

CONTENTS

Preface to the second edition | xiii
Acknowledgements | xv
List of abbreviations | xvi

1 Classification of chemical messengers | 1
1.1 Hormones, the brain and behavior | 1
1.2 The body’s three communication systems | 2
1.3 Methods of communication between cells | 5
1.4 Types of chemical messenger | 7
1.5 Neuropeptides and neuromodulators | 14
1.6 Summary | 16

2 The endocrine glands and their hormones | 19
2.1 The endocrine glands | 19
2.2 The hormones of the endocrine glands | 19
2.3 Summary | 40

3 The pituitary gland and its hormones | 45
3.1 The pituitary gland | 45
3.2 The hormones of the pituitary gland | 49
3.3 Pituitary hormones in the brain | 54
3.4 Summary | 54

4 The hypothalamic hormones | 57
4.1 Functions of the hypothalamus | 57
4.2 Hypothalamic neurosecretory cells | 58
4.3 Hypothalamic hypophysiotropic hormones | 62
4.4 Complexities of hypothalamic-pituitary interactions | 71
4.5 Summary | 73

5 Neurotransmitters | 78
5.1 The neuron and the synapse | 78
5.2 Categories of neurotransmitters | 80
5.3 Neurotransmitter biosynthesis and storage | 88
5.4 Release of neurotransmitters | 92
5.5 Receptors for neurotransmitters | 94

- 5.6 Inactivation of neurotransmitters | 97
- 5.7 Neurotransmitter pathways | 97
- 5.8 Drugs influencing neurotransmitters, and their receptors, in the nervous system | 102
- 5.9 Can nutrients modify neurotransmitter levels and behavior? | 107
- 5.10 Divisions of the nervous system | 109
- 5.11 Summary | 114
- 6 Neurotransmitter and neuropeptide control of hypothalamic, pituitary and other hormones | 120**
 - 6.1 The cascade of chemical messengers | 120
 - 6.2 Neural control of hypothalamic neurosecretory cells | 120
 - 6.3 Neurotransmitter regulation of anterior pituitary hormone secretion | 124
 - 6.4 Neurotransmitter regulation of neurohypophyseal hormone secretion | 133
 - 6.5 Electrophysiology of neurosecretory cells | 135
 - 6.6 Neurotransmitter regulation of other endocrine glands | 135
 - 6.7 Complications in the study of neurotransmitter control of hypothalamic hormone release | 138
 - 6.8 Neuroendocrine correlates of psychiatric disorders and psychotropic drug treatment of these disorders | 141
 - 6.9 Glial cells and the regulation of hormone release | 142
 - 6.10 Summary | 150
- 7 Regulation of hormone synthesis, storage, release, transport and deactivation | 157**
 - 7.1 The chemical structure of hormones | 157
 - 7.2 Hormone synthesis | 159
 - 7.3 Storage and intracellular transport of hormones | 162
 - 7.4 Hormone release | 163
 - 7.5 Hormone transport | 164
 - 7.6 Deactivation of hormones | 166
 - 7.7 Methodology for neuroendocrine research | 166
 - 7.8 Summary | 168
- 8 Regulation of hormone levels in the bloodstream | 170**
 - 8.1 Analysis of hormone levels | 170
 - 8.2 Mechanisms regulating hormone levels | 174
 - 8.3 Hormonal modulation of neurotransmitter release | 183
 - 8.4 The cascade of chemical messengers revisited | 184

- 8.5 When hormone regulatory mechanisms fail | 186
- 8.6 Summary | 187

9 Steroid and thyroid hormone receptors | 192

- 9.1 The intracellular receptor superfamily | 193
- 9.2 How are steroid hormone target cells identified? | 196
- 9.3 How are steroid hormone target cells differentiated from non-target cells? | 198
- 9.4 Genomic and non-genomic actions of steroid hormones | 198
- 9.5 Measurement and regulation of hormone receptor numbers | 205
- 9.6 Gonadal steroid hormone target cells in the brain | 206
- 9.7 Adrenal steroid target cells in the brain | 210
- 9.8 Steroid hormone-induced changes in neurotransmitter release | 214
- 9.9 Functions of steroid hormone modulation of nerve cells | 215
- 9.10 Thyroid hormone receptors in the brain | 223
- 9.11 Summary | 225

10 Receptors for peptide hormones, neuropeptides and neurotransmitters | 236

- 10.1 Membrane receptors | 236
- 10.2 Signal transduction by G proteins | 240
- 10.3 Second messenger systems | 242
- 10.4 Interactions in second messenger systems | 248
- 10.5 Signal amplification | 249
- 10.6 Second messengers in the brain and neuroendocrine system | 249
- 10.7 Comparison of neurotransmitter/neuropeptide and steroid hormone actions at their target cells | 252
- 10.8 Summary | 253

11 Neuropeptides I: classification, synthesis and co-localization with classical neurotransmitters | 257

- 11.1 Classification of neuropeptides | 257
- 11.2 Synthesis, storage, release and deactivation of neuropeptides | 259
- 11.3 Exploring the relationships among neuropeptides, neurotransmitters and hormones | 261
- 11.4 Coexistence (co-localization) of neurotransmitters and neuropeptides | 266
- 11.5 Localization of neuropeptide cell bodies and pathways in the brain | 269
- 11.6 Neuropeptide receptors and second messenger systems | 272
- 11.7 Neuropeptides and the blood-brain barrier | 275
- 11.8 Summary | 278

12 Neuropeptides II: function | 286

- 12.1 Neurotransmitter and neuromodulator actions of neuropeptides: a dichotomy or a continuum? | 286
- 12.2 Neurotransmitter actions of neuropeptides | 287
- 12.3 Neuromodulator actions of neuropeptides | 293
- 12.4 Regulatory effects of neuropeptides on the neuroendocrine system | 299
- 12.5 Kisspeptin and GnRH as hypothalamic regulators of fertility | 300
- 12.6 Neuropeptides and the regulation of food intake and body weight | 302
- 12.7 Visceral, cognitive and behavioral effects of neuropeptides | 313
- 12.8 Summary | 332

13 Cytokines and the interaction between the neuroendocrine and immune systems | 351

- 13.1 The cells of the immune system | 351
- 13.2 The thymus gland and its hormones | 354
- 13.3 Cytokines: the messengers of the immune system | 356
- 13.4 The functions of cytokines in the immune and hematopoietic systems | 360
- 13.5 Effects of cytokines and other immunomodulators on the brain and neuroendocrine system | 364
- 13.6 Neural and endocrine regulation of the immune system | 374
- 13.7 Hypothalamic integration of the neuroendocrine and immune systems | 384
- 13.8 Summary | 387

14 Methods for the study of behavioral neuroendocrinology | 400

- 14.1 Behavioral bioassays | 400
- 14.2 Correlational studies of hormonal and behavioral changes | 403
- 14.3 Experimental studies I: behavioral responses to neuroendocrine manipulation | 407
- 14.4 Experimental studies II: neuroendocrine responses to environmental, behavioral and cognitive stimuli | 416
- 14.5 Neural and genomic mechanisms mediating neuroendocrine-behavior interactions | 424
- 14.6 Confounding variables in behavioral neuroendocrinology research | 434
- 14.7 Summary | 444

15 An overview of behavioral neuroendocrinology: present, past
and future | 458

15.1 The aim of this book | 458

15.2 The history of endocrinology and behavioral
neuroendocrinology | 460

15.3 The future of behavioral neuroendocrinology | 460

Index | 469