

Cambridge University Press

978-1-107-40658-2 - Allostasis, Homeostasis, and the Costs of Physiological Adaptation

Edited by Jay Schulkin

Index

[More information](#)

## Index

- acetylcholine esterase production, 180
- adaptations
  - appropriate/inappropriate, 50–1
  - short-term, long-term disruptions and, 3
- addiction
  - allostatic state and, 348–9
  - mechanisms involved in, 40, 47
  - tolerance and sensitization in, 159–61
- adenosine, 253–4, 255
- ADHD (attention deficit, hyperactivity disorder) treatment, 56
- affect, 37
- African-Americans, 43–4
- AL. *See* allostatic load
- allometry, 354
- allostasis
  - adaptive nature of, 229
  - advantages over homeostasis model, 22
  - concept of, 1, 7, 11–12, 68–9, 89, 90, 107, 165, 346–8
  - criteria defining, restricting, 281
  - defined, 7, 18, 66, 150, 312, 346
  - examples of, 69, 229
  - health in, 54, 58
  - homeostasis versus, 151, 230–1, 347–8
  - origins of idea, 19–22, 346
  - pathology and, 350–1
  - phenomena types at question, 277–8
  - principles of, 26–34, 228–9
  - regulated, 311, 312
  - see-saw analogy to, 231
  - thermostatic analogy to, 101, 110
  - utility of concept, 207
  - see also* allostatic states; predictive regulation
- allostasis health model, 58
- allostatic load
  - allostatic states versus, 79
  - assessing, 80
  - categories, Boolean-specified, 126
  - concept overview, 349–50
  - contributing factors, 74, 313
  - defined, 67, 70, 73, 75, 89, 108, 152, 312, 313, 347
  - elevated
    - criteria for, 142
    - hostility and, 116
    - social relationships and, 116
  - endocrine/neuroendocrine secretions and, 323–5
  - examples of, 75–8
  - future study possibilities
    - challenge, 131–2
    - longitudinal, 132–3, 143–5
    - using <sup>1</sup>H-NMR, 138–42
  - glucocorticoid secretion and, 323–5
  - home temperature analogy to, 109–10
  - indicators of
    - possible future, 130–2
    - rationale for, 133–7
  - labile perturbation factors effects on, 317–21
  - measurement/scoring of
    - approaches summarized, 114
    - biomarkers used in, 115, 116
    - canonical weight, 120–3, 143
    - elevated-risk zone, 115–20, 142–3
    - gender-specific, 128–30
    - limitations to extant, 137
    - recursive partitioning, 123–8, 143
    - using <sup>1</sup>H-NMR spectra, 139
  - regulatory processing costs and, 313
  - reproductive life history stage effects on, 321–3
  - see also* allostatic overload
- allostatic load score, 114, 115

Cambridge University Press

978-1-107-40658-2 - Allostasis, Homeostasis, and the Costs of Physiological Adaptation

Edited by Jay Schulkin

Index

[More information](#)

366

Index

- allostatic overload
  - amygdala glucocorticoids role in, 204–6
  - defined, 7, 349
  - example of, 9–11
  - indicators of, 9
  - sensitization and, 197–201
  - types of, 325
- allostatic states
  - allostatic load versus, 79
  - assessing, 79, 80
  - contributing factors, 74, 78
  - defined, 7, 67, 75, 152, 153, 347
  - examples of, 71, 75–6, 348–9
  - maintenance of, 109–10
- amygdala
  - abnormal responses to aversive stimuli, 204–5
  - basolateral complex, fear and
    - glucocorticoid involvement in, 186–9
  - blocking NMDA receptors in, 183
  - central nucleus' role in fear, 189–90
  - corticosterone in, 187–9
  - CRH gene expression in, 9
  - dendritic changes in, 202–3
  - fear circuits involving, 172–3
  - fear-related involvement, 172, 173–4, 175–6
  - 'flashbulb' memory and, 72
  - functions of, 37, 202
  - glucocorticoid-induced allostatic changes
    - in, 201–2
  - glucocorticoid-induced morphological changes in, 203–4
  - glucocorticoids in, role in human allostatic overload, 204–6
  - glucose metabolism in, depression and, 9
  - hyperexcitability in, 199–201
  - memory consolidation and, 178–9
  - neuronal events from fear conditioning, 182–6, 187
  - projections to cortex, 176
  - stria terminalis and, 193–4
  - uncertainty states and, 174
- anxiety
  - amygdala activation and, 174
  - amygdala-cortisol interactivity in, 205
  - amygdala infusion of corticosterone and, 181
  - brain stress system changes and, 161
  - fear versus, 193, 206
  - HPA axis in, 205
  - neural mechanisms for, 37–8
  - pathological
    - CREB and, 184
    - depression and, 168–9
  - sensitization and, 197–9
  - stria terminalis' bed nucleus and, 193–4
- autoimmune diseases, 86
- autonomic nervous system, 243
- Bayesian response patterns, 30–1
- behavior, neural-endocrine regulation of, 7–8
- Bernard, Claude, 17, 99, 100, 150–1
- beta adrenergic receptor blockers, 72
- beta-endorphin, 326
- black-headed gulls, 328
- blackbirds, European, 331
- blood chemistry, 20–1
- blood glucose levels, 29, 33
- blood pressure
  - anticipation of elevated, 33
  - attention demands and, 19–20
  - brain's control of, 25
  - children's, rise in, 41, 42
  - circadian rhythms and, 237
  - daily variations in, 23–5, 43, 72
- blood supply, 27–8
- body fluid depletion, 8
- body temperature
  - circadian variation in, 354–7
  - daily fluctuations, 233
  - regulation
    - circadian set-point changes and, 233–4
    - daily rhythm ranges, 234–5
    - defined, 233
- body water regulation, 106–8
- bone mineral density, 10
- brain
  - blood requirements, 28
  - circadian rhythm pathways in, 246
  - CRH receptor site distribution in, 192
  - fear-affecting lesions in, 173
  - fear-related circuits in, 172–3
  - glucocorticoid-induced morphological changes in, 202–4
  - reward system of, 159
- breast cancer, 271
- calcium
  - metabolism, 352–4
  - regulation, 350
- camels, 234–5
- Cannon, Walter B., 1–2, 29, 99, 231, 344–5
- canonical weight scoring, 120–3, 143
- carbohydrates, 20
- cardiovascular disease, 268–70
- cardiovascular function
  - catecholamines and, 84
  - glucocorticoids and, 81
- catecholamines
  - as stress indicators, 136–7
  - cardiovascular function and, 84

Cambridge University Press

978-1-107-40658-2 - Allostasis, Homeostasis, and the Costs of Physiological Adaptation

Edited by Jay Schulkin

Index

[More information](#)

## Index

367

- central nervous system and, 85
- dangerous effects of, 70–2
- elevated levels, 85
- fluid volume and, 84
- glucocorticoids and, 83–4, 327
- immunity and, 69, 84–5
- inflammation and, 84–5
- memory formation and, 72
- metabolism and, 85
- central nervous system
  - catecholamines and, 85
  - glucocorticoids and, 81–2
  - peripheral physiology and, 358
- chickens, 326
- chronic fatigue syndrome, 87
- circadian prediction, 32
- circadian rhythms
  - anticipatory advantages of, 232
  - as homeostatic states, 357
  - blood pressure and, 237
  - brain structure assays for, 246
  - defined, 232
  - food-entrainable oscillators, 248
  - heart rate and, 237
  - masking effects, 235
  - molecular genetic bases of, 240–1
  - non-SCN sources of, 245–8
  - organ foci of autonomous clock gene expression, 246–8
  - pacemaker outputs, 243–5, 255
  - photoc entrainment of pacemaker, 241–2
  - ubiquity of, 232–3
- cognitive functioning, 136
- congestive heart failure, 103
- coronary artery disease study, 139
- corticosteroid-receptor complexes, 186–9
- corticosterone
  - amygdala implants of, 196–7
  - amygdala infusion of, 181
  - CRH facilitation by, 195, 196
  - diet-administered: effects in chickens, 326
  - elevated
    - acetylcholine esterase production and, 180
    - foraging behavior and, 326, 328
    - low testosterone and, 177
    - metabolic rate and, 328
    - oxygen consumption and, 328
    - parental behavior in birds and, 326
    - predator pressure and, 329
    - reproduction behavior suppression and, 326
    - territorial aggression reduction and, 325–6
  - fat in chickens and
  - glucose/fatty acid/triglyceride levels and, 327
  - implants in sparrows, 326, 328
  - nongenomic membrane effects of, 194
  - parent-child separation and, 41
  - recovery from acute stress and, 328
  - snow bunting secretion of, 316
  - social status and, 331
  - stress, body conditions, and, 334
- cortisol
  - actions of, 9
  - as biomarker in AL challenge study, 131–2
  - elevated
    - depression and, 11, 116, 178, 206–7
    - evening, 76
    - fat distribution and, 46
    - fearfulness in children and, 178
    - in monkeys, 178
    - incidence of, 47
    - long-term effects, 3
    - osteoporosis and, 116
    - short-term effects, 3
  - gluconeogenesis and, 327
  - inadequate levels, 76
- CREB (cyclic AMP-response element binding protein), 182, 183, 184
- CRH (corticotropin-releasing hormone)
  - anxious depression and, 9
  - behavioral effects in birds, 326
  - behavioral inhibition in monkeys and, 178
  - central activation of, fear and, 192–3
  - corticosterone facilitation of, fear and, 195, 196
  - distribution in brain, 191
  - feed-forward system involving, 152
  - functional associations, 190–1
  - increases in cerebrospinal fluid, 204
  - infusions into stria terminalis, 193–4
  - response in sheep to threats, 201–2
  - seizures from, 195–6, 197
  - startle response facilitation and, 192, 195
- CRH family receptors, 192
- cytokines
  - anti-inflammatory, 86
  - autoimmune diseases and, 86
  - chronic fatigue syndrome and, 87
  - defined, 86
  - elevated levels of, 86
  - fibromyalgia and, 87
  - inflammatory, 86, 87–8
  - measurement problems, 88
  - oxidative stress and, 87
  - sleep regulation and, 86–7

- dark-eyed juncos, 319, 327
- 'DASH' study, 55
- daylength effects, 32
- dendrite length changes, 202–3
- depression
  - allostatic model and, 161
  - amygdala activity in, 204
  - anxious, 9–11
  - bone mineral density and, 10, 76
  - cortisol and, 11, 116, 178, 206–7
  - hypercortisolemia in, 204, 205
  - osteoporosis and, 116
  - pre-frontal cortex in, 171, 172, 204
  - shift worker, 273
- DHEA, 82–3, 135–6
- diabetes (type 2)
  - origins, 85
  - pathologies associated with, 44
  - 'thrifty genes' and, 47–8
- disease, income and education and, 228
- distress, 107, 109
- dopamine release, 38–40
- drugs, neural effects of, 38–40
- effector adaptation
  - circadian, 32–3
  - muscles, 32
- effectors
  - compensatory activation of, 104
  - redundancy in, 101, 104
  - shared, 104, 105
- efficiency of organisms, 26–8
- EG, 317
- egr-1* (early growth response gene 1), 184–6
- elevated-risk zone scoring, 115–20, 142–3
- ELHS (emergency life history stages)
  - allostatic load reduction by, 318–21, 324
  - defined, 309
  - hormonal actions in relation to, 325
  - responses to
    - ACTH and
    - corticosterone treatment and, 327
- energy requirements model
  - basic terms of, 316–7
  - endocrine/neuroendocrine bases of, 323–5
  - labile perturbation factors in, 317–21
  - reproductive life history stage in, 321–3
- EO, 317–9
- epinephrine
  - memory consolidation and, 178–9
  - release of, 84
- Escheria coli*, 134–5
- exercise, mental benefits of, 57
- fainting reactions, 103
- fat
  - distribution of, 46
  - hunger for, hormones and, 20
- fatty acid levels, family stress and, 20–1
- fear
  - allostatic processes of
    - amygdala's role in, 174
    - prefrontal cortex in, 174–5
  - amygdala involvement in, 172, 173–4, 175–6
  - anxiety versus, 193, 206
  - brain circuits involved with, 172–3
  - brain lesions affecting, 173
  - brain systems and, 179–80
  - categorizing, 359
  - chronic, 359
  - defined, 167–8
  - extinction of learned, 181
  - general characteristics, 359
  - glucocorticoid secretion and, 176–7
  - in pathological anxiety, 168, 169
  - intracellular events and long-term memory of, 183
  - learning/memory of
    - amygdala's role in, 176, 203
    - epinephrine/norepinephrine and, 178–9
    - ngfi-b* (nerve growth factor induced gene-B) involvement in, 188–9
    - signal transduction pathways for, 182–6
    - speed of, 167
  - neuroanatomical schematic of, 170
  - normal, 168
  - organs engaged in states of, 166
  - prefrontal cortex involvement, 171
  - response sustaining mechanisms, 176
  - sensitizing factors, 198
  - see also* anxiety
- feed-forward mechanisms, 8, 151–2
- fibrinogen concentration, 46
- fibromyalgia, 87
- Fisher rats, 76
- fluid volume
  - catecholamines and, 84
  - glucocorticoids and, 81
- flycatchers, pied, 326, 329
- food-entrainable oscillators, 248
- forskolin treatment, 245–6
- gastrointestinal disorders, 266–8
- General Adaptation Syndrome, 90
- genetic factors, 74, 75
- GHT (geniculohypothalamic tract), 242
- glucocorticoids
  - allostatic load and, 323–5
  - as AL biomarkers, 135
  - cardiovascular function and, 81

Cambridge University Press

978-1-107-40658-2 - Allostasis, Homeostasis, and the Costs of Physiological Adaptation

Edited by Jay Schulkin

Index

[More information](#)

## Index

369

- catecholamines and, 83–4, 327
- central nervous system and, 81–2
- character and action of, 186
- chronic activation of, 177
- chronic insufficiency of, 82
- cognitive functioning and, 136
- DHEA and, 82–3, 135–6
- elevated levels of, 70, 72–3, 76
- fear conditioning and, 180–1
- fear feed-forward regulation by, 188, 189
- fluid volume and, 81
- functions of, 70, 81, 177
- glucose utilization and, 177
- high-levels before conditioning, 181
- HPA activation restraint by, 194
- immunity and, 81
- inflammation and, 81
- measurement problems, 88
- memory and, 72, 179
- metabolic effects, 81, 327
- night restfulness and, 328
- reproduction and, 82
- secretion of
  - allostatic load and, 323–5
  - fear and, 176–7
  - predator pressure and, 329–30
  - see also* corticosterone; cortisol
- gluconeogenesis, 327
- glutamate receptors, 182–3, 187
- golden lion tamarins, 355–7
- great tits, 328
- Hcrt (hypocretin), 253
- health, allostatic, 54, 58
- health care, 57–8
- heart disease, social conditions and, 19
- heart rate, 237
- heroin, 159–61
- heterostasis, 3–4
- hippocampus
  - adrenal steroid receptors in, 136
  - extracellular glutamate levels in, 76–7
  - neuronal shrinkage in, 199, 203–4
  - shrinkage of, 73, 136, 273
- homeorrhexis, 238–9, 310, 345
- homeostasis
  - allostasis versus, 151, 230–1, 347–8
  - body size and, 354
  - Cannon's view of, 99, 231, 344–5
  - defined, 67, 150, 310–11, 344–5
  - examples of, 1, 2
  - inadequacy of model, 22–6, 345
  - initial model of, 17–18, 230
  - 'predictive,' 4, 345–6
  - 'reactive,' 4
  - 19th century ideas of, 1–2
  - homeostatic systems principles, 102–4
  - homeostats
    - defined., 101–3
    - resetting, 101
  - hormone secretions
    - levels of, 313–5
    - roles of, 304
  - HPA (hypothalamic pituitary adrenal) axis, 9, 194, 205
  - hypercortisolemia, 204, 205
  - hyperglycemia, 51–2, 108
  - hypertension
    - allostatic view of, 41–4
    - current treatment recommendations, 55
    - fat consumption and, 20
    - homeostatic treatment model, 51, 52–4
    - incidence of, 40, 150
    - salt consumption and, 20
    - social conditions and, 19
  - hypervigilance. *See* vigilance
  - hypocretin, 253
  - hyposatisfaction
  - hypothalamus
    - anterior, 252–3
    - lateral, 253
    - posterior, 253
  - hypothermia, 106–7
  - IGL (intergeniculate leaflet) projection, 242
  - iguanas, 334
  - IL-6 (interleukin-6), 131
  - illness incidence
    - genetic abnormalities and, 48
    - race and, 19
  - immediate early genes, 184–6
  - immune system
    - catecholamines and, 84–5
    - effects of stress on, 77–8
    - glucocorticoids and, 81
    - impairments of, 271–2
  - inflammation
    - catecholamines and, 84–5
    - glucocorticoids and, 81
  - insomnia, 276–7
  - insulin, 133
  - insulin resistance, 45–6, 133–4
  - internal milieu, 4–5, 68
  - intervention
    - demand distribution and responses, 52
    - higher-level, 57–8
    - low-level mechanism, problems with, 51–4
    - most successful, 55–6
  - kindling, 199–201
  - king penguins, 334

Cambridge University Press

978-1-107-40658-2 - Allostasis, Homeostasis, and the Costs of Physiological Adaptation

Edited by Jay Schulkin

Index

[More information](#)

## 370

## Index

- labile perturbation factors (LPF)
  - defined, 303
  - effects on allostatic load, 317–21
  - responses to
    - body condition and, 331–4
    - social status and, 330–1
    - types of, 309
- lactation, calcium metabolism during, 352–4
- leptin deficiency, 45, 85
- Lewis rats, 76
- life history stages (LHS)
  - concept, review of, 351–2
  - durations of, 307–8
  - examples of, 306, 307
  - hormone roles in, 304
  - human singularity of, 308–9
  - labile perturbations in, 317–21
  - levels of, 309–10
  - overlap of, 308
  - patterns of, 304–6
  - phases of, 306
  - reproductive, 321–3
  - substages of, 306
  - temporal sequence boundaries of, 307
  - see also* ELHS (emergency life history stages)
- lobotomy, 35, 36–7
- LPF. *See* labile perturbation factors (LPF)
- MacArthur Study of Successful Aging, 115
- masking effects, 235
- mediators
  - immediate positive effects of, 70, 72
  - inadequate responses of, 76
  - pathophysiology from, 75
  - patterns of release, 71, 73–6
  - protection versus damage from, 76
  - summarized, 74
  - systemic versus local, 73
- melanopsin, 241
- melatonin secretion, 243, 245
- Melville, Herman, 50
- memory
  - consolidation mechanisms, 179
  - CREB and, 184
  - 'flash-bulb,' 72
  - mediators in formation of, 69
- mental disorders
  - in shift workers, 272–4
  - pharmacotherapy for, 54, 56
  - see also* depression
- metabolic syndrome
  - allostatic view of, 46–8
  - defined, 44
  - low-level treatments for, 54
- metabolism
  - catecholamines and, 85
  - glucocorticoids and, 81, 327
- metabonomics, 137–8
- methylphenidate, 56
- metryrapone
- milieu intérieur, 99, 100
- mortality
  - employment status and, 45
  - marital status and, 45
  - occupational, per time of day, 274, 275
  - social organization and, 39
  - social relationships disruption and, 228
- motivation, 159, 324–5
- natural killer cell activity, 272
- negative feedback, 101
- nervous system, evolution of, 5
- nest-building, 4
- ngfi-b* (nerve growth factor induced gene-B)
- NMR spectroscopy
  - basics of, 138
  - recursive partitioning of spectra, 140
  - terminal node spectra, 141
  - use in AL assessments, 138–42
- norepinephrine release, 84
- NPY, 47
- nutrient needs and replenishment, 33–4, 354
- obesity
  - cultural disruption and, 48
  - homeostatic treatment model, 51, 54
  - incidence of, 44, 48
  - pathological sequelae, 44
  - 'thrifty genes' and, 47–8
- opiates, 159–61
- orexin, 253
- pain placebos, 57
- Parkinson's disease, 57
- Per* genes, 240–1, 245
- petrels, 319, 321
- pharmacotherapy, 54, 56
- phosphate regulation, 6–7
- physiological systems
  - capacities per loads on, 26–7
  - levels of functioning of, 310–3
- physiology
  - brain control of, 19–21
  - defined, 344
  - kinds of change in, review of, 351–2
  - long-term needs versus short term demands, 357–8
  - 'stability' in, 346
- Pine Siskins, 328
- PKA (protein kinase A), 183

Cambridge University Press

978-1-107-40658-2 - Allostasis, Homeostasis, and the Costs of Physiological Adaptation

Edited by Jay Schulkin

Index

[More information](#)

## Index

371

- poikilostasis, 310, 311–12
- positive feedback systems, 103–4, 360–1
- post-traumatic stress disorder, 161, 205–6
- predictive homeostasis, 4, 345–6
- predictive regulation
  - behavioral neural adaptation and, 37–8
  - examples of, 24–5, 28–9
  - levels of, 32
  - time course of, 31–2
- prefrontal cortex
  - anxiety/depressive disorders and, 204
  - 'demands' of, 38
  - integrative function of, 35–7
  - roles of, 171–2, 174–5
- pregnancy
  - calcium metabolism during, 352–4
  - nutrient partitioning regulation during, 238–9
  - risks from shift work during, 270–1
- preindustrial communities, 48–9
- public speaking stress, 75
- raphe projection, 242
- rats
  - adrenalectomized, 4–5, 180
  - anxiety in, corticosterone and, 181
  - parathyroidectomized, 4–5
  - phosphate-deprived, 6
  - pre-frontal cortex in, 171
  - responses to extreme temperatures, 4
  - SCN efferent pathways in, 244
  - urine <sup>1</sup>H-NMR spectrum, 138
- 'reactive' homeostasis, 4
- receptor downregulation, 33
- recursive partitioning scoring, 123–8, 143
- regulatory systems
  - chronic activation of, 7
  - circadian versus homeostatic, 279–81
  - input/output curves per load, 30
  - optimal functioning mode, 9
- reproduction
  - energy needs and allostatic load during, 321–3
  - glucocorticoids and, 82
  - seasonal variations in, 308–9
  - women's problems with, 270–1
- restlessness, 38, 56
- restraint stress, 76–7
- rheostasis
  - defined, 4, 25–6, 237, 310, 311, 345
  - programmed, 237–8, 239
  - reactive, 238, 239
  - second order, 238
- RHT (retinohypothalamic) projection, 241, 242
- Richter, Curt, 4
- Ritalin, 56
- rough-skinned newt, 326
- rufous hummingbird, 320
- salt
  - hunger for, 20, 41
  - hypertension and, 20
- satisfaction
  - best, 50
  - fleetingness of, 50
  - in industrial societies, 50
  - in preindustrial societies, 49
  - neural mechanisms for, 38–40
  - socioeconomic status and, 47
  - see also* hyposatisfaction
- SCN (suprachiasmatic nucleus)
  - afferent systems to, 241–2
  - anatomy of, 240
  - efferents from, 243–5, 255
  - functions of, 240, 244–5
  - neuronal components, 240
- Selye, Hans, 3, 90, 99–101, 107
- sensitization
  - allostatic overload and, 197–201
  - as neural process, 199–201
  - early-life-induced, 198–9
- sensor adaptation
  - rate of, per input change rate, 31–2
  - sensitivity, 31
  - transduction range, 29–31
- serotonin, 37–8, 255
- set point, 23, 345
- sheep, CRH response to threats in, 201–2
- shift work
  - ability to tolerate, 256
  - accidents risk during, 274
  - age of workers performing, 256
  - circadian rhythm adaptation during, 257–60
  - circadian rhythm adjustment rates during, 260
  - commuting accidents risk, 274
  - domestic/social effects of, 264–6
  - health effects
    - breast cancer, 271
    - cardiovascular, 268–70
    - gastrointestinal, 266–8
    - immune system, 271–2
    - mental, 272–4
    - reproductive, 270–1
  - incidence of, 256
  - models of, 277
  - research in, challenges of, 257
  - stress from, 256, 274–5, 276
  - see also* shift workers
- shift workers
  - adrenaline excretion by, 258, 259

- shift workers (*cont.*)
  - body temperature studies, 257–8
  - circadian reentrainment incompleteness, 260
  - eating habits, 267–8
  - EEG recordings of, 262–3
  - light exposure effects on, 260
  - primary complaints of, 261
  - salivary melatonin and cortisol level
    - rhythms of, 259–60
  - sleep disturbances in, 261–4, 275–6
  - sleep length per sleep onset time, 261, 262
  - sleep timing, metabolic effects of, 268
- shrikes, fiscal, 329
- side-blotched lizards, 326
- skeletal muscle, 27–8
- skin immunity, 77–8
- sleep
  - circadian-homeostatic influences on
    - interactions between, 254–6
    - separating, 250
  - cytokines and regulation of, 86–7
  - deprivation of, 76, 86, 249, 272
  - naps, 249, 263
  - NREM (non-rapid-eye-movement), 249–50
  - parameters of, circadian variations in, 249–50
  - pathways for circadian control of, 244
  - physiological/hormonal parameter profiles
    - during, 235–7
  - processes regulating, 248–9
  - REM, glucocorticosteroids and, 328
  - two-process regulation model, 250–1
  - see also* insomnia; sleep-arousal
- sleep-arousal
  - adenosine's role in, 253–4, 255
  - basal forebrain circuits involved in, 252–3
  - lateral hypothalamus circuits involved in, 253
  - posterior hypothalamus circuits involved in, 253
- snow bunting, 316
- snowshoe hares, 329–30
- social phobics, 206
- social relationships, 116–18
- social status, 330–1
- societies
  - industrial, 49–50
  - preindustrial, 48–9
- sparrows
  - Harris', 331
  - song, 325, 326, 328
  - white-crowned, 323, 326, 328
- startle response
  - bases for, 189, 193
  - CRH facilitation of, 192, 195
  - unconditioned, interference with, 193
- steroid functions, 7–8
- stonechats, tropical, 329
- stress
  - behavioral responses to, 68
  - defined, 67, 89–90
  - homeostatic theory of, 104–7
  - medical/psychological consequences, 108–9
  - repeated, effects of, 75
  - Selyes theory of, 99–101, 107
  - stressor-intensity/effector-system models, 100
- stress responses, failure to turn off, 75–6
- stressors
  - effects on ACTH/epinephrine/norepinephrine, 102
  - neuroendocrine responses and, 106
- stria terminalis, 193–4
- stroke, social conditions and, 19
- symmorphosis, 26–7
- Syndrome X. *See* metabolic syndrome
- system challenges, adaptive responses to, 2
- testosterone, corticosterone and, 177
- therapeutic communities, 55–6
- thermoregulation. *See* body temperature
- TNF alpha levels, 87
- ulcers, peptic, 267, 268
- uncertainty states, 174
- urocortins, 191
- vigilance
  - African-American, 43–4
  - long-term effects of, 41–4
- VTA (ventral tegmental area), 38
- waist-to-hip ratio, 134