

Index

- acousticolateralis system, in teleosts, 63–64
 schooling functions of, 63–64
- AD. *See* Alzheimer's disease
- adaptationism, 173, 174
- adenosine triphosphate (ATP)
 in biochemical regulation of sleep, 95–96
 in organization of sleep, 99
- aggressiveness, insomnia and, 115–116
- aging, sleep and
 in *Drosophila melanogaster*, 46–47
 in honeybees, 40–41
 insomnia, 110
 in zebrafish, 256–259
- albacores. *See* scombrids
- Alzheimer's disease (AD), 231
- amphibians
 evolution of, 201–202
 REM sleep in, 201–202
- amylase, 51
- Angelman syndrome (AS), 228
- animal models, of sleep, 145.
See also mouse models,
 for sleep
 in *Drosophila melanogaster*, 145
- mice as, 219–232
 circadian mechanisms and, 226–228
 electrophysiology protocols in, 221
 genetics and, 219–232
 genomic imprinting in, 228–230
 high-throughput technology protocols in, 221–222
 NREM in, 228–232
 REM during, 223, 230–232
 in sleep-wake studies, 224–225
 wakefulness and, 224–226, 230–232
- animals in the wild
 future sleep research on, 9–10
 REM and, captive animals v., 210–211
 sleep times for, captive animals v., 14–15
- ANS. *See* automatic nervous system
- anxiety, insomnia and, 114
- Apis mellifera*. *See* honeybees,
 sleep in
- AS. *See* Angelman syndrome
- Aserinsky, Eugene, 197
- ATP. *See* adenosine triphosphate
- automatic nervous system (ANS), 3
- avian sleep. *See* birds, sleep in
- baboons. *See* nonhuman primates, sleep in
- bears, hibernation and, 8
- bees. *See* honeybees, sleep in
- behavioral measures, of sleep, 2–3, 35
- circadian influences on, 35
- homeostatic factors in, 35
- in insects, 37
 in honeybees, variations among species, 40
- NREM, 2–3
 HVSW in, 3
 REM, 2
- bihemispheric sleep, 7
- birds, sleep in, 145–164
 brain size and, 157
 homeostasis for, 152–155
 sleep deprivation and, 152–153
 SWA and, 153

268 Index

- birds, sleep in (*cont.*)
 REM during, 145, 150–152, 204–205
 duration of, 151–152
 evolution of, 155, 161
 Flanigan–Tobler criteria for, 205
 mammalian sleep v., 151–152, 153–155, 205–210
 study history of, 204–205
 thermoregulatory responses during, 150–151
 sleep duration, 146–147
 SWS in, 145, 146–150
 drowsiness v., 146
 energy conservation hypothesis for, 156–157
 evolution of, 155
 thermoregulatory responses during, 146
 unihemispheric, 148–150
 USWS, 148–149
- blindness
 schooling of teleosts and, 67–68
 sleep and, for mammals, 60
- body mass, sleep and, 1
 in mammals, 25
- bonitos. *See* scombrids
- brain development
 in birds, sleep and, 157
 of forebrain, 2
 in mammals, sleep and, 157
 sleep as localized in, 97–98
 SWA and, evolution of, 157–160
- cAMP pathway. *See* cycle AMP pathway
- cAMP response element
 binding (CREB) proteins, 47
- cephalopods, 200
- cerebrospinal fluids,
 sleep-promoting substances in, 92
 TNF in, 94
- cetaceans, 7
 REM sleep in, 208–209
 unihemispheric sleep in, 208–209
- chimpanzees. *See* nonhuman primates, sleep in
- circadian rhythms
 in mouse models, for sleep, 226–228
 sleep behaviors and, 35
 in zebrafish, 247–248
- collothalamic system, 178–179
- compensatory sleep, 246
- conflict theory, 228
- CONLEARN process, 188
- CONSPEC process, 188
- continuous swimming, of scombrids, 73–74
- coral reefs
 hypoxia in, 67
 piscivores v. herbivores in, 66
 teleosts in, sleep v. restful waking for, 65–67
 in nocturnal species, 66
- Cousteau, Philippe, 77
- CREB proteins. *See* cAMP response element binding proteins
- cycle AMP (cAMP) pathway, 47
- cytokines, 92. *See also* tumor necrosis factor
- DAMS. *See* *Drosophila* Activity Monitoring System
- Dennett, D. C., 173
- depression, dyssomnias and, 108
- deprivation of sleep. *See* sleep deprivation
- detailed focal vision, sleep and, 59–61
 blind mammals and, 60
- Diptera punctata*, sleep deprivation for, 38–39
- diurnal activity
 in fish, 239–241
 in zebrafish, 242
 in nonhuman primates as biological characteristic, 131–133
 evolution of, 131–133, 134, 135–136
- dopamines, 47–48
- Drosophila* Activity Monitoring System (DAMS), 49
- Drosophila melanogaster*, sleep in, 42–51
 aging and, 46–47
 as animal model, 145
 electrophysiology of, 44–45
 LFPs in, 44–45
 as evaluation model, for humans, 42–43
 genetics and, 45–46
 short-sleeping strains and, 46
 methodological considerations, in studies of, 48–49
 with DAMS, 49
 neurotransmitters in, 47–48
 signaling pathways in, 47
 sleep deprivation for, 43
 drowsiness, SWS v., in birds, 146
- duck-billed platypus, REM sleep in, 206–207

- dyssomnias, 108–109
 depression and, 108
 health risks as result of, 108
 hypersomnolence, 108
 idiopathic hypersomnia, 117–118
 infections and, 118–119
 insomnia, 50–51, 108, 110–116
 aggressiveness and, 115–116
 aging and, 110
 anxiety and, 114
 chronicity of, 110
 definition of, 110
 economic impact of, 110–111
 evolutionary medicine and, 112–113, 114
 features of, 111
 homeostatic regulation and, as resistance to, 112, 113
 idiopathic, 111
 pain thresholds and, 111
 psychiatric disorders and, as risk factor for, 111
 REM sleep and, 115
 short sleepers and, 112
 sleep deprivation v., 111–112
 stress and, 113–114
 KLS, 118
 narcolepsy, 116–117
 age profiles for, 116–117
 genetic factors for, 116
 infection and, 119
 REM and, 116–117
 polysomnographic sleep findings for,
 SWS and, 118
- EEG. *See* electroencephalography
 EGFR. *See* epidermal growth factor receptor
 electroencephalography (EEG)
 for mammalian sleep architecture, 13–15
 for nonhuman primates, 125
 in mouse models, for sleep, 221
 for nonhuman primates sleep quotas, 125
 during REM sleep, 197
 for frogs, 202
 for wakefulness in mammals, 181–182
 reptiles v., 185–186
 for wakefulness in reptiles, 182–183
 mammals v., 182–183
 energy conservation hypothesis, 156–157
 epidermal growth factor receptor (EGFR), 47
 Epworth Sleepiness Scale, 112
 ERPs. *See* evoked response potentials
 evoked response potentials (ERPs), 98–99
 evolution
 of amphibians, 201–202
 of diurnal activity, in nonhuman primates, 131–133
 for developmental sleep patterns, 135–136
 for sleep duration, 134
 of mammals, 205
 of monotremes, 206
 of reptiles, 202
 of sleep in birds, 155, 161
- humoral signaling in, 88
 in insects, 35
 in mammals, 155, 161
 memory processing as, 58
 for monophasic sleep cycles, in nonhuman primates, 133–134
 in nonhuman primates, 127–130, 135
 studies for, 172–173
 in teleosts, 61
 of wakefulness, in mammals, 187
 evolutionary medicine
 definition of, 107
 new infectious disorders and, 119
 of sleep disorders, 107–120
 for insomnia, 112–113, 114
- fishes, sleep in, 238–261. *See also* scombrids; teleosts, sleep in; zebrafish, sleep in
 behavioral features of, 238
 diurnal activity and, 239–241
 light illumination and, 260–261
 REM during, 201
 Flanigan–Tobler criteria, for sleep, 201
 in birds, 205
 in reptiles, 202–203
 forebrain development, sleep and, 2
 frogs, REM sleep in, 202
 EEG activity in, 202
 fruit flies. *See* *Drosophila melanogaster*, sleep in
 full polygraphic sleep, 4

270 Index

- GABA. *See* gamma-aminobutyric acid
 receptor agonists
 gamma-aminobutyric acid (GABA) receptor agonists, 48
 in zebrafish, 248–251
 genetics
 DNA structure discovery, role in, 218
Drosophila melanogaster and, short-sleeping strains of, 46
Drosophila melanogaster and, sleep in, 45–46
 mouse model for, 219–232
 expression profiling in, 224–226
 variations' influence on, 222–224
 narcolepsy and, 116
 sleep and, 218–232
 phenotypes for, 218–219
 variations, 222–224
 genomic imprinting, 228–230, 232
 conflict theory and, 228
 hibernation, 8
 bears and, 8
 through SWS, 8
 high-voltage slow waves (HVSW), 3
 histamine receptor agonists, 252
 homeostatic regulation, for sleep, 2, 35
 in birds, 152–155
 sleep deprivation and, 152–153
 SWA and, 153
 insomnia and, as resistance to, 112, 113
 for intensity, 109–110
 SWA in, 109
 two-process model of, 109–110
 in zebrafish, 245–247
 honeybees, sleep in, 39–42
 age as factor for, 40–41
 antenna mobility and, 39–40
 colony tasks as factor in, 41
 sleep behaviors in, variations among species, 40
 sleep derivation for, 40
 HVSW. *See* high-voltage slow waves
 hypersomnolence, 108. *See also* narcolepsy
 hypocretins, 252–253, 261
 hypoxia, in coral reefs, 67
 sleep-swimming and, 67
 idiopathic hypersomnia, 117–118
 idiopathic insomnia, 111
 immunocompetence, duration of sleep and, 1
 infections, mammalian sleep influenced by, 28
 dyssomnias and, narcolepsy, 119
 evolutionary medicine and, 119
 inner ear, in teleosts, 64
 insects, sleep in, 34–51. *See also* *Drosophila melanogaster*, sleep in
Drosophila melanogaster, 42–51
 aging and, 46–47
 electrophysiology of, 44–45
 as evaluation model, for humans, 42–43
 genetics and, 45–46
 methodological considerations, in studies of, 48–49
 neurotransmitters in, 47–48
 short-sleeping strains of, 45–46
 signaling pathways in, 47
 sleep deprivation for, 43
 early observational studies of, 37
 behavioral factors in, 37
 from evolutionary standpoint, 35
 in honeybees, 39–42
 age as factor for, 40–41
 antenna mobility and, 39–40
 colony tasks as factor in, 41
 sleep behaviors in, variations among species, 40
 sleep derivation for, 40
 REM during, 200
 systematic studies of, 37–39
 mosquitos in, 38
 moths in, 38
 scorpions in, 38
 of sleep deprivation, 38–39
 insomnia, 50–51, 108, 110–116
 aggressiveness and, 115–116
 aging and, 110
 anxiety and, 114
 chronicity of, 110
 definition of, 110
 economic impact of, 110–111

- evolutionary medicine and, 112–113, 114
- features of, 111
- homeostatic regulation
and as resistance to, 112, 113
- idiopathic, 111
- pain thresholds and, 111
- psychiatric disorders and,
as risk factor for, 111
- REM sleep and, 115
- short sleepers and, 112
- sleep deprivation v.,
111–112
- stress and, 113–114
- intensity. *See* sleep intensity
- International Classification of Sleep Disorders*, 111
- invertebrates, REM sleep in,
200
- cephalopods, 200
- Kleine–Levin syndrome (KLS),
118
- KLS. *See* Kleine–Levin syndrome
- laboratory conditions,
mammalian sleep
architecture under,
13–15
- data collection and, 14
- with EEG, 13–15
- genetic variations
influence on, 222–224
- for nonhuman primates,
125
- predation in, 25
- REM and, wild animals v.,
210–211
- sleep times, wild animals
v., 14–15
- of teleosts, 65
- lemnthalamic system, 4,
178–179
- lemurs. *See* nonhuman primates, sleep in
- LFPs. *See* local field potentials
- local field potentials (LFPs),
44–45
- mackerels. *See* scombrids
- mammals, sleep in. *See also*
marine mammals,
sleep in; nonhuman primates, sleep in
- architecture of, 15–18
- duration of sleep in, 17
- infections as influence
on, 28
- under laboratory
conditions, 13–15
- monophasic cycles in, 18
- plasticity of, 25–28
- polyphasic cycles in, 18
- predation and, 20–23
- for primates, 125–131
- social sleeping and,
21–22
- tropic niche and, 23–24
- for blind mammals, 60
- brain size and, 157
- classification of, 205
- deprivation of, 12
- ecological constraints on,
12–29
- body mass as, 25
- direct costs of, 12
- energy requirements as,
24–25
- under laboratory
conditions, 13–15
- opportunity costs of, 12
- tropic niche as, 23–24
- evolution of, 205
- full polygraphic sleep in, 4
- hibernation for, 8
- monotremes, 206–207
- negative consequences of,
174–175
- NREM in, 4, 15–18
- predation and, 22–23
- REM v., 17–18
- placental, 207–208
- primitive marsupials,
207–208
- quiescent states v., 50
- REM in, 4, 15–18, 205–210
- avian sleep v., 151–152,
153–155, 205–210
- evolution of, 155, 161
- in monotremes, 206–207
- NREM v., 17–18
- in placental mammals,
207–208
- plasticity of, 25–28
- predation and, 22–23
- in primitive marsupials,
207–208
- rest v., 173–174
- sleep rebound in, 12, 175
- SWS in, evolution of, 155
- mammals, wakefulness in,
172–190
- embryological studies of,
188–189
- evolution of, 187
- neurological signs of,
181–185
- EEG arousal patterns
and, 181–182
- reptiles v., 185–186
- sleep spindles and,
184–185
- rest v. sleep in, 173–174
- sensory processing for,
177
- visual system structure in,
177–179
- collothalamic system in,
178–179

272 Index

- mammals, wakefulness (*cont.*)
 lemnothalamic system
 in, 4, 178–179
 Sprague effect in, 181
 telencephalic processing
 in, 180–181
- marine mammals, sleep in,
 2, 7
- for cetaceans,
 REM sleep in, 208–209
- ecological constraints for,
 13
- for pinnipeds, 7
 bihemispheric, 7
 REM during, 209
 unihemispheric, 7
 REM in, 208–210
 in cetaceans, 208–209
- melatonin, 253, 255, 261
- memory processing, during
 sleep, 58
 as evolutionary process, 58
 for teleosts, 74–75
- microsleeps, 112
- models. *See* animal models,
 of sleep
- monkeys. *See* nonhuman
 primates, sleep in
- monophasic sleep cycles, 18
 in nonhuman primates,
 evolution of, 133–134
- monotremes
 evolution of, 206
 sleep in, 206–207
 in duck-billed platypus,
 206–207
- mosquitos, sleep in, 38
- moths, sleeping postures in,
 38
- mouse models, for sleep,
 221–230
 circadian mechanisms and,
 226–228
 electrophysiology protocols
 in, 221
- genetics and, 219–232
 expression profiling in,
 224–226
 variations' influence on,
 222–224
- genomic imprinting in,
 228–230, 232
- conflict theory and, 228
- NREM and, 228–230
- REM and, 228–230
- high-throughput
 technology protocols
 in, 221–222
- NREM in, 228–232
- REM during, 223, 230–232
 genomic imprinting and,
 228–230
- in sleep-wake studies,
 224–225
- wakefulness and, 224–226,
 230–232
- Multiple Sleep Latency Test,
 112
- narcolepsy, 116–117
 age profiles for, 116–117
 genetic factors for, 116
 infection and, 119
 REM and, 116–117
 PFC development and,
 117
- Nature*, 218
- neonates, REM sleep in, 199
- neurotransmitters, for sleep,
 47–48
 dopamines, 47–48
 GABA receptor agonists, 48
 during REM, 198–199
 serotonin, 47
- nonhuman primates, sleep
 in, 123–140. *See also*
 diurnal activity, in
 nonhuman primates
 biological characteristics
 and, 131–138
- developmental pattern
 alteration as, 135–136
- monophasic sleep as,
 evolution of, 133–134
- nocturnal to diurnal
 activity transition as,
 131–133
- sleep duration as,
 evolution of, 134
- sleep intensity as,
 evolution of, 135
- classification of, 123
- clinical study history for,
 123–124
- future research
 recommendations for,
 138–140
- sleep quotas in, 125–126,
 131
 with EEG, 125
- empirical data for,
 126–131
- evolutionary patterns
 for, 127–130
- under laboratory
 conditions, 125–126
- NREM and, 131, 135
- phylogenetic signals in,
 129–130
- REM and, 131, 135–136
- social sleeping in,
 136–138
 functions of, 136–137
- non-rapid eye movement
 (NREM), during sleep,
 2–3
- HVSW in, 3
- in mammals, 4, 15–18
 nonhuman primates,
 131, 135
 predation and, 22–23
 REM v., 17–18
- in mouse models, 230–232
 genomic imprinting and,
 228–230

- as physiologic indicator of sleep, 35–36
 TNF role in, 86, 92–94
 NREM. *See* non-rapid eye movement, during sleep
- octopi. *See* cephalopods
- opportunity costs, of sleep, in mammals, 12
- Pacific beetle cockroach. *See* *Diploptera punctata*, sleep deprivation for
- paradoxical sleep, in reptiles, 203–204
- parasomnias, 108
- partial warm-bloodedness (PWB), 74
- PFC. *See* prefrontal cortex, development of
- phylogenetic signals. *See also* genetics
 in nonhuman primates, 129–130
 in REM sleep, 198, 199
- physiologic indices, of sleep, 3, 35–36
 ANS and, 3
 NREM as, 35–36
 REM as, 36
- pinnipeds, sleep in, 7
 bihemispheric, 7
 REM, 209
 unihemispheric, 7
- placental mammals, REM sleep in, 207–208
- polyphasic sleep cycles, 18
- Prader–Willi syndrome (PWS), 228
- predation, sleep architecture and, 20–23
 by generalist predators, 23
 under laboratory conditions, 25
- REM–NREM sleep cycles and, 22–23, 115
 risk of, as factor in sleep time, 20–21
 schooling in teleosts and, 62, 68, 69
 social sleeping and, 21–22
 by specialist predators, 23
 unihemispheric sleep in birds and, 149–150
- prefrontal cortex (PFC), development of, 117
- primates. *See* nonhuman primates, sleep in
- primitive marsupials, REM sleep in, 207–208
- psychiatric disorders, insomnia as risk factor for, 111
- PWB. *See* partial warm-bloodedness
- PWS. *See* Prader–Willi syndrome
- quiescent states, in mammals, 50. *See also* mammals, sleep in
- rapid eye movements (REM), during sleep, 2
 in amphibians, 201–202
 in frogs, 202
 during avian sleep, 145, 150–152, 204–205
 duration of, 151–152
 evolution of, 155, 161
 Flanigan–Tobler criteria for, 205
 mammalian sleep v., 151–152
 study history for, 204–205
 thermoregulatory responses during, 150–151
- in cetaceans, 208–209
 EEG activity during, 197
 evolution of, 197–211
 in insects, 200
 insomnia and, 115
 in invertebrates, 200
 cephalopods, 200
 in laboratory conditions v. wild animals, 210–211
 in mammals, 4, 15–18, 205–210
 evolution of, 155, 161
 marine, 208–210
 in monotremes, 206–207
 neuronal systems responsible for, 198–199
 nonhuman primates, 131, 135–136
 NREM v., 17–18
 placental, 207–208
 plasticity of, 25–28
 predation and, 22–23, 115
 in primitive marsupials, 207–208
 in mouse models, 223, 230–232
 genomic imprinting and, 228–230
 narcolepsy and, 116–117
 in neonates, 199
 phylogenetic studies of, 198–199
 limitations of, 198
 as physiologic indicator of sleep, 36
 in pinnipeds, 209
 in reptiles, 202–204
 sleep rebound and, 199
 SOREM, 116
 in vertebrates, 200–206
- rebound effect, 3
 in mammals, 12

274 Index

- Rechtschaffen, A., 174
- REM. *See* rapid eye movements, during sleep
- reptiles, sleep in
 NREM, 202–203
 paradoxical, 203–204
 REM, 202–204
 evolution in, 202
 Flanigan–Tobler criteria, 202–203
- reptiles, wakefulness in, 172–190
- neurological signs of, 181–185
 EEG arousal patterns and, 182–183
 mammals *v.*, 185–186
 sensory processing for, 177
 visual system structure in, 177–179
 collothalamal system in, 178–179
 lemnothalamal system in, 4, 178–179
 Sprague effect in, 181
 telencephalic processing in, 180–181
- rest
 in fish, 260
 sleep *v.*, in mammals, 173–174
- restful waking, in teleosts, sleep *v.*, 64–67
 in captive fishes, 65
 in coral reefs, 65–67
 in free-living fishes, 64–65
- retinal structure, in teleosts, 63
- schooling, in teleosts, 67–70, 77–79
 acousticolateralis system and, 63–64
 for blind species, 67–68
 feeding patterns and, 70
 formation factors for, 68
 predators and, effectiveness against, 62, 68, 69
 in scombrids, 73
 vision and, 62, 67
- Science*, 218
- scombrids, 70–74
 continuous swimming of, 73–74
 geographic distribution of, 71–72
 migration patterns of, 72–73
 physical characteristics of, 70–71
 oxygen consumption and, 71
 PWB and, 74
 schooling in, 73
- scorpions, states of vigilance for, 38
- serotonin, 47
- short sleepers, insomnia and, 112
- signaling pathways, for sleep
 cAMP, 47
 CREB proteins in, 47
 in *Drosophila melanogaster*, 47
 EFGR in, 47
- skipjacks. *See* scombrids
- sleep. *See also* aging, sleep and; insects, sleep in; mammals, sleep in; mouse models, for sleep; nonhuman primates, sleep in; non-rapid eye movement, during sleep; rapid eye movements, during sleep; sleep deprivation; sleep disorders; sleep intensity; sleep studies; teleosts, sleep in
 AD and, 231
 animal models of, 145
 mice as, 219–232
 behavioral measures of, 2–3, 35
 circadian influences on, 35
 NREM, 2–3
 REM, 2
 biochemical regulation of, 91–97
 ATP in, 95–96
 through cerebrospinal fluids, 92
 insomnia as resistance to, 112, 113
 SWA in, 109
 TNF in, 91–97
 two-process model of, 109–110
 body mass and, 1
 comparative approach to, 1
 definition of, 2–3
 criteria for, 3, 35–36
 duration of, 107–108
 immunocompetence and, 1
 evolution of, 87–91
 humoral signaling in, 88
 studies for, 172–173
 Flanigan–Tobler criteria for, 201
 in reptiles, 202–203
 forebrain development and, 2
 function of, 9, 57–61, 99–100, 189–190
 brain operational efficiency as, 60

- SRS role in, 100
 theories of, 100
 future research on, 8–10
 sleep expression, 9
 sleep function, 9, 57–61
 in wild animals, 9–10
 genetic studies for,
 218–232
 genomic imprinting for,
 228–230, 232
 hibernation and, 8
 bears and, 8
 through SWS, 8
 homeostatic regulation
 and, 2, 35
 in birds, 152–155
 insomnia and, as
 resistance to, 112, 113
 for sleep intensity,
 109–110
 SWA in, 109
 two-process model of,
 109–110
 intensity of, 97, 109–110
 for marine mammals, 2,
 7
 for cetaceans, 7
 for pinnipeds, 7
 memory processing during,
 58
 microbial influence on,
 91
 monophasic cycles of, 18
 as network-emergent
 property, 86–100
 of whole-organism, 87
 at neuronal level, 89–91
 organization of, 97–99
 ATP role in, 99
 cortical columns' role in,
 98–99
 ERPs in, 98–99
 as localized event in
 brain, 97–98
 origin of, 57–61
 detailed focal vision and,
 59–61
 memory processing and,
 58
 physiologic indices of, 3,
 35–36
 ANS and, 3
 polyphasic cycles of, 18
 rebound effect with, 3
 in mammals, 12
 restful waking v., in
 teleosts, 64–67
 in captive fishes, 65
 in coral reefs, 65–67
 in free-living fishes,
 64–65
 studies for, 172–173
 TNF and, 86–87
 in biochemical
 regulation of, 91–97
 NREM and, 86, 92–94
 unihemispheric, 7
 in birds, 148–150
 in cetaceans, 208–209
 sleep deprivation and, 8
 sleep deprivation
 in birds, 152–153
 REM states after,
 mammals v., 153–155
 in insects, 38–39
 in *Diptera punctata*,
 38–39
 in *Drosophila melanogaster*,
 43
 in honeybees, 40
 insomnia v., 111–112
 in mammals, 12
 microsleeps and, 112
 sleep intensity and, 109
 sleep rebound effect after,
 175
 unihemispheric sleep and,
 8
 sleep disorders. *See also*
 dyssomnias
 classification of, 108–109
 dyssomnias, 108–109
 depression and, 108
 health risks as result of,
 108
 hypersomnolence, 108
 idiopathic hypersomnia,
 117–118
 infections and, 118–119
 insomnia, 50–51, 108,
 110–116
 KLS, 118
 narcolepsy, 116–117
 polysomnographic sleep
 findings for,
 SWS and, 118
 evolutionary medicine of,
 107–113, 114, 120
 parasomnias, 108
 sleep duration, 107–108
 in birds, 146–147
 immunocompetence
 and, 1
 in nonhuman primates,
 evolution of, 134
 sleep expression, 9
 sleep intensity, 9, 97,
 109–110
 homeostatic regulation of,
 109–110
 SWA in, 109
 two-process model of,
 109–110
 in nonhuman primates,
 evolution of, 135
 NREM and, 135
 sleep deprivation and,
 109
 SWA and, 9
 sleep onset rapid eye
 movements (SOREM),
 116

276 Index

- sleep quotas
 in nonhuman primates,
 125–126, 131
 with EEG, 125
 empirical data for,
 126–131
 evolutionary patterns
 for, 127–130
 under laboratory
 conditions, 125–126
 NREM and, 131
 phylogenetic signals in,
 129–130
 REM and, 131
 social sleeping as influence
 on, 137–138
- sleep rebound
 in mammals, 12
 after sleep deprivation,
 175
 REM sleep and, 199
- sleep spindles, wakefulness
 and, 184–185
- sleep studies
 of *Drosophila melanogaster*,
 methodological
 considerations in,
 48–49
 with DAMS, 49
 evolution of sleep in,
 172–173
 of insects, 37
 behavioral factors in,
 37
 systematic, 37–39
 of nonhuman primates,
 123–124
 paradigm shifts in,
 172–173, 176
- sleepiness
 Epworth Sleepiness Scale,
 112
 Multiple Sleep Latency Test
 for, 112
- sleep-swimming, hypoxia
 and, 67
- sleep-wake studies, in mouse
 models, 224–225
- slow-wave activity (SWA), 9
 during avian sleep,
 146–150
 brain development and,
 157–160
 in homeostatic regulation
 of sleep, 109
 in birds, 153
 synaptic homeostasis
 hypothesis and,
 160–161
- slow-wave sleep (SWS), 8
 in birds, 145, 146–150
 drowsiness v., 146
 energy conservation
 hypothesis for,
 156–157
 evolution of, 155
 thermoregulatory
 responses during, 146
 unihemispheric,
 148–150
 USWS, 148–149
 dyssomnias and, 118
 in mammals, evolution of,
 155
 synaptic homeostasis
 hypothesis for, 161
- social sleeping, 21–22
 in nonhuman primates,
 136–138
 functions of, 136–137
 sleep quotas influenced by,
 137–138
- Sprague effect, 181
- squids. *See* cephalopods
- SRS, role in function of sleep,
 100
- stress, insomnia and, 113–114
- SWA. *See* slow-wave activity
- SWS. *See* slow-wave sleep
- synaptic homeostasis
 hypothesis
 for SWA, 160–161
 for SWS, 161
- telencephalic processing,
 functional properties
 of, 180–181
 Sprague effect and, 181
- teleosts, sleep in, 61–80
 acousticolateralis system
 in, 63–64
 activity phasing flexibility
 for, 79
 brain complexity among,
 77
 daily routine as factor in,
 75–77
 predation in, 76
 defining features of, 61–62
 evolutionary development
 of, 61
 eye structure in, 62–63
 inner ear in, 64
 memory processing for,
 74–75
 nocturnal species of, 66
 origin of, 61
 retinal structure in, 63
 role of senses for, 62–64
 vision, 62
- schooling for, 67–70, 77–79
 acousticolateralis system
 and, 63–64
 for blind species, 67–68
 feeding patterns and, 70
 formation factors for, 68
 predators and,
 effectiveness against,
 62, 68, 69
 in scombrids, 73
 vision and, 62, 67
- scombrids, 70–74

- continuous swimming
 of, 73–74
- geographic distribution
 of, 71–72
- migration patterns of,
 72–73
- physical characteristics
 of, 70–71
- PWB and, 74
- schooling in, 73
- sleep v. restful waking in,
 64–67
- in captive fishes, 65
- in coral reefs, 65–67
- in free-living fishes,
 64–65
- sleep-swimming in, 67
- torpor. *See* hibernation
- tropic niche, sleep
 constraints as result
 of, 23–24
- tumor necrosis factor (TNF)
 in cerebrospinal fluids, 94
- sleep and, 86–87
- biochemical regulation
 of, 91–97
- NREM in, 86, 92–94
- tunas. *See* scombrids
- unihemispheric sleep, 7
 in birds, 148–150
 predation and, 149–150
 USWS in, 148–149
- in cetaceans, 208–209
- sleep deprivation and, 8
- unihemispheric slow-wave
 sleep (USWS), in birds,
 148–149
- predation and, 149–150
- prolonged flights and, 150
- USWS. *See* unihemispheric
 slow-wave sleep, in
 birds
- vertebrates, REM sleep in,
 200–206. *See also* birds,
 sleep in; fishes, sleep
 in; mammals, sleep in;
 reptiles, sleep in;
 reptiles, wakefulness
 in
- classification of, 200–201
- vision, in teleosts, 62
- for schooling, 62, 67
- wakefulness. *See also*
 mammals,
 wakefulness in;
 reptiles, wakefulness
 in
- as adaptive response, 173,
 174
- analogous traits for, across
 species, 176–177
- homologous traits for,
 across species, 176–177
- between mammals and
 reptiles, 186–187
- in mammals, 172–190
- embryological studies of,
 188–189
- in mouse models,
 224–226, 230–232
- neurological signs of,
 181–185
- rest v. sleep in, 173–174
- sensory processing in,
 177
- visual system structure
 and, 177–179
- in reptiles, 172–190
- neurological signs of,
 181–185
- sensory processing in,
 177
- visual system structure
 and, 177–179
- Williams, G. C., 189
- zebrafish, sleep in, 242–259
- aging and, 256–259
- behaviors during, 242–245
- circadian regulation in,
 247–248
- compensatory sleep and,
 246
- development cycle of,
 242
- diurnal activity of, 242
- homeostatic regulation
 during, 245–247
- light sensitivity of,
 246–247
- neurochemical
 mechanisms of,
 248–253
- histamine receptor
 agonists and, 252
- hypocretins and,
 252–253, 261
- melatonin and, 253, 255,
 261
- neuronal structures in,
 253–256