Subject Index

Adrenocorticotropic hormone
antagonist therapy 61
immune system expression and function 50–52, 54
nitric oxide response function
endotoxemia model 28, 29
paraventricular nucleus neuron stimulation 34–36
proinflammatory cytokine response 24–27, 30
turpentine-induced injury 27, 28
rheumatoid arthritis levels 76
sex differences, endotoxin response 92, 95, 97, 100–102
Antisense oligodeoxynucleotides,
immunoneuropeptide knockdown 59
Calcitonin gene related peptide, immune system expression and function 58
Carbon monoxide
formation 18, 108
gonadotropin-releasing hormone regulation 112, 113
growth-hormone-releasing hormone regulation 113
heme oxygenase
distribution and regulation 19, 20
isoforms 109
hemin studies, neuroendocrine regulation 110, 111, 113
hemoglobin binding 108
hypothalamic-pituitary-adrenal axis functions
adrenal function effects 36
corticotropin-releasing hormone control 111, 112
heme oxygenase inhibition studies 22, 23, 111
neurogenic stressor response, role 30, 32
interleukin-1 regulation 113
overview of effects 16, 17
prospects for neuroendocrine-immune interaction studies 113, 114
signaling pathways 109, 110
Corticosterone, sex differences in endotoxemia response 95, 102
Corticotropin-releasing hormone antagonist therapy 61
carbon monoxide control 111, 112
effects on nitric oxide formation, paraventricular nucleus 37, 38
immune system expression and function 54–56
nitric oxide regulation 126
sex differences, endotoxemia response 95, 97, 102, 105
stress response 71
Cyclic adenosine monophosphate, signaling in immune and neuroendocrine systems 4
Cyclic guanosine monophosphate, nitric oxide signaling 120, 122, 124
Cytokines

*see also* specific cytokines

- adrenocorticotropic hormone response, role of nitric oxide 24–27, 30
- anterior pituitary hormone release modulation 127
- central nervous system, production 3, 6
- endotoxin response 117–119
- glucocorticoid effects 73
- immune cell cytokine effects on neuroendocrine mechanisms behavior 9
- brain neurotransmitters and neuronal activity 8, 9
- food intake 9
- hypothalamus-pituitary-adrenal axis 7, 8
- hypothalamus-pituitary-thyroid axis 8
- intermediate metabolism 9, 10
- neuromodulation 12
- neuronal growth, differentiation, and repair 9
- peripheral immune function 9
- sleep 9
- thermoregulation 9
- immune-neuroendocrine circuits regulatory circuits 10, 11
- resetting and homeostasis disruption 12
- immune-neuroendocrine product coexistence 3
- neuroendocrine effects on immune system
  - antigen presentation 6
  - cytokine production 6
  - immune cell recirculating and homing 6
  - immune response autoregulation 6, 7
  - immunospecificity contribution 5
  - lymphocyte selection during ontogeny 5
- receptors for hormones, neurotransmitters, neuropeptides, and immune mediators 3, 4
- signaling of immune and neuroendocrine systems 4

Endomorphins, immune system expression and function 57

β-Endorphin, immune system expression and function 50–52, 54

Endotoxemia

- nitric oxide functions, hypothalamic-pituitary-adrenal axis response 28, 29
- sex differences in response
  - adrenocorticotropic hormone response 92, 95, 100–102
  - corticosterone response 95, 102
  - corticotropin-releasing hormone response 95, 97, 102, 105
  - gonadectomy effects 97–99
  - mouse model 92, 97
  - tumor necrosis factor alpha response 97, 98, 102

Enkephalins, immune system expression and function 56, 57
Subject Index

Gene therapy, immunoneuropeptide strategies 61
Glucocorticoids
  immune system modulation 72, 73
  sex differences, endotoxin response 92, 95, 97
Gonadotropin-releasing hormone, carbon monoxide regulation 112, 113
Granulocyte-macrophage colony-stimulating factor, nitric oxide mediation in luteinizing hormone-releasing hormone release 124, 125
Growth hormone
  carbon monoxide regulation 113
  immune system expression and function 57, 58
  nitric oxide regulation 126
Heme oxygenase
  distribution and regulation 19, 20
  inhibition studies 22, 23, 111
  isoforms 109
Hypothalamic-pituitary-adrenal axis
  carbon monoxide functions
    adrenal function effects 36
    corticotropin-releasing hormone control 111, 112
    heme oxygenase inhibition studies 22, 23, 111
    neurogenic stressor response, role 30, 32
  immune cell cytokine effects 7, 8
  nitric oxide functions
    adrenal function effects 36, 37
    adrenocorticotropic hormone response, roles
    endotoxemia model 28, 29
    paraventricular nucleus neuron stimulation 34–36
    proinflammatory cytokine response 24–27, 30
    turpentine-induced injury 27, 28
    corticotropin-releasing factor effects on formation 37, 38
    neurogenic stressor response, role 30–34
  nitric oxide synthase inhibition studies 20–22
  vasopressin effects on formation 37, 38
  rat models with blunted responses 74, 75
  rheumatoid arthritis response 76
  stress response 15, 16, 70, 71
  systemic lupus erythematosus response 77
Hypothalamic-pituitary-gonadal axis
  hypothalamic-pituitary-adrenal axis interactions 91, 92, 105
  neuroendocrine-immune interactions 91
  sexual dimorphism, see Sex differences, neuroendocrine-immune interactions
  Insulin-like growth factor, immune system expression and function 58
Interleukin-1
  carbon monoxide regulation 113
  endotoxin response 118, 119
  glucocorticoid effects 73
  nitric oxide mediation in luteinizing-hormone-releasing hormone release 124, 125
  peripheral stimulation of central nervous system 71, 72
Knockout mouse, immunoneuropeptides 60
Luteinizing hormone-releasing hormone, nitric oxide regulation
  γ-aminobutyric acid, role 123
  glutamate, role 122, 123
  adrenocorticotropic hormone response, roles
  endotoxemia model 28, 29
  paraventricular nucleus neuron stimulation 34–36
  proinflammatory cytokine response 24–27, 30
  turpentine-induced injury 27, 28
  corticotropin-releasing factor effects on formation 37, 38
  neurogenic stressor response, role 30–34
  mechanisms 121–123
  norepinephrine, role 121–123
  oxytocin, role 123
  synthase inhibitor studies 121
Lymphoid tissue
  immune cell cytokine effects on neuroendocrine mechanisms behavior 9
brain neurotransmitters and neuronal activity 8, 9
food intake 9
hypothalamus-pituitary-adrenal axis 7, 8
hypothalamus-pituitary-thyroid axis 8
intermediate metabolism 9, 10
neuromodulation 12
neuronal growth, differentiation, and repair 9
peripheral immune function 9
sleep 9
thermoregulation 9
immune-neuroendocrine circuits regulatory circuits 10, 11
resetting and homeostasis disruption 12
immune-neuroendocrine product coexistence 3
neuroendocrine effects on immune system
antigen presentation 6
cytokine production 6
immune cell recirculating and homing 6
immune response autoregulation 6, 7
immunospecificity contribution 5
lymphocyte selection during ontogeny 5
receptors for hormones, neurotransmitters, neuropeptides, and immune mediators 3, 4
signaling of immune and neuroendocrine systems 4

Macrophage migration inhibitory factor abundance in anterior pituitary 84
blood levels 84
counterregulatory role 86, 87
discovery 83
macrophage release 85
proinflammatory actions 85, 86
prospects for study 87, 88
structure 83, 84
Magnetic cell sorting, immunoneuropeptide studies 60

α-Melanocyte-stimulating hormone agonist therapy 61
immune system expression and function 51
Met-enkephalin, immune system expression and function 56, 57

Neural cells
immune cell cytokine effects on neuroendocrine mechanisms
behavior 9
brain neurotransmitters and neuronal activity 8, 9
food intake 9
hypothalamus-pituitary-adrenal axis 7, 8
hypothalamus-pituitary-thyroid axis 8
intermediate metabolism 9, 10
neuromodulation 12
neuronal growth, differentiation, and repair 9
peripheral immune function 9
sleep 9
thermoregulation 9
immune-neuroendocrine circuits regulatory circuits 10, 11
resetting and homeostasis disruption 12
immune-neuroendocrine product coexistence 3
neuroendocrine effects on immune system
antigen presentation 6
cytokine production 6
immune cell recirculating and homing 6
immune response autoregulation 6, 7
immunospecificity contribution 5
lymphocyte selection during ontogeny 5
receptors for hormones, neurotransmitters, neuropeptides, and immune mediators 3, 4
signaling of immune and neuroendocrine systems 4
Neurophysin, immune system expression and function 58
Neurotensin, immune system expression and function 58
Nitric oxide
anterior pituitary hormone release modulation 126, 127
formation 17, 18
half-life 119
hypothalamic peptide release, role 126
hypothalamic-pituitary-adrenal axis functions
adrenal function effects 36, 37
adrenocorticotropic hormone response, roles
endotoxemia model 28, 29
paraventricular nucleus neuron stimulation 34–36
proinflammatory cytokine response 24–27, 30
turpentine-induced injury 27, 28
corticotropin-releasing factor effects on formation 37, 38
neurogenic stressor response, role 30–34
nitric oxide synthase inhibition studies 20–22, 120, 121
vasopressin effects on formation 37, 38
luteinizing-hormone-releasing hormone regulation
γ-aminobutyric acid, role 123
glutamate, role 122, 123
granulocyte-macrophage colony-stimulating factor, role 124, 125
interleukin-1, role 124
mating behavior 125, 126
mechanisms 121–123
norepinephrine, role 121–123
oxytocin, role 123
synthase inhibitor studies 121
overview of effects 16, 17
synthase distribution and regulation
endothelial enzyme 19, 120
inducible enzyme 19, 119
neuronal enzyme 18, 19, 120

Peripheral nervous system, inflammation and immune system, role 73, 74
Prolactin
immune system expression and function 58
nitric oxide regulation 126, 127
Proopiomelanocortin, immune system expression and function 50–52, 54
Rheumatoid arthritis, neuroendocrine-immune interactions 76, 78
Sex differences, neuroendocrine-immune interactions
endotoxin response
adrenocorticotropic hormone response 92, 95, 100–102
corticosterone response 95, 102
corticotropin-releasing hormone response 95, 97, 102, 105
gonadectomy effects 97–99
mouse model 92, 97
tumor necrosis factor alpha response 97, 98, 102
hypogonadism in critically ill patients 103
skin allograft rejection 92
Somatostatin, immune system expression and function 58
Substance P
antagonist therapy 61
immune system expression and function 55, 56, 58
Sympathetic nervous system, inflammation and immune system, role 73, 74
Systemic lupus erythematosus, neuroendocrine-immune interactions 77, 78
Transgenic mouse, immunoneuropeptides 60
Tumor necrosis factor alpha, sex differences in endotoxemia response 97, 98, 102
Vasoactive intestinal peptide, immune system expression and function 58, 59
Vasopressin
effects on nitric oxide formation in paraventricular nucleus 37, 38
immune system expression and function 54, 55

Subject Index 134