Index

Bold page numbers indicate figures, italic page numbers indicate tables.

5-HT, see serotonin abdominal ganglia DILP7-expressing neurons, 23, 25 sex peptide and, 90 acids, aversion to, 57, 60 actin, and tau, 146 AD (Alzheimer's disease), 145-149, 164-165 drug targets, 147, 148, 171-172 adenylyl cyclase (AC) pathways, see rut (rutabaga) adipokinetic hormone (AKH), 24, 26, 30 immature males courted by other males, 119-120 lifespan extension, 24, 180 - 181premature aging in drd mutants, 83-85 of virgin females and male courtship, 119 age-related memory impairment (AMI), 178, 177-181 aggression cVA, 57, 60, 117 epistasis, 220 fru/dsx, 90 genomics, 190 neuropeptide F, 25 transcriptional network, 222 A-IFM, see asynchronous indirect flight muscle air flow in olfactory learning experiments, 237 AKH (adipokinetic hormone), 24, 26, 30 alcohol NPF regulation of consumption, 23, 25 sensitivity/tolerance insulin signaling, 28 transcriptional networks, 223, 223, 225

allatostatin A (AstA), 24 allodynia, 67, 70-71 α -synuclein, 141 Drosophila models of PD, 141-142 and other genes, 139, 140, 143-144 role in pathogenesis, 141 ALS (amyotrophic lateral sclerosis), 151-153 Alzheimer's disease (AD), 145-149, 164-165 drug targets, 147, 148, 171-172 amacrine neurons, 7 Amfor (honey bee for), 198 AMI (age-related memory impairment), 178, 177-181amn (amnesiac) memory defects, 118, 131, 177, **178** nociception, 70 AMP-activated protein kinase (AMPK), 148 amyloid (A β , amyloid plaques), 145, 147–149, 164, 165, 171 Arctic mutation, 147 amyloid precursor protein (APP), 147, 148–149, 164 amyloid precursor protein-like gene (Appl/APPL), 147-148, 165 amyotrophic lateral sclerosis (ALS), 151–153 anesthesia, in behavioral experiments, 232 anesthesia-resistant memory, 237 antennal lobe, 55-56, 57 neuropeptides, 25 response to starvation, 59 antennal sensilla, 49, 50-51 antibodies (intrabodies), 137, 150 antioxidants, 171, 180

ants, foraging behavior, 198 Apis mellifera (honey bee) foraging behavior, 198, 220-221 proboscis extension reflex assay, 240 APP (amyloid precursor protein), 147, 148-149, appetitive classical conditioning in adults, **240**, **241**, 239–241 courtship enhancement, 121 in larvae, 244, 244-245 apterous, 90 Arena assay, 241, 241 Argonaute-1/Argonaute-2, 203 arista sensilla, 51 arouser, 132 arrestins, 41, 42 associative learning, 234 appetitive classical conditioning in adults, 121, 240, 241, 239-241 in larvae, 244-245 aversive classical conditioning in adults, 120, 235, 236, 238, 239, 234-239 in larvae, 243-244 complex conditioning dual conditioning in larvae, 245 multiple odors, 241-242 odor concentration, 242 second-order conditioning, 242 temporal, 242 and courtship behavior, 120, 121 in larvae, 164, 244, 243-245 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125-128 AstA (allatostatin A), 24

asynchronous indirect flight muscle (A-IFM), 79 drd mutants, 85 flightin, 82, 80-82 MLC2 and mlc2 mutants, 80, 79-80 sphingosine-1-P lyase, 82-83 ataxins, 149–150 ATP13A2/ATP13A2, 137 automation of chemosensory jump assays, 233 of conditioning assays, 238, **239**, 238–239, 246 of genome-wide screens, 211 autophagy LRRK2 and, 143 of polyQ proteins, 150 of tau, 146 aversive classical conditioning in adults, 235, 236, 238, 239, 234-239 courtship suppression, 120 in larvae, 244, 243-244 aversive phototaxis suppression (APS) assay, 164 aversive stimuli (unconditioned stimulus) electrical, 236, 237, 243 mechanical, 238, 244 avoidance behavior light, 67, 164 nocifensive escape behavior in larvae, 67-68, 69 olfaction/taste, 57, 60 BACE (β -site APP-cleaving enzyme), 145, 147, 164

BACE (β-site APP-cleaving enzyme), 145, 147, 164 baiser, 94 barcoding of individual neuronal connections (BOINC), 263 barrel assay, 238, 238, 239 basiconic sensilla, 49, 50, 51, 52 bees, see honey bee (Apis mellifera)

273

Index

behavioral assays
circadian rhythms, 105, 105
general considerations, 164,
231–232, 246
in large-scale genome screens,
206–207
nociceptive, 67, 68, 72 ,
71–73
olfactory
appetitive classical
conditioning, 240, 241,
239–241, 244–245
aversive classical
conditioning, 235, 236,
238 , 239 , 234–239,
243–244
complex conditioning, 241–242, 245
habituation, 233 , 233–234,
243
in larvae, 164, 244 ,
242–245
visualization using
fluorescent indicators,
245–246
phototaxis, 43, 164
place memory, 126 , 125–128,
130
benzaldehyde, 237
β -site APP-cleaving enzyme
(BACE), 145, 147, 164
binary systems, 251 , 250–251
Gal4/UAS, 136, 251-253
LexA-LexAop, 253-254
limitations, 254
Q, 254
biogenic amines
see also dopamine
locomotor activity, 78
memory, 128 , 131
reproductive behavior, 91–92,
96
taste, 59-60
vision, 7, 14, 42
wakefulness, 28
bioinformatics, 208–209, 211
bitter taste, 53, 54, 55, 58
DEET, 60
pheromones, 117
blue light, 2
photoreceptor, see cry/CRY
(cryptochrome)
body posture, stagger behavior,
84
Brain Activity Map (BAM), 263 brain of <i>Drosophila</i>
advantages as a model system,
163
dissection method, 270
FlyCircuit database, 269 ,
268–272
visualization of neurons,

Neurotechnologies
(BRAIN), 263 Buridan paradigm, 130
Caenorhabditis elegans (nematode worm)
egl-4 and foraging behavior,
198 nervous system, 262–263
calcineurin inhibitors (RCAN1),
167 calcium channels
AMI (L-type voltage gated
channels), 180 , 179–180 in flight muscles, 83
nociception (subunit $\alpha 2\delta 3$),
67, 69
in photoreceptors, 41, 42 CaLexA trans-synaptic labeling
method, 261, 261-262
calpain, 142, 146 Cameleon (fluorescent
indicator), 245
CaMKII (calmodulin-dependent protein kinase II), 92, 119
cAMP signaling
and memory, 131, 168
AMI, 178 , 178–180 and ovulation, 92
canalization, 220, 221
candidate gene approach (reverse genetics), 163
capillary feeder (CAFE) assay,
197 capitate projections, 2, 42
carbohydrates, 193, 196
AKH, 24, 26 carbon dioxide, aversion to, 52,
57
carcinine, 42 casein kinase 2 (CK2), 106
Catecholamines-up, 144
Catsup, 220
cell cycle regulation, 146 central complex, 129–130
locomotor activity, 26, 27
neuropeptides, 27, 27 cGMP-dependent protein kinase
(PKG), 195, 196
see also for (foraging) in ants, 198
in C. elegans, 198
chaste, 91 cheerio, 167
chemosensory jump assay, 233,
233
chemosensory systems, <i>see</i> olfaction; taste
Chico/CHICO, 26
CHIP (E3 ligase), 149 cholesterol metabolism, 147–148
circadian plasticity, 110
circadian rhythms, 105,

104–111, 183

in behavior, 110

eclosion, 104
locomotor activity, 24, 105, 105 , 188 , 187–188
mating time preference, 189, 189
clock genes and proteins, 106 , 105–107
clock neurons, 107 , 107–108 genetic variation
and compensation for seasonal variations, 185, 183–186
jetlag, 187 , 186–187
period, 104, 183–184, 188 , 189 , 187–189
timeless, 185 , 184–186 within the <i>Drosophila</i>
genus, 188–190
inputs (<i>zeitgebers</i>), 104, 108, 183
tim polymorphism, 185 , 184–186
in mammals, 107 neuropeptides, 7, 24, 28, 108,
110 outputs, 109 , 109–110
peripheral clocks, 108
CK2 (casein kinase 2), 106
CLARITY technique, 263
classical conditioning (olfactory)
appetitive, 240 , 241 , 239–241,
244–245
aversive, 235, 236, 238, 239,
234–239, 243–244
complex
dual conditioning in larvae,
multiple odors, 241–242
odor concentration, 242
second-order conditioning,
242
temporal, 242 in larvae, 164, 244 , 242–245
Eleaning of equipment, 232, 238
238 Clk/CLK (clock), 105, 106, 186
clock neurons, 107 , 107–108
clock genes and proteins, 106 , 105–107
neuropeptides and, 24, 28, 108, 110
outputs, 109–110
clockwork-orange (cwo), 107
coeloconic sensilla, 49, 50, 52
ognitive disorders, 165, 162–172
age-related memory
impairment, 178,
177–181
Alzheimer's disease, 145–149,
164-165
drug targets, 147, 148, 171–172
Down syndrome, 167

Drosophila as a model system,
163 , 162–164, 165, <i>166</i> ,
172, 177
drug targets, 171–172
Fragile X syndrome, 119, 167,
170–171
neurofibromatosis type I, 168
Noonan syndrome, 169–170
Noonan syndrome, 109–170
schizophrenia, 167–168, 171
tauopathies, 145–147,
148–149, 165–166, 171–172, 180
color vision, 2, 40
COMPLEAT tool, 209
compound eye
see also vision
anatomy, 1-2, 38, 37-38
use in genetic screening
experiments, 137
connectome research, 263,
268–272
corazonin, 30
corkscrew (csw), 170
corpora allata, 26
corpora pedunculata, see
mushroom bodies (MB)
courtship behavior, 116-121
female receptivity
increased, 24, 57, 120
post-mating decrease, 24,
88-91
social learning of mate
preference, 121
uninterested virgins, 91
in the male
deciding what and what not
to court, 57, 91, 116–121,
164
neuropeptides, 24–25
olfactory/gustatory cues,
116–117, 120: decreased
female attractiveness, 91,
117; sensing, 55, 57, 60
songs, 120, 190 CREB, 170, 179
CREB, 170, 179
cry/CRY (cryptochrome), 106,
108, 186
JET/CRY interactions, 187,
186-187
csw (corkscrew), 170
cVA (cis-vaccenyl acetate)
and courtship behavior in the
male, 57, 60, 91, 117, 120
and LUSH binding, 53
oviposition site preference, 93
sexual dimorphism, 57–58
cwo (clockwork-orange), 107
cyc/CYC (cycle), 105, 106, 186
DAC (4:1.1 1) 10 11
DAG (diacylglycerol), 40, 41
Daphnia (water flea), 221
databases
genomic, 204, 209, 221
neurons (FlyCircuit), 269,

271, 268–272

Advancing Innovative

Brain Research through

Index

davunetide, 147
DBT (doubletime kinase), 106
DC0 (PKA subunit), 178,
178–179
Dcr-2/Dcr-2 (Dicer 2), 203, 207,
210
Ddc (Dopa decarboxylase), 78
decision-making behavior, 93
DEET (N,N-diethyl-m-
toluamide), 60
DEG/ENaC proteins, 55, 67,
69–70
see also pickpocket (ppk)
dementia
Alzheimer's disease, 145-149
164–165, 171–172
drug targets, 147, 148,
171–172
frontotemporal (tauopathy),
145–147, 148–149,
165–166, 171–172, 180
³ H-2-deoxyglucose (2-DOG), 9
depth perception, 37
dfmr1/dmfr1, 119, 167, 171
dg2, see for (foraging)
DGRP (Drosophila melanogaste
Genetic Reference
Panel), 219, 223-226
diacylglycerol (DAG), 40, 41
diapause, 186
Dicer proteins/ <i>Dcr-2</i> , 203, 207,
210
diet
in behavioral experiments,
in behavioral experiments,
in behavioral experiments, 232 calorie restriction extends
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diuretic hormones, 24
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diuretic hormones, 24 diurnal activity patterns, 26
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diuretic hormones, 24 diurnal activity patterns, 26 in the male, 105
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diuretic hormones, 24 diurnal activity patterns, 26 in the male, 105 in the post-mated female, 95
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diuretic hormones, 24 diurnal activity patterns, 26 in the male, 105
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diuretic hormones, 24 diurnal activity patterns, 26 in the male, 105 in the post-mated female, 95 siesta, 188, 187–188
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diuretic hormones, 24 diurnal activity patterns, 26 in the male, 105 in the post-mated female, 95 siesta, 188, 187–188 DJ-1/DJ-1, 140–141, 143
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diuretic hormones, 24 diurnal activity patterns, 26 in the male, 105 in the post-mated female, 95 siesta, 188, 187–188 DJ-1/DJ-1, 140–141, 143 Dmpiezo/DmPiezo, 70
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diuretic hormones, 24 diurnal activity patterns, 26 in the male, 105 in the post-mated female, 95 siesta, 188, 187–188 DJ-1/DJ-1, 140–141, 143 Dmpiezo/DmPiezo, 70 DNA barcoding of neurons, 263
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diuretic hormones, 24 diurnal activity patterns, 26 in the male, 105 in the post-mated female, 95 siesta, 188, 187–188 DJ-1/DJ-1, 140–141, 143 Dmpiezo/DmPiezo, 70 DNA barcoding of neurons, 263 dnc (cAMP-specific
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diuretic hormones, 24 diurnal activity patterns, 26 in the male, 105 in the post-mated female, 95 siesta, 188, 187–188 DJ-1/DJ-1, 140–141, 143 Dmpiezo/DmPiezo, 70 DNA barcoding of neurons, 263 dnc (cAMP-specific phosphodiesterase), 179
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diuretic hormones, 24 diurnal activity patterns, 26 in the male, 105 in the post-mated female, 95 siesta, 188, 187–188 DJ-1/DJ-1, 140–141, 143 Dmpiezo/DmPiezo, 70 DNA barcoding of neurons, 263 dnc (cAMP-specific phosphodiesterase), 179 Dopa decarboxylase (Ddc), 78
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diurretic hormones, 24 diurnal activity patterns, 26 in the male, 105 in the post-mated female, 95 siesta, 188, 187–188 DJ-1/DJ-1, 140–141, 143 Dmpiezo/DmPiezo, 70 DNA barcoding of neurons, 263 dnc (cAMP-specific phosphodiesterase), 179 Dopa decarboxylase (Ddc), 78 dopamine
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diurretic hormones, 24 diurnal activity patterns, 26 in the male, 105 in the post-mated female, 95 siesta, 188, 187–188 DJ-1/DJ-1, 140–141, 143 Dmpiezo/DmPiezo, 70 DNA barcoding of neurons, 263 dnc (cAMP-specific phosphodiesterase), 179 Dopa decarboxylase (Ddc), 78 dopamine locomotor system, 78
in behavioral experiments, 232 calorie restriction extends lifespan, 24, 180–181 protein/carbohydrate content 95, 193 DILPs (<i>Drosophila</i> insulin-like peptides), 20, 28–30 egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 dInR (<i>Drosophila</i> insulin receptor), 20, 25, 59 disco (disconnected), 107 dishabituation, 233 dissatisfaction (dsf), 91, 94 diurretic hormones, 24 diurnal activity patterns, 26 in the male, 105 in the post-mated female, 95 siesta, 188, 187–188 DJ-1/DJ-1, 140–141, 143 Dmpiezo/DmPiezo, 70 DNA barcoding of neurons, 263 dnc (cAMP-specific phosphodiesterase), 179 Dopa decarboxylase (Ddc), 78 dopamine

```
paraquat, 144
    rotenone, 144
  place memory, 128, 131
  taste, 59-60
dorsal lateral peptidergic (DLP)
       neurons, 30
dorsal-paired medial (DPM)
       neurons, 177-178
doublesex (dsx), 89-90, 97
doubletime kinase (DBT), 106
Down syndrome, 167
dparkin/dparkin, see
       parkin/parkin
dPINK1/dPINK1, see
       PINK1/PINK1
dPS/dPsn, see presenilins
dronc caspase, 70-71
drop-dead (drd), 84, 83-85
Drosophila genus, genetic
       variation within,
       188-190
Drosophila melanogaster Genetic
       Reference Panel (DGRP),
       219, 223-226
drp1 (dynamin related protein
       I), 139
drug screening, 137, 164,
       171-172
  Alzheimer's disease, 147, 148,
       171-172
  Fragile X syndrome, 171
  Huntington's disease, 150
  Parkinson's disease, 145
dsf (dissatisfaction), 91, 94
dsh (Dishevelled), 149
DSK (drosulfakinin)
  in locomotion, 26-27
  satiety factor, 23
DSL-Notch trans-synaptic
       labeling, 259–261
dsx (doublesex), 89-90, 97
Dtk/DTK (Drosophila
       tachykinin), 21, 27, 30,
       31
DTKR (Drosophila tachykinin
       receptor), 21, 25
dTRPA1/dTRPA1, 69, 71
  see also TRP/TRPL channels
dunce, 131
dynamin related protein I
       (drp1 gene), 139
DYRK1A (dual-specificity
       tyrosine-(Y)-
       phosphorylation
       regulated kinase 1A), 167
dysbindin/dysbindin, 168, 171
ebony, 42
eca (eclair), 94
eclosion, circadian rhythms, 104
eclosion hormone, 21
EGFR (epidermal growth factor
```

receptor), 172

egg production, 91-94, 95

diapause, 186

```
60,93
  sperm storage in the female,
       89, 95-96
egl-4 (C. elegans PKG), 198
eiger, 70-71
elav-Gal4 pan-neuronal driver,
       2.07
electric shocks used in aversive
       classical conditioning,
       236, 237, 243
electrophysiological recordings
       in clock neurons, 110
electroretinograms, 42, 42-43
elementary motion detector
       (EMD), 10-12
ellipsoid body, 129-130
"empty neuron" strategy, 51-52
environmental chambers for
       behavioral experiments,
epistasis, 219, 219-220, 221, 226
  olfaction, 220, 226, 227
  PINK1 and parkin, 138-139
eQTL (expression QTL),
       226-227
escape behavior in larvae, 67-68,
ET-FLP (enhancer-trap flippase),
       257, 256–258, 263
ethanol
  NPF regulation of
       consumption, 23, 25
  sensitivity/tolerance
     insulin signaling, 28
     transcriptional networks,
       223, 223, 225
ether, 232
excretion in the post-mated
       female, 94
expression QTL (eQTL),
       226-227
  see also vision
  anatomy, 1-2, 38, 37-38
  use in genetic screening
       experiments, 137
familial episodic pain syndrome,
fan-shaped body, 27
fat body, 24, 28, 96
feeding behavior
  foraging gene, 132, 193, 195,
       194-198
  genetic variation in foraging
       behavior, 192-199
  larval, 21-23, 193, 195,
       193-196
  neuropeptides affecting, 22,
       21-24, 25, 26
  in the post-mated female, 24,
  responses to hunger, 23, 25,
       26, 59-60
```

```
oviposition site selection, 25,
                                       starvation resistance, 24,
                                         192-193, 194
                                  females
                                    see also sexual dimorphism
                                    courtship suppression in the
                                         male, 91, 118-119
                                    post-mating, see post-mated
                                         females
                                     receptivity to males
                                       decreased post-mating, 24,
                                       increased, 24, 57, 120
                                       just not interested, 91
                                       social learning of mate
                                         preference, 121
                                    reproductive tract, 89
                                  feminizing cells (FCs), 26
                                  FINGR method, 257, 256-258,
                                         263
                                     "logic gates" strategy, 258
                                  5-HT, see serotonin
                                  flight behavior, 77-85
                                    muscle function, 77, 78, 79
                                       drd mutants, 84, 83-85
                                       flightin, 82, 80-82
                                       MLC2 and mlc2 mutants,
                                         80, 79-80
                                       sphingosine-1-P lyase,
                                         82-83
                                    neurotransmitters, 78
                                    virtual reality flight
                                         simulation, 82, 81-82, 84
                                    wing motion, 77, 78
                                  fln (flightin), 82, 80-82
                                  FLP (flippase)
                                    FINGR method, 257,
                                         256-258, 263
                                    FRT-FLP system, 254
                                       "logic gates" strategy, 258,
                                         259
                                    UAS>stop>effector Flip-in,
                                         257, 258
                                  FlyCircuit database, 269, 271,
                                         268 - 272
                                  FlyMine database, 209
                                  FlyRNAi database, 209
                                  FMR1 gene/FMRP protein, 167,
                                         170-171
                                 for (foraging)
                                    adult behavior, 196-197
                                    difference between rover and
                                         sitter variants, 193, 194,
                                         195, 195–197
                                    identification of gene,
                                         194-195
                                    memory and, 132, 196
                                    in other species, 197-198
                                  foraging behavior, see feeding
                                         behavior
                                  forward genetics, 67, 163-164,
                                         204, 205–212
                                  FOXO transcription factor, 180
                                  Fragile X syndrome (FXS), 119,
                                         167, 170–171
                                    drug screening, 171
```

Index

frontotemporal dementia (tauopathy), 145-147, 148-149, 165-166, 171-172, 180 FRT-FRP system, 254, 258 see also FINGR method "logic gates" strategy, 258, **259** fru (fruitless) in the male, 24, 57 in the post-mated female, 89-90, 93, 94, 97 fructose, 54 functionomics, 263-264 FUS protein (fused in sarcoma), FXS (Fragile X syndrome), 119, 167, 170-171 drug screening, 171 G protein-coupled receptors (GPCRs), 20-21 TANGO technique, 260 GABA (γ -aminobutyric acid), 11, 78 Gal4-based mosaic-inducible and reporterexchangeable enhancer trap (G-MARET), 258 Gal4/UAS system, 136, 218, 251, 251-252 Gal4 drivers in RNAi, 207 Gal80, 252, 254, 255 limitations, 254 Split Gal4, **255**, 254–255 UAS-lines, *253*, 252–253 in zebrafish, 263 gap junctions in the visual system, 13-14 gastrointestinal system drd mutants, 83 gustatory receptors, 54 GCaMP (fluorescent indicator), 245 gene annotation databases, 209, 221 Gene Ontology consortium (GO), 209 gene silencing, see RNA interference (RNAi) GeneMANIA database, 209 General Combining Ability (GCA), 220 GeneSwitch system, 208, 252 genome-wide association studies (GWAS), 153, 218-219, 223-226 genome-wide screens, 137, 206-209 false negatives (knock-down efficiency variation), 210 false positives (off-targeting), 209-210 future developments,

GenomeRNAi database, 209 genotype-by-environment interactions (GEI), 220, 221 genotype-phenotype relationships, 217 germline, gene silencing, 205 GFP (green fluorescent protein) bioluminescent indicator (GFP-aequorin), 245 photoactivatable, 262, 262 **GFP** Reconstitution Across Synaptic Partners (GRASP) method, 12, **259**, 258-259 glial cells, 264 circadian rhythms, 108 drd mutants, 83 visual system, 2, 14, 42 glomeruli olfactory, 50-51, 55-56, 57, 59 optic, 9 glutamate oviduct contractions, 92 schizophrenia, 168, 171 glutamate receptors, 52, 171 glycogen synthase- 3β (GSK- 3β), 145, 148, 172 G-MARET method, 258 GO (Gene Ontology consortium), 209 GPCRs (G protein-coupled receptors), 20-21 TANGO technique, 260 Gr/Gr (Gustatory receptor), 52, 53-55, 117 Gr5a, 53-54, 193 GRASP (GFP Reconstitution Across Synaptic Partners) method, 12, 259, 258-259 GSK-3 β (glycogen synthase-3 β), 145, 148, 172 gustatory receptor neurons (GRNs), 54, 53-55, 117 blends of tastes, 58-59 connections in the brain, 58 response to pheromones, 60 response to starvation, 59-60 gustatory system, see taste GWAS (genome-wide association studies), 153, 218-219, 223-226

habituation

heat

in courtship learning, 120

in adults, 233, 233-234

thermal nociception, 68-69,

olfactory learning assays

in larvae, 243

149-151

HD (Huntington's disease),

foraging behavior, 198, 220–221 proboscis extension reflex assay, 240 housefly (Musca domestica), visual system, 8-9, 14 Hsp90/Hsp90, 221 hug (hugin), 21, 58, 192 humidity in behavioral experiments, 231, 232 hunger changes in olfactory and gustatory neurons, 59-60 neuropeptides affecting feeding behavior, 22, 21-24, 25, 26 starvation resistance, 24, 192-193, 194 Huntington's disease (HD), 149 - 151hyperalgesia, 70 hypoxia, drd mutants, 83 icebox, 91 IGF (insulin-like growth factor), 180-181 illuminance (lux), 37 imaging of the Drosophila brain FlyCircuit analysis, 269, 271, 268-272 transmission electron microscopy, 268 visualization of neurons, 245-246, 263, 268 immunohistochemistry, 270-271 inaC (PKC), 41 inaE (DAG lipase), 41 innexins, 13-14 inositol-1, 4, 5, trisphosphate (IP_3) , 40, 41 inositol-1, 4, 5-trisphosphate receptor (ITPR1), 152 insulin receptor (dInR), 20, 25, insulin-like growth factor (IGF), 180 - 181insulin-like peptides (DILPs), 20, 28-30

thermal nociception assays,

67, 68, 72, 71–73

heat-box experiments, 126,

heat-maze experiments, 126,

heatshock protein Hsp90, 221

heatshock-induced Gal4, 252

Hedgehog signaling pathway, 71

channel (ort), 5, 42, 43,

125 - 127

127-128

histamine, 7, 14, 42

44

histamine-gated chloride

histone deacetylases, 150

honey bee (Apis mellifera)

egg-laying behavior, 25, 94 feeding behavior, 23 olfaction and, 25 sex-specific behavior, 26 insulin-producing cells (IPCs), 26, **29**, 28–30 intersectin, 167 intersectional methods, 250, 263 FINGR, 257, 256-258, 263 G-MARET, 258 "logic gates", 258, 259 Split Gal4, **255**, 254–255 Split LexA, **256**, 255–256 UAS>stop>effector Flip-in, **257**, 258 intrabodies, 137, 150 ion transport peptide (ITP), 28, 30, 108 Ionotropic receptor (Ir), 52, 55 IP₃ (inositol-1,4,5, trisphosphate), 40, 41 receptor (ITPR1), 152 IPCs (insulin-producing cells), 26, 29, 28-30 Ir (Ionotropic receptor), 52, 55 irradiance (W/m²), 37 ITP (ion transport peptide), 28, 30, 108 jet/JET (jetlag), 106, 187, 186 - 187juvenile hormone (JH), 26, 95 KEGG (Kyoto Encyclopedia of Genes and Genomes), 209 Kenyon cells (KC), 23, 26, 128-129 PNs and olfaction, 56-57, 129 "knock-down" strategy, 203 variable efficiency, 210 Kufor-Rakeb disease, 137 labellum, 54, 53-55 larvae behavioral assays, 164, 232 nociception, 67, 72, 71-73 olfactory learning, 244, 242-245 feeding behavior, 21-23, 193-194 foraging gene, 132, **193**, **195**, 194–196 nociception assays, 67, 72, 71-73 escape behavior, 67-68, 69 sensitization, 70 lateral horn, 56 Lawf1/Lawf2 neurons, 6-7 learning courtship, 117-118, 121 courtship enhancement, 120-121 courtship suppression, 118–120, 164 female receptivity, 121

211-212

Index

```
rhodopsins, 39-40
linkage disequilibrium, 225
lipids
  AKH and, 24, 26
  larval, 194, 196
lithium chloride, 243
LKB-1 (tumor suppressor),
       148-149
lobula plate giant tangential cells
       (LPTCs), 4, 9, 11
locomotor activity
  see also flight behavior
  circadian rhythms, 24, 105,
       105, 188, 187–188
  CNS control, 26-28
  diurnal patterns, 26, 95, 105,
       188, 187–188
  dopamine and, 78
  foraging gene
    adult behavior, 196-197
    larval behavior, 193, 194,
       195-196
  nocifensive escape
       locomotion, 67–68, 69
  sexual dimorphism, 24, 26, 95
  stagger behavior, 84
loe\ (l\"{o}chrig),\,147-148
"logic gates" strategy, 258, 259
loj (logjam), 94
long-term memory (LTM)
  in courtship learning, 119
  dmfr1 and, 167
  impaired, 167, 179
  olfactory classical
       conditioning, 237
  olfactory habituation, 234
  translational control, 170-171
longevity
  and AMI, 181
  caloric restriction, 24,
       180 - 181
Lou Gehrig's disease
       (amyotrophic lateral
       sclerosis), 151-153
LPTCs (lobula plate tangential
       cells), 4, 9, 11
LRRK2/LRRK2 (leucine-rich
       repeat kinase 2), 140,
       143
LTM, see long-term memory
LUSH protein, 53
MADM (mosaic analysis with
       double markers), 263
  see also sexual dimorphism
  courtship, see courtship
       behavior, in the male
  diurnal activity patterns, 105
malvolio, 192
```

maneuverability of Drosophila,

protein kinase), 169, 169,

MAPK (mitogen-activated

170

\(\text{1}\)
MARCM (mosaic analysis with a
repressible cell marker),
203, 252
MARK2 (microtubule-affinity
regulating kinase),
145–146
mating behavior
see also courtship behavior;
post-mated females
neuropeptides affecting,
24–25
per affects circadian rhythms,
189, 189
mating plug, 89
maxillary palps, 49, 51
MB, see mushroom bodies
mechanical aversive US, 238, 244
mechanical nociception
assays, 67, 71, 72, 73
Dmpiezo, 70
pain, 68
meclizine, 150
median bundle, 130-131
median neurosecretory cells, see
insulin-producing cells
(IPCs)
memory
see also learning; memory
impairment; place
memory
anesthesia-resistant, 237
csw/MAPK and, 169, 170
for polymorphism, 196
neurofibromin (NF1) and,
169 , 168–169
persisting from larvae to
adults, 244
translational control and LTM
formation, 170–171
memory impairment, 165,
162–172
age-related, 178 , 177–181
Alzheimer's disease, 145–149,
164–165
drug targets, 147, 148,
171–172
Down syndrome, 167
Drosophila as a model system,
163, 162–164, 165, <i>166</i> ,
172, 177
drug targets, 171–172 Fragile X syndrome, 119, 167,
170–171
neurofibromatosis type I,
168
Noonan syndrome, 169–170
schizophrenia, 167–168
tauopathies, 145–147,
149 140 165 166
148–149, 165–166,
171–172, 180
metabolism
AKH, 24, 26
foraging polymorphism, 196
4-methylcyclohexanol, 237
methylene blue, 150

Mhc/MHC (myosin heavy
chain), 80
mice, transgenic, 263
microscopy of the <i>Drosophila</i>
brain, 269 FlyCircuit analysis, 269 , 271 ,
268–272
transmission electron
microscopy, 268
visualization of neurons,
245-246
microtubule-affinity regulating
kinase (MARK2),
145-146
microtubules, 143, 145 middle-term memory (MTM)
age-related loss, 177
in olfactory classical
conditioning, 237
MIPs (myoinhibitory peptides),
90
miRNA (microRNA), 203, 221
mitochondrial dysfunction in
PD, 138–141, 144
<i>mlc2</i> /MLC2 (myosin regulatory light chain), <i>80</i> , 79–80
mnb (minibrain), 23, 167
ModENCODE database, 209
modulated modularity clustering
(MMC), 221, 222
mosaic analysis with double
markers (MADM), 263
mosaic analysis with a
repressible cell marker
(MARKM), 203, 252 motion detection, 2, 9, 11 , 10–12
MTM, see middle-term memory
multidendritic (md) neurons,
nociceptive, 67–68
Musca domestica (housefly),
visual system, 8–9, 14
mushroom bodies (MB)
anatomy, 128-129
courtship learning, 119
feeding regulation, 23
locomotor activity, 26 olfactory learning, 26, 56, 57,
129
place memory, 129
post-mating behavior in the
female, 95
mutagenesis screening
disadvantages, 202-203
foraging, 195
myoinhibitory peptides (MIPs), 90
myosin binding protein
(flightin), 82 , 80–82
myosin heavy chain (MHC), 80
myosin regulatory light chain
(MLC2), 80, 79–80
National Institute of
Genomics-FLY
(NIG-FLY), 204, 205

Index

natural selection experiments,
192
navigation in the heat maze,
127–128
nebula, 167
negative frequency-dependent
selection, 196
NEL (nocifensive escape
locomotion), 67–68, 69
neuralized, 220
neurodegenerative diseases,
135–153
Alzheimer's disease, 145–149,
164–165
drug targets, 147, 148,
171–172
amyotrophic lateral sclerosis,
151–153
Drosophila as a model system,
135–137, 144–145, 149,
153
drug targets, 171–172
Huntington's disease,
149–151
Parkinson's disease, 78, 137–145
neurofibrillary tangles, 145,
180
neurofibromatosis type I, 168
neurofibromin (NF1), 169 , 168–169
neuropeptides, 20–31, 264 aggression, 25
clock system, 7, 24, 28, 108,
110
as cotransmitters, 31
DILPs, 20, 23, 25, 28–30
egg-laying behavior, 25, 94
feeding behavior, 21–24, 25,
26
learning and memory, 26
locomotor activity, 26–28
nociceptive, 70
numbers and distribution,
20–21, 22
olfaction, 23, 25–26, 59
pleiotropy, 30–31
reproductive behavior, 24–25
stress response, 30
neurotransmitters/
neuromodulators, 264
see also dopamine
circadian rhythms, 110
locomotor activity, 78
memory, 128 , 131
reproductive behavior, 91-92,
96
schizophrenia, 168
taste, 59–60
visual system, 6, 7, 9, 11, 14,
42
wakefulness, 28
next generation sequencing, 190
NF1 (neurofibromin), 169,

NFAT (nuclear factor of
activated T cells), 261 nicotinamide mononucleotide
adenylyl transferase
(NMNAT), 147
NIG-FLY (National Institute of
Genomics-FLY), 204,
205
ninaE (rhodopsin 1), 39, 42, 44
nociception, 66-73
in adults, 68
assays, 67, 68, 72 , 71–73
assays, 67, 66, 72, 71-73
genes, 68-70
in humans, 66, 67, 68
larval escape behavior, 67-68
69
in mammals, 71
sensitization, 70-71
non-associative learning, see
habituation, sensitizatio
nonA (no-on-transient-A), 190
Noonan syndrome, 169-170
nope (DEG/ENaC), 55
NPF (neuropeptide F)
see also sNPF (short NPF)
aggression, 25
clock neurons, 24, 28
feeding behavior, 21-23
learning, 26
reproductive behavior, 24-25
NPFR1/NPFR1, 70
NPY (neuropeptide Y), 70
nSyb-Gal4 pan-neuronal driver,
207
nuclear factor of activated T cel
nuclear factor of activated T cel
nuclear factor of activated T cel (NFAT), 261
(NFAT), 261
(NFAT), 261 OA, <i>see</i> octopamine
(NFAT), 261 OA, <i>see</i> octopamine
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA)
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA)
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117 odorant-binding proteins
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117 odorant-binding proteins (OBPs), 52–53, 193
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117 odorant-binding proteins (OBPs), 52–53, 193 Obp gene transcriptional
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117 odorant-binding proteins (OBPs), 52–53, 193 Obp gene transcriptional networks, 223, 224
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117 odorant-binding proteins (OBPs), 52–53, 193 Obp gene transcriptional networks, 223, 224
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117 odorant-binding proteins (OBPs), 52–53, 193 Obp gene transcriptional networks, 223, 224 ovipositor site preference, 93
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117 odorant-binding proteins (OBPs), 52–53, 193 Obp gene transcriptional networks, 223, 224 ovipositor site preference, 93 off-targeting in RNAi, 209–210
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117 odorant-binding proteins (OBPs), 52–53, 193 Obp gene transcriptional networks, 223, 224 ovipositor site preference, 93 off-targeting in RNAi, 209–210 ogre, 14
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117 odorant-binding proteins (OBPs), 52–53, 193 Obp gene transcriptional networks, 223, 224 ovipositor site preference, 93 off-targeting in RNAi, 209–210 ogre, 14 olfaction
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117 odorant-binding proteins (OBPs), 52–53, 193 Obp gene transcriptional networks, 223, 224 ovipositor site preference, 93 off-targeting in RNAi, 209–210 ogre, 14 olfaction avoidance behavior, 57, 60
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117 odorant-binding proteins (OBPs), 52–53, 193 Obp gene transcriptional networks, 223, 224 ovipositor site preference, 93 off-targeting in RNAi, 209–210 ogre, 14 olfaction avoidance behavior, 57, 60
(NFAT), 261 OA, see octopamine oamb (OA receptor), 92 Obp/OBP (odorant-binding proteins), 52–53, 193 ovipositor site preference, 93 transcriptional networks, 223 224 3-octanol, 237 octopamine (OA) flight behavior, 78 memory, 128, 131 ovulation, 91–92 sperm storage, 96 wakefulness, 28 Odd-skipped, 9 Odor receptor (Or), 51–52 and courtship behavior, 117 odorant-binding proteins (OBPs), 52–53, 193 Obp gene transcriptional networks, 223, 224 ovipositor site preference, 93 off-targeting in RNAi, 209–210 ogre, 14 olfaction

courtship behavior, 57, 60, 91, 117 discrimination of multiple odors, 58, 241–242 of odor concentration, 242 epistasis, 220, 226, 227 feeding behavior, 59, 193 genetic variation, 193, 223, 224 interactions with taste, 60 neuropeptides affecting, 23, 25–26, 59 peripheral system, 49–53 classification of OSNs, 50–51 olfactory learning, 132 experimental methods, 164, 231–232, 246 appetitive classical conditioning, 240, 241, 239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15 internal chiasma, 8	
discrimination of multiple odors, 58, 241–242 of odor concentration, 242 epistasis, 220, 226, 227 feeding behavior, 59, 193 genetic variation, 193, 223, 224 interactions with taste, 60 neuropeptides affecting, 23, 25–26, 59 peripheral system, 49–53 classification of OSNs, 50–51 olfactory learning, 132 experimental methods, 164, 231–232, 246 appetitive classical conditioning, 240, 241, 239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
discrimination of multiple odors, 58,	
of odor concentration, 242 epistasis, 220, 226, 227 feeding behavior, 59, 193 genetic variation, 193, 223, 224 interactions with taste, 60 neuropeptides affecting, 23, 25–26, 59 peripheral system, 49–53 classification of OSNs, 50–51 olfactory learning, 132 experimental methods, 164, 231–232, 246 appetitive classical conditioning, 240, 241, 239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	discrimination
epistasis, 220, 226, 227 feeding behavior, 59, 193 genetic variation, 193, 223, 224 interactions with taste, 60 neuropeptides affecting, 23, 25–26, 59 peripheral system, 49–53 classification of OSNs, 50–51 olfactory learning, 132 experimental methods, 164, 231–232, 246 appetitive classical conditioning, 240, 241, 239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	241-242
feeding behavior, 59, 193 genetic variation, 193, 223, 224 interactions with taste, 60 neuropeptides affecting, 23, 25–26, 59 peripheral system, 49–53 classification of OSNs, 50–51 olfactory learning, 132 experimental methods, 164, 231–232, 246 appetitive classical conditioning, 240, 241, 239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
genetic variation, 193, 223, 224 interactions with taste, 60 neuropeptides affecting, 23, 25–26, 59 peripheral system, 49–53 classification of OSNs, 50–51 olfactory learning, 132 experimental methods, 164, 231–232, 246 appetitive classical conditioning, 240, 241, 239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
interactions with taste, 60 neuropeptides affecting, 23, 25–26, 59 peripheral system, 49–53 classification of OSNs, 50–51 olfactory learning, 132 experimental methods, 164, 231–232, 246 appetitive classical conditioning, 240, 241, 239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	genetic variation, 193, 223,
neuropeptides affecting, 23, 25–26, 59 peripheral system, 49–53 classification of OSNs, 50–51 olfactory learning, 132 experimental methods, 164, 231–232, 246 appetitive classical conditioning, 240, 241, 239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
peripheral system, 49–53 classification of OSNs, 50–51 olfactory learning, 132 experimental methods, 164, 231–232, 246 appetitive classical conditioning, 240, 241, 239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	neuropeptides affecting, 23,
olfactory learning, 132 experimental methods, 164, 231–232, 246 appetitive classical conditioning, 240, 241, 239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	peripheral system, 49–53 classification of OSNs,
experimental methods, 164, 231–232, 246 appetitive classical conditioning, 240, 241, 239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
conditioning, 240, 241, 239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	experimental methods, 164,
239–241, 244–245 aversive classical conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
conditioning, 235, 236, 238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	239-241, 244-245
238, 239, 234–239, 243–244 complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
complex conditioning, 241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	238 , 239 , 234–239,
241–242, 245 habituation, 233, 233–234, 243 in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
in larvae, 164, 244, 242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
242–245 sensitization, 233, 246 visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	habituation, 233, 233-234,
visualization using fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
fluorescent/luminescent indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
indicators, 245–246 and the mushroom bodies, 26, 56, 57, 129 neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
neuropeptides and neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	indicators, 245-246
neurotransmitters, 26, 131 operant conditioning, 234, 239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	56, 57, 129
239, 246 olfactory sensory neurons (OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	neurotransmitters, 26,
(OSNs) blends of odors, 58 chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	239, 246
chemoreceptor types, 51–52 classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
classification, 50–51 connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
connections in the brain, 55–56 neuropeptides, 25–26, 59 response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
response to starvation, 59 sensilla, 49 ommatidia anatomy, 1–2, 38, 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	connections in the brain,
sensilla, 49 ommatidia anatomy, 1–2, 38 , 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126 , 125–128 optic lobe anatomy, 1, 3, 2–15	
ommatidia anatomy, 1–2, 38 , 37–38 pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126 , 125–128 optic lobe anatomy, 1, 3, 2–15	
pale and yellow, 40 oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	*
oogenesis, 95 diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
diapause, 186 operant conditioning olfactory learning, 234, 239, 246 place memory, 126, 125–128 optic lobe anatomy, 1, 3, 2–15	
operant conditioning olfactory learning, 234, 239, 246 place memory, 126 , 125–128 optic lobe anatomy, 1, 3, 2–15	diapause, 186
246 place memory, 126 , 125–128 optic lobe anatomy, 1, 3, 2–15	operant conditioning
place memory, 126 , 125–128 optic lobe anatomy, 1, 3 , 2–15	
anatomy, 1, 3, 2–15	place memory, 126 , 125–128
internai cinasilia, o	anatomy, 1, 3, 2–15
	inici nai Ciliabilia, o

lamina, 2, 4, 6-7, 13, 14
lobula complex, 8–9, 11 medulla, 2–3, 5, 7–8, 10–12
medulla, 2-3, 5, 7-8, 10-12
motion-detecting pathways, 11, 10–12
range of cell types, 6 , 3–6
synapses, 7, 9–10, 12–14
glial cells, 2, 14, 42
histamine in, 7, 14, 42
optogenetics, 263 Or/Or (Odor receptor), 51–52
and courtship behavior, 117
ora (ninaE/ort double mutants),
44
Orco/Orco (Or co-receptor), 51–52
orientation memory, 130
ort/Ort (histamine-gated
chloride channel), 5, 42,
43, 44
OSNs, see olfactory sensory neurons
outcrossing of fly lines, 232
oviduct, 92
oviposition, 93–94
genetic analysis, 94 site selection, 25, 60, 93
ovulation, 91–93
ovulin/ovulin, 88, 92
oxidative stress
and aging/AMI, 180
and PD, 143, 144 tauopathies, 143, 171
-
<i>P</i> -element insertions, 217–218
P2X2-Ca/cAMP trans-synaptic
labeling method, 261 , 262
Pael-R (parkin-associated
endothelin like receptor),
139
pain, see nociception painless (pain)/Pain, 68-69, 71
pale ommatidia, 40
PAR-1 (kinase), 146, 148–149
paraquat, 144
parkin/parkin, PD and, 138–140
α-synuclein, 140, 143–144 Parkinson's disease (PD), 78,
137–145
pdf/PDF (pigment-dispersing
factor)
circadian rhythms, 28, 108, 110
water homeostasis, 24
$pdp1\varepsilon$ (PAR domain protein 1ε),
107
PEBII (seminal fluid protein), 89
PER, see period or proboscis extension response/reflex
performance index (PI), 126, 236
period (per/PER)
in the circadian oscillator,

105-106

eclosion period variation, 104

168-169

Index

inter-specific variation, 188–189
and mating time preference, 189, 189
peripheral clocks, 108
temperature compensation in
the circadian clock,
183–184
temperature-dependent
splicing and periods of locomotor activity, 188 ,
187–188
personal care products, to be
avoided by
experimenters, 232
pesticides, and PD, 143, 144-145
pharmacology, see drug
screening
phenotypic plasticity, 220–221 phenotypic robustness, 220
pheromones
courtship behavior, 57, 60, 91,
117, 120
olfaction and taste, 53, 55, 57,
60
oviposition site preference, 93 in the post-mated female, 91
phosphatidylinositol-4,
5-bisphosphate (PIP ₂),
41
phosphatidylinositol 3-kinase
(PI3K), 141, 165
phospholipase C (PLC), 40, 41
photoactivatable GFP (PA-GFP), 262, 262
photoreceptors
acceptance angle, 38–39
adaptation to high light levels,
42
neurotransmitters, 42
phototransduction, 38, 41, 40–41
rhodopsin, 2, 39 , 39–40, 41
structure, 1–2, 7, 38 , 37–38
structure, 1–2, 7, 38 , 37–38 phototaxis, 43 , 43–44
APS assay, 164
larval avoidance behavior, 67
PI3K (phosphatidylinositol
3-kinase), 141, 165
pickpocket (ppk) (DEG/ENaC proteins), 55
nociception, 67, 69–70
sex peptide response, 89–90,
93, 95
piezo/Piezo, 70
pigment-dispersing factor (PDF)
circadian rhythms, 28, 108,
110
water homeostasis, 24 <i>PINK1</i> /PINK1, PD and, 138–139
α -synuclein, 139, 143–144
PIP ₂ (phosphatidylinositol-4,
5-bisphosphate), 41
piRNA (piwi interacting RNA),

```
PKG (cGMP-dependent protein
       kinase), 195, 196
  see also for (foraging)
  in ants, 198
  in C. elegans, 198
place memory, 125-132
  behavioral experiments, 126,
       125-128, 130
  genetics, 129, 130-132
  neural systems, 128
    biogenic amines, 131
    ellipsoid body, 129-130
    median bundle, 130-131
    mushroom bodies, 129
  orientation memory, 130
PLC (phospholipase C), 40,
       41
pleiotropy, 220
  neuropeptides, 30-31
PNs, see projection neurons
polarization of light, 40
polyQ diseases, 149-151
population density
  in behavioral experiments,
       232
  and feeding behavior, 194,
       196
post-mated females, 88-98
  courtship receptivity, 88-91
  courtship suppression in the
       male, 91, 118-119
  diurnal activity, 95
  egg production, 91-94, 95
    oviposition site selection,
       25, 60, 93
  feeding, 24, 94
  neuronal changes, 95, 96-97
  sex peptide and, 24, 89-90, 93,
       94, 95, 96
  sperm storage, 89, 95-96
  transcriptomic changes, 96
ppk (pickpocket) (DEG/ENaC
       proteins), 55
  nociception, 67, 69-70
  sex peptide response, 89-90,
       93, 95
presenilins (Psn/PS1/PS2), 147,
       148, 164, 165
proboscis extension
       response/reflex (PER),
       197, 197
  behavioral assay based on,
       240
projection neurons (PNs)
  in olfaction, 56-57, 59, 129
  PA-GFP labeling, 262, 262
  visual, 3, 4, 9
proteasomes, 146, 150
protein, dietary, 95, 193
protein kinases
  in clock neurons, 106
  memory and, 119, 131, 178,
       178 - 180
     MAPK, 169, 169, 170
  neurodegeneration and, 148
```

```
tau phosphorylation,
       145-146
PKA, 131, 178, 178-180
PKC in photoreceptors, 40-41
PKG, 195, 196
  see also for (foraging)
  in ants, 198
  in C. elegans, 198
proteomics, 228
prothoracicotropic hormone
       (PTTH), 20
protocerebrum, 9, 56-57
  see also mushroom bodies
PTPN11 (protein tyrosine
       phosphatase), 170
pupation, 194
puromycin sensitive
       aminopeptidase (PSA),
       146 - 147
O system
  binary, 251, 254
  in C elegans, 263
   "logic gates" strategy, 258, 259
qRT-PCR, verification of
       knock-down efficiency,
       210
quantitative trait loci (QTLs),
       190, 192
  eOTL, 226-227
Quinn Harris Benzer (QHB)
       assay, 235, 234-235
Rab11 GTPase, 150
radish (rsh), 131-132
RBPs (RNA-binding proteins),
RCAN1 (calcipressin 1), 167
rdgA (DAG kinase), 41
rdgB mutants, 44
rearing conditions in behavioral
       experiments, 231-232
red eyes, 40
reproductive behavior
  courtship, see courtship
       behavior
  egg production, 91-94, 95
     diapause, 186
     oviposition site selection,
       25, 60, 93
  neuropeptides, 24-25
  sperm storage in the female,
       89, 95-96
reproductive tract, female, 89
respiration, drd mutants, 83
retina
  see also photoreceptors
  anatomy, 1-2, 38, 37-38
  electroretinograms, 42, 42-43
reverse genetics, 163
reward systems, NPF and, 23, 25
rhabdomeres R1-R6
  anatomy, 1-2, 7, 10, 12, 14,
       37
  rhodopsin, 39-40
```

```
rhabdomeres R7/R8
  anatomy, 2, 7, 8, 10, 37, 39
  phototaxis, 10, 44
  polarization of light, 40
  rhodopsin, 40
rhodopsin, 2, 39, 39-40
  phototransduction cascade,
       40, 41
ring (R) neurons, 130
RNA interference (RNAi),
       202-212, 218
  canalization by piRNA,
       221
  gene cluster studies, 206
  gene-tailored studies, 205
  genome-wide studies, 204,
       206-209
     false negatives
       (knock-down efficiency
       variation), 210
     false positives
       (off-targeting), 209-210
     future developments,
       211-212
  in neuronal mapping,
       210 - 211
  principles, 203-204
  public resources
    collections of transgenic
       flies, 204-205, 211
     gene annotation databases,
       209
RNA transcriptome, see
       transcriptomics
RNA-binding proteins (RBPs),
       170
RNAiCut database, 209
rotenone, 143, 144
rover form of foraging gene, 193,
       194, 195, 195–197
rsh (radish), 131-132
rut (rutabaga), 129, 130-131
  NF1 and memory acquisition,
       168, 169
sacculus sensilla, 51
salt taste, 53, 55
SCA, see spinocerebellar ataxia
       or Specific Combining
       Ability
schizophrenia, 167-168, 171
seasonality, circadian clock
       polymorphism, 185,
       183-186
  per splicing and periods of
       locomotor activity, 188,
       187-188
\beta-secretase, 145
γ-secretase, 145
seminal fluid proteins (Sfps), 88,
       89-90
  ovulin, 92
  PEBII, 89
  sex peptide, see sex peptide
seminal receptacles, 95, 96
```

Index

sensilla
olfaction, 49, 50-51
taste, 53, 54
sensitization
courtship enhancement, 121
nociceptive, 70–71
olfactory, 233, 246
serotonin (5-HT)
locomotor activity, 78
memory, 128 , 131
visual neurons, 7
sev mutants, 44
sex peptide (SP), and female post
mating-behavior, 88, 97
diurnal activity, 95 feeding behavior, 24, 94
oogenesis, 95
oviposition rate, 93
receptivity decrease, 24,
89–90
sperm storage, 89, 96
sex peptide receptor (SPR), 24,
89, 90
and MIPS, 90
RNAi, 210–211
sexual dimorphism
aggression, 25, 57
locomotor activity, 24, 26, 95
response to cVA, 57-58
susceptibility to paraquat,
144
Shaggy (SGG), 106, 145, 146
shakB(neural) (innexin), 14
shaking, as an aversive US, 238
short-term memory (STM)
courtship memory, 118, 167,
171
for polymorphism, 196
olfactory classical conditioning, 236
olfactory habituation, 234
SIFamide, 24
single fly assay, 239 , 238–239
single nucleotide
polymorphisms (SNPs),
225–226
siRNA (small interfering RNA),
203
sitter form of foraging gene, 193,
194, 195 , 195–197
sleep
deprivation and for
polymorphism, 196
insulin signaling, 28
in the post-mated female, 95
sliding box assay, 240 , 239–240
SLIMB (supernumerary limbs),
106
smell, see olfaction
Snmp (sensory neuron

```
olfaction, 25, 26, 59
  stress response, 30
SNPs (single nucleotide
       polymorphisms),
       225-226
social learning
  female mate preferences, 121
  oviposition site preference, 93
SOD (superoxide dismutase),
       151, 180
songs, courtship, 120, 190
SP, see sex peptide
spacing effect in memory,
       169-170
spatial memory, see place
       memory
spatial resolution of the visual
       system, 38-39
speciation, and timing of
       mating, 189, 189
Specific Combining Ability
       (SCA), 220
spectral preference behavior, 43,
       43-44
sperm storage in the female, 89,
       95-96
spermathecae, 94, 95
sphingosine-1-P lyase/sply,
       82-83
spinocerebellar ataxia (SCA),
       149 - 150
spinster, 91
Split Gal4 system, 255, 254-255
Split LexA system, 256, 255-256
SPR, see sex peptide receptor
stagger behavior, 84
startle response assay, 233-234
starvation
  changes in olfactory and
       gustatory neurons,
       59-60
  neuropeptides affecting
       feeding behavior, 22,
       21-24, 25, 26
  resistance to, 24, 192-193, 194
stj (straightjacket), 69
STM, see short-term memory
stress response, 30
subesophageal ganglion, 21, 25,
       58, 90
sugar
  in appetitive classical
       conditioning, 239
  sweet taste, 53-54, 58
  trehalose sensitivity, 193
sulfakinin (DSK)
  in locomotion, 26-27
  satiety factor, 23
superoxide dismutase (SOD),
       151, 180
sweet taste, 53-54, 58
  trehalose sensitivity, 193
synaptojanin, 167
synapto-pHluorin (fluorescent
```

indicator), 245

ynuclein, see α-synuclein
ystems biology analysis, 208–209, 211
ystems genetics, 217–228
see also RNA interference
(RNAi)
environmental effects, 220–221
epistasis, 219 , 219–220, 221, 226, 227
future developments, 211-212, 227-228
GWAS, 153, 218-219,
223–226 induced mutations, 217–218
pleiotropy, 220
transcriptional networks, 222,
223, 221–223, 224, 225
<i>cis</i> and <i>trans</i> regulation, 223, 226–227, 228
C
Γ-maze assay, 236 , 235–238, 239 achykinin (DTK), 21, 27, 30, 31
akeout, 192
an, 42
TANGO trans-synaptic labeling,
260 , 259–261
TAR DNA binding protein (TDP-43), 151–152,
(1DF-43), 131–132, 153
TARGET (Temporal and
Regional Gene
Expression Targeting),
208, 252
arget of rapamycin (TOR) pathways
lifespan extension, 180–181
tau and, 146
TOR/S6k in nutrient sensing,
60
arsi, taste neurons, 53, 55 aste
bitter, 53, 54, 55, 58, 60, 117
blends, 58–59
central nervous system, 58
and courtship behavior in the
male, 116–117, 120 egg-laying site selection, 25,
60
interactions with olfaction, 60
peripheral system, 54, 53–55, 117
salt, 53, 55
starvation-induced changes, 59-60
sweet, 53-54, 58
trehalose sensitivity, 193 auopathies, 145–147, 148–149,
165–166, 180
drug targets, 171–172
$\Gamma \beta H$ (tyrosine β -hydroxylase),
91. 92

tdc2 (tyramine decarboxylase 2),

TDP-43 (TAR DNA binding
protein), 151–152, 153
temperature
see also thermal nociception
in behavioral experiments
aversive, 126
for rearing flies, 232
compensation for seasonal
variation, 183–184, 188 ,
187–188
of <i>in vivo</i> RNAi screening, 210
temporal conditioning, 242
temporal control of transgene
expression, 208, 252
temporal resolution of the visual
system, 39, 41
territorial defense, 25
thermal nociception, 68-69, 70
thermal nociception assays
in adults, 68
in larvae, 67, 71–73
thermal probe, 72
tim/TIM (timeless), 105–106
JET/TIM interactions, 187 , 186–187
polymorphism, 185 , 184–186
tissue-specific RNAi (TSRi), see
RNA interference (RNAi)
TNF (tumor necrosis factor), 67,
70-71
TOR (target of rapamycin)
pathways
lifespan extension, 180–181
tau and, 146
TOR/S6k in nutrient sensing,
toxicology, pesticides and PD,
143, 144–145
trachea, <i>drd</i> mutant, 83
transcriptomics, 190
circadian rhythms, 109
environmental effects, 221
post-mated females, 96
transcriptional networks, 222,
223 , 221–223, 224 , 225
cis and trans regulation,
223, 226–227, 228
transgenic methods binary systems, 251 , 250–251
Gal4/UAS, 136, 251–253
LexA-LexAop, 253–254
limitations, 254
Q, 254
FRT-FRP system, 254
intersectional methods, 250,
263
FINGR, 257 , 256–258,
263
G-MARET, 258
"logic gates", 258, 259 Split Gal4, 255 , 254–255
Split Ga14, 255 , 254–255 Split LexA, 256 , 255–256
UAS>stop>effector
Flip-in, 257 , 258

membrane protein), 53

see also NPF (neuropeptide F)

sNPF (short NPF)

feeding behavior, 23

locomotor activity, 27

Index

in other organisms, 262-263 tissue-specific RNAi, see RNA interference (RNAi) Transgenic RNAi Project (TRIP), 204, 205 transmission electron microscopy, 268 transposon mutagenesis (P-element insertions), 217-218 trans-synaptic labeling CaLexA, 261, 261-262 connectome research, 263, 268-272 future directions, 263-264 GRASP, 12, 259, 258-259 P2X2-Ca/cAMP method, 261, 262 photoactivatable GFP, 262, 262 TANGO, 260, 259-261 Tre (trehalose sensitivity), 193 tribbles, 131 trichoid sensilla, 49, 50-51, 53 (z)-7-tricosene, 60 trinucleotide repeat diseases Fragile X syndrome, 167, 170-171 Huntington's disease, 149-151 trisomy 21 (Down syndrome), 167 TRP/TRPL channels in GSNs, 55

in nociception (TRPA), 67, 68-69, 71 in photoreceptors, 40, 41 TSRi (tissue-specific RNAi), see RNA interference (RNAi) tumor necrosis factor (TNF), 67, 70-71 tyramine, 91, 92 tyramine decarboxylase 2 gene (tdc2), 92tyrosine β -hydroxylase (T β H), 91, 92 tyrosine kinase receptors (dInR), 20, 25, 59 UAS (Upstream Activating Sequence), 251 see also Gal4/UAS system effectors and reporters, 253, 252-253 UAS>stop>effector Flip-in method, 257, 258 ubiquilin, 148 ubiquitin-proteasome system, 146, 150 unconditioned stimulus (US) appetitive (sugar), 239 aversive electrical, 236, 237, 243 mechanical, 238, 244 UV light larval avoidance behavior, nociceptive sensitization, 70

rhodopsins, 2, 39, 40 cis-vaccenyl acetate, see cVA VAPB (vesicle-associated membrane protein), 152 Veela, 187 vibration, as an aversive US, 238, 244 Vienna Drosophila Research Center (VDRC), 204, 205 virgin females not interested in mating, 91 suppression of male courtship towards, 119 vision, 37-44 anatomy of the visual system, 1-15, 38, 37-38 circadian system and, 108 color, 2, 40 and courtship behavior in the male, 116 electroretinograms, 42, 42-43 intensity of light, 37 adaptation to high levels, 42 motion detection, 1-2, 9, 11, 10 - 12neurotransmitters, 6, 7, 9, 11, 14, 42 phototransduction, 38, 41, 40 - 41polarization of light, 40 spatial resolution, 38-39 temporal resolution, 39, 41

phototaxis, 43

visual field, 37 wavelength of light, 2, 37 phototaxis, 43, 43-44 rhodopsins, 39–40 visual associative learning in larvae, 164 Von Frey fibers, 72 VP16 transcriptional activation domain, 254, 255 vri (vrille), 106 wakefulness, insulin signaling, water homeostasis, 24 water-sensing neurons, 55 wavelength of light, 2, 37 phototaxis, 43, 43-44 rhodopsins, 39-40 wengen (TNF receptor), 67, 70 - 71white, 131 white rabbit (whir), 60 wing motion, 77, 78 work loop technique, 81 X chromosome genes, 104, 193, 223 Y-maze assay, 233, 234 yellow ommatidia, 40 zebrafish, 263 zeitgebers, 104, 108, 183 tim polymorphism, 185, 184-186