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
clothin-mediated endocytosis, 291
cornet 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
Anchoring, 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, 283–284
Axin, 340
Axoneme. See Cilia
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
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
dendritic recycling machinery
interactions, 122–123
history of study, 118
immune response, 124
microtubule-organizing center, 120–121
Index

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
      - mechachemical 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 (Dpl), 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
  - DYNCHI, 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
  - EBD1, 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 (EMD), 210–211
  - EMT. See Epithelial-to-mesenchymal transition
  - Ena, 20, 286, 290
  - Enplakin, 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

© 2017 by Cold Spring Harbor Laboratory Press. All rights reserved.
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
GeZ, 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
IE. 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
cell 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 single-filament mechanics, 217–219
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
Index

Kinesin (Continued)
  microtubule regulation, 79
  nuclear, 209
Kinetochores, 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
List1, 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
Melanosomes, 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-binding 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
Mito, 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
Ndcb, 359
Ndfr, 374
Nesprin
  nesprin-1, 94

© 2017 by Cold Spring Harbor Laboratory Press. All rights reserved.
Index

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
PCMK, 122
Peripherin
brain diseases, 151
expression in nervous system, 151
Periplakin, 137
Pg. See Plakoglobin
PINK, 234
PKA. See Protein kinase A
PKC. See Protein kinase C
Pkp. See Plakophilin
Plakins. See also specific plakins
family members, 93–94
keratin–cytoskeleton interaction
mediation, 137
Plakoglobin (Pg), 185–187, 190–191
Plakophilin (Pkp), 185, 188
Plectin, 93–94, 137, 192–194
Plk1, 372
PLK4, 118
PRC1, 372
PRMT1, 18
Protein kinase A (PKA), 175, 235–236, 246, 311
Protein kinase C (PKC), 152, 187–188, 346
P Rup, 267–268
Rab8, 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
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
Spectrophilin
invertebrates, 92
overview, 91–92
vertebrates
BPAG1, 93
desmoplakin, 84

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
Spectrophilin
invertebrates, 92
overview, 91–92
vertebrates
BPAG1, 93
desmoplakin, 84

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

MACF1, 92–93
nectin, 93–94
Spindle pole body, structure, 34
Ste20, 374
SUMO, 208
SUN, 210
Syntaphilin, 234