleoskeleton
diseases, 210–211
overview, 204
NuMa, 209
spectrins, 209
titin, 208–209
NuMa, 209

O

OFD1, 122
OGT, 232

P

PAK, 17
Parkin, 234
ParM, 10
PCM1, 122
Peripherin
brain diseases, 151
expression in nervous system, 151
Periplakin, 137
Pg. *See* Plakoglobulin
PINK1, 234
PKA. *See* Protein kinase A
PKC. *See* Protein kinase C
Pkp. *See* Plakophilin
Plakinin, 191
Plakins. *See also specific plakins*
family members, 93–94
keratin–cytoskeleton interaction mediation, 137
Plakoglobulin (Pg), 185–187, 190–191
Plakophilin (Pkp), 185, 188
Plectin, 93–94, 137, 192–194
Plk1, 372
PLK4, 118
PRC1, 372
PRMT-1, 18
Protein kinase A (PKA), 175, 235–236, 246, 311
Protein kinase C (PKC), 152, 187–188, 346

R

Rab, 267–268
Rab8, 123
Rab11, 123
Rac, 17
Rac1, 187, 193
Radial spoke. *See* Cilia
Ran, 244
Rce1, 206
Reactive gliosis, 150
Regeneration. *See* Intermediate filament
Rho, 17, 105
RhoA, 188, 372–373, 376–377
Rng2, 371
ROCK, 17, 376–377

S

Sarcolemma, desmin function, 143
Sarcomere
actin–myosin interactions, 308
signaling, 310
structure, 304–305
Scar, 292
Septation initiation network (SIN), 374
She2p, 270
SIN. *See* Septation initiation network
Slug, 349
Spectrins, 90–91, 209
Spectroplakin
invertebrates, 92
overview, 91–92
vertebrates
BPAG1, 93
desmoplakin, 84
MACF1, 92–93
plectin, 93–94
Spindle pole body, structure, 34
Ste20, 374
SUMO, 208
SUN, 210
Syntaphilin, 234

T

TACC, 121
Tau, 41
Thymosin-β4, 15–16
Titin, 208–209, 305, 308
Tm. *See* Tropomyosin
Tn. *See* Troponin
TRiC, 125
TRIM2, 174
Tropomodulin, 20
Tropomyosin (Tm), 267, 304, 312
Troponin (Tn), 304, 306
Tubulin
assembly, 4
isoforms, 31
structure, 4

U

Usher syndrome, 272
Utrophin, 91

V

Vascular cell adhesion molecule 1 (VCAM-1), 344
VASP, 20, 286, 290, 294, 296
VAV2, 196
Vimentin
focal adhesion interactions, 193–194
injury marker, 342
intermediate filament scaffolds for signaling and trafficking, 152
regulation of growth and differentiation, 151–152

W

WASH, 17, 291
WASP, 17–18
WASp, 289, 291–292
WAVE, 18, 292
WHAMM, 291
Wound healing. *See* Intermediate filament

X

XMAP215, 40

Z

Z-line, 305, 308–309
Zmpste24, 206