

# Contents

**Authors** .....iv

**Preface** .....xv

**1. Introduction to Endocrinology** .....1

*John D. Baxter, MD, & Ralff C. J. Ribeiro, MD, PhD*

The Endocrine System 1	Hormone Synthesis & Release 17
Paracrine & Autocrine Actions 3	Hormone Transport 17
Chemical Composition of Hormones 3	Steroid & Thyroid Hormones & Vitamin D 18
Vitamins & Hormones 4	Polypeptide Hormones 18
Hormones & Oncogenes 4	Metabolism & Elimination of Hormones 19
Hormones & the Immune System 5	Peptide Hormones 19
Eicosanoids: Prostaglandins, Thromboxanes, Leukotrienes, & Related Compounds 5	Steroid & Thyroid Hormones & Vitamin D 19
Mechanisms of Hormone Action 6	Catecholamine & Eicosanoid Metabolism 19
Hormone Receptors 6	Regulation of the Endocrine System 20
Regulation of Responsiveness to Hormones 7	Actions of Hormones 20
Interactions Between Hormone Response Systems 8	Developmental Effects 20
Classes of Hormone Action 8	Cell Growth & Cancer 20
Use of Receptors for Classifying Types of Hormone Action 9	Central Nervous System Effects 21
Classification of Hormones by the Types of Ligands: Agonists, Antagonists, Partial Agonists-Partial Antagonists, & Inactive Compounds 10	Effects on Metabolism 21
Endocrine & Nervous System Relationships:	Effects on Cardiovascular & Renal Function 21
Neuroendocrinology 11	Effects on Mineral & Water Metabolism 22
Neurotransmitters & Hormones 11	Effects on Skeletal Functions 22
Hypothalamic-Pituitary Relationships 11	Effects on Reproductive Function 22
Gene Expression in Endocrinology & Metabolism:	Release of Other Hormones 22
Molecular Basis for Function of the System & Genetic Endocrine Disease 13	Effects on Immunologic Functions 23
Evolution of the Endocrine System 14	Disorders of the Endocrine System 23
Cellular Control Networks & the Origins of Regulatory Chemicals 15	Endocrine Hypofunction 23
The Origins of Regulatory Proteins 15	Endocrine Hyperfunction 24
The Origins of Hormones 15	Defects in Sensitivity to Hormones 25
Intracellular Communication 16	Syndromes of Hormone Excess Due to Administration of Exogenous Hormone or Medication 26
Evolution of Genes Involved in the Endocrine System 16	Disorders of the Endocrine Glands not Associated With Endocrine Disease 27
Integrative Networks 16	Approach to the Patient With Endocrine Disease 27
Evolution of the Endocrine Glands 16	History & Physical Examination 27
	Laboratory Studies 28
	Screening for Endocrine Diseases 32
	Treatment of Endocrine Diseases 33
	Uses of Hormones in Therapy of Nonendocrine Disease 34

**2. Hormone Synthesis & Release** .....38

*Vishwanath R. Lingappa, MD, PhD, & Synthia H. Mellon, PhD*

Overview of Hormone Biosynthesis 38	Metabolism, Transport, Elimination, & Regulation of Hormones 55
Membrane Vesicle-Mediated Hormone Export 39	
Hormone Export not Mediated by Membrane Vesicles 49	

**3. Mechanisms of Hormone Action** .....59

*David G. Gardner, MD*

Receptors 59	G Protein Transducers 62
Neurotransmitter & Peptide Hormone Receptors 61	Effectors 63
Seven-Transmembrane Receptors 62	G Protein-Linked Receptors & Human Disease 66

Growth Factor Receptors 67  
 Cytokine Receptors 69  
 Guanylyl Cyclase-Linked Receptors 70  
 Nuclear Action of Peptide Hormones 71  
 Nuclear Receptors 72

Steroid Receptor Family 72  
 Thyroid Receptor Family 74  
 Nongenomic Effects of the Steroid Hormones 77  
 Steroid & Thyroid Hormone Receptor Resistance  
 Syndromes 77

**4. Endocrine Autoimmunity . . . . .80**  
*Juan Carlos Jaume, MD*

Basic Immune Components & Mechanisms 81  
 Immune Recognition & Response 81  
 Tolerance 85  
 Autoimmunity Is Multifactorial 90  
 Genetic Factors in Autoimmunity 90  
 Environmental Factors in Autoimmunity 90  
 Single Gland Autoimmune Syndromes 91  
 Autoimmune Aspects of Thyroid Disease 91  
 Autoimmune Aspects of Type 1 Diabetes 93

Autoimmune Aspects of Other  
 Endocrinopathies 95  
 Autoimmune Polyglandular Syndromes 97  
 Autoimmune Polyglandular Syndrome I  
 (APS-I) 97  
 Autoimmune Polyglandular Syndrome II  
 (APS-II) 98  
 Management of Autoimmune Polyglandular  
 Syndromes 98

**5. Hypothalamus & Pituitary . . . . .100**  
*David C. Aron, MS, MD, James W. Findling, MD, & J. Blake Tyrrell, MD*

Hypothalamic Hormones 105  
 Anterior Pituitary Hormones 110  
 ACTH & Related Peptides 110  
 Growth Hormone 112  
 Prolactin 114  
 Thyrotropin 116  
 Gonadotropins: Luteinizing Hormone,  
 Follicle-Stimulating Hormone 117  
 Endocrinologic Evaluation of the Hypothalamic-  
 Pituitary Axis 119  
 Evaluation of ACTH 120  
 Evaluation of Growth Hormone 121  
 Evaluation of Prolactin 122  
 Evaluation of TSH 122  
 Evaluation of LH & FSH 122  
 Problems in Evaluation of the Hypothalamic-  
 Pituitary Axis 122

Effects of Pharmacologic Agents on  
 Hypothalamic-Pituitary Function 123  
 Endocrine Tests of Hypothalamic-Pituitary  
 Function 123  
 Neuroradiologic Evaluation 123  
 Pituitary & Hypothalamic Disorders 126  
 Empty Sella Syndrome 128  
 Hypothalamic Dysfunction 129  
 Hypopituitarism 130  
 Pituitary Adenomas 136  
 Posterior Pituitary 151  
 Antidiuretic Hormone (ADH; Vasopressin) 151  
 Oxytocin 152  
 Control of Water Balance 152  
 Diabetes Insipidus 154  
 Syndrome of Inappropriate Secretion of  
 Antidiuretic Hormone (SIADH) 158

**6. Growth . . . . .163**  
*Dennis Styne, MD*

Normal Growth 163  
 Intrauterine Growth 163  
 The Placenta 164  
 Classic Hormones of Growth & Fetal Growth 164  
 Growth Factors & Oncogenes in Fetal Growth 164  
 Insulin-like Growth Factors, Receptors, &  
 Binding Proteins 164  
 Insulin 165  
 Epidermal Growth Factor 165  
 Fetal Origins of Adult Disease 166

Postnatal Growth 166  
 Measurement of Growth 176  
 Skeletal (Bone) Age 178  
 Disorders of Growth 178  
 Short Stature Due to Nonendocrine  
 Causes 178  
 Short Stature Due to Endocrine Disorders 184  
 The Diagnosis of Short Stature 195  
 Tall Stature Due to Nonendocrine Causes 196  
 Tall Stature Due to Endocrine Disorders 197

**7. The Thyroid Gland . . . . .201**  
*Francis S. Greenspan, MD, FACP*

Anatomy & Histology 202  
 Physiology 204  
 Structure of Thyroid Hormones 204  
 Iodine Metabolism 204  
 Thyroid Hormone Synthesis & Secretion 206  
 Abnormalities in Thyroid Hormone Synthesis &  
 Release 210  
 Thyroid Hormone Transport 210  
 Metabolism of Thyroid Hormones 213  
 Control of Thyroid Function 217  
 The Action of Thyroid Hormones 222  
 Physiologic Changes in Thyroid Function 225  
 Thyroid Autoimmunity 226  
 Tests of Thyroid Function 227

Tests of Thyroid Hormones in Blood 227  
 Evaluation of the Hypothalamic-Pituitary-  
 Thyroid Axis 228  
 Iodine Metabolism & Biosynthetic Activity 229  
 Thyroid Imaging 231  
 Thyroid Ultrasonography or Magnetic Resonance  
 Imaging 231  
 Thyroid Biopsy 232  
 Effects of Thyroid Hormones on Peripheral  
 Tissues 232  
 Measurement of Thyroid Autoantibodies 232  
 Summary: Clinical Use of Thyroid Function  
 Tests 233  
 Disorders of the Thyroid 233

Hypothyroidism 235  
 Hyperthyroidism & Thyrotoxicosis 242  
 Thyroid Hormone Resistance Syndromes 253  
 Nontoxic Goiter 254

Thyroiditis 256  
 Effects of Ionizing Radiation on the Thyroid Gland 258  
 Thyroid Nodules & Thyroid Cancer 260

**8. Mineral Metabolism & Metabolic Bone Disease** ..... **.273**  
*Dolores Shoback, MD, Robert Marcus, MD, Daniel Bikle, MD, PhD, & Gordon Strewler, MD*

Cellular & Extracellular Calcium Metabolism 273  
 Parathyroid Hormone 274  
 Calcitonin 279  
 Vitamin D 281  
 Integrated Control of Mineral Homeostasis 288  
 Medullary Thyroid Carcinoma 288  
 Hypercalcemia 288

Hypocalcemia 300  
 Bone Anatomy & Remodeling 306  
 Osteoporosis 310  
 Osteomalacia & Rickets 320  
 Paget's Disease of Bone (Osteitis Deformans) 326  
 Renal Osteodystrophy 329

**9. Glucocorticoids & Adrenal Androgens** ..... **.334**  
*David C. Aron, MD, MS, James W. Findling, MD, & J. Blake Tyrrell, MD*

Embryology & Anatomy 334  
 Biosynthesis of Cortisol & Adrenal Androgens 337  
 Circulation of Cortisol & Adrenal Androgens 342  
 Metabolism of Cortisol & Adrenal Androgens 342  
 Biologic Effects 343  
     Glucocorticoids 343  
     Adrenal Androgens 347  
     Laboratory Evaluation 347  
 Disorders of Adrenocortical Insufficiency 351  
     Primary Adrenocortical Insufficiency (Addison's Disease) 351

Secondary Adrenocortical Insufficiency 355  
 Diagnosis of Adrenocortical Insufficiency 355  
 Treatment of Adrenocortical Insufficiency 358  
 Prognosis of Adrenocortical Insufficiency 360  
 Cushing's Syndrome 360  
     Hirsutism & Virilism 371  
     Incidental Adrenal Mass 371  
     Glucocorticoid Therapy for Nonendocrine Disorders 373

**10. Endocrine Hypertension** ..... **.377**  
*Burl R. Don, MD, & Morris Schambelan, MD*

Hypertension of Adrenal Origin 377  
 Hypertension of Renal Origin 389

Other Hormone Systems & Hypertension 395

**11. Adrenal Medulla** ..... **.399**  
*Alan Goldfien, MD*

Anatomy 399  
 Hormones of the Adrenal Medulla 400  
     Catecholamines 400  
     Other Hormones 409

Disorders of Adrenal Medullary Function 410  
     Adrenal Medullary Hypofunction 410  
     Adrenal Medullary Hyperfunction 410  
 Pheochromocytoma 411

**12. Testes** ..... **.422**  
*Glenn D. Braunstein, MD*

Anatomy & Structure-Function Relationships 422  
     Testes 422  
     Accessory Structures 424  
 Physiology of the Male Reproductive System 424  
     Gonadal Steroids 424  
     Control of Testicular Function 426  
 Evaluation of Male Gonadal Function 428  
     Clinical Evaluation 428  
     Laboratory Tests of Testicular Function 428  
 Pharmacology of Drugs Used to Treat Male Gonadal Disorders 431  
     Androgens 431  
     Gonadotropins 433  
     Gonadotropin-Releasing Hormone 434

Clinical Male Gonadal Disorders 434  
     Klinefelter's Syndrome 434  
     Bilateral Anorchia 436  
     Leydig Cell Aplasia 437  
     Cryptorchidism 437  
     Noonan's Syndrome (Male Turner's Syndrome) 439  
     Myotonic Dystrophy 440  
     Adult Seminiferous Tubule Failure 440  
     Adult Leydig Cell Failure (Andropause) 441  
     Erectile Dysfunction (Impotence) 442  
     Male Infertility 444  
     Gynecomastia 446  
     Testicular Tumors 448

**13. Ovaries** ..... **.453**  
*Alan Goldfien, MD*

Anatomy of the Ovaries 453  
 Hormones of the Ovary 454  
     Steroid Hormones 454

Relaxin 460  
 Other Ovarian Hormones & Regulatory Substances 460

The Menstrual Cycle 461	Threatened Abortion 490
Hormonal Profiles During the Menstrual Cycle 461	Inadequate Luteal Phase 491
The Ovarian Cycle 463	Diagnostic Uses 491
Hormone Interaction & Regulation During the Menstrual Cycle 466	Inhibitors of Ovarian Function 491
Cyclic Changes in the Female Reproductive Tract 467	Gonadotropin-Releasing Hormone Analogs & Antagonists 491
Histology of the Endometrium Throughout the Menstrual Cycle 467	Selective Estrogen Receptor Modulators & Antiestrogens 491
Cervical Mucus 469	Danazol 492
Vaginal Epithelium 470	Antiprogestins 492
Extragenital Symptoms Associated With Normal Menstrual Function 471	Antiandrogens 492
Premenstrual Dysmorphic Disorder (Premenstrual Syndrome) 471	Menopause 493
Dysmenorrhea 472	Hormonal Changes 493
Disorders of Ovarian & Menstrual Function 473	Clinical Manifestations of Menopause 494
Amenorrhea in the Absence of Sexual Maturation 474	Management of Menopause 495
Amenorrhea in Patients With Normal Secondary Sex Characteristics 474	Hormonal Contraception (Oral Contraceptives) 498
Disorders of Androgen Metabolism 480	Pharmacologic Effects of Estrogens & Synthetic Progestins 498
Hirsutism 483	Clinical Uses of Oral Contraceptives 499
Anovulatory Bleeding 488	Adverse Effects of Oral Contraceptives 500
Ovulation Induction 488	Noncontraceptive Advantages of Hormonal Contraception 502
Clomiphene Citrate 488	Contraindications & Cautions 502
Human Menopausal Gonadotropins (Menotropins) 489	Drug Interactions With Oral Contraceptives 502
Gonadotropin-Releasing Hormone 490	Contraception With Progestins 503
Bromocriptine 490	Postcoital Contraceptives & Emergency Contraception 503
Therapeutic Use of Ovarian Hormones & Their Synthetic Analogs 490	Infertility 503
Treatment of Primary Hypogonadism 490	Semen Abnormalities 503
Ovarian Suppression 490	Ovulatory Disorders 504

**14. Abnormalities of Sexual Determination & Differentiation . . . . .509**  
*Felix A. Conte, MD, & Melvin M. Grumbach, MD*

Normal Sex Differentiation 509	Female Pseudohermaphroditism 527
Testicular & Ovarian Differentiation 515	P450 Aromatase Deficiency 531
Psychosexual Differentiation 517	Maternal Androgens & Progestogens 531
Abnormal Sex Differentiation 519	Male Pseudohermaphroditism 531
Seminiferous Tubule Dysgenesis: Chromatin-Positive Klinefelter's Syndrome & Its Variants 520	Unclassified Forms of Abnormal Sexual Development in Males 540
Syndrome of Gonadal Dysgenesis: Turner's Syndrome & Its Variants 522	Unclassified Forms of Abnormal Sexual Development in Females 542
46,XX & 46,XY Gonadal Dysgenesis 524	Management of Patients With Intersex Problems 542
True Hermaphroditism 526	

**15. Puberty . . . . .547**  
*Dennis Styne, MD*

Physiology of Puberty 547	Precocious Puberty (Sexual Precocity) 566
Delayed Puberty or Absent Puberty (Sexual Infantilism) 556	

**16. The Endocrinology of Pregnancy . . . . .575**  
*Robert N. Taylor, MD, PhD, Dan I. Lebovic, MD, & Mary C. Martin-Cadieux, MD*

Conception & Implantation 575	Endocrine Disorders & Pregnancy 589
Fetal-Placental-Decidual Unit 576	Pregnancy & Pituitary Pathology 589
Polypeptide Hormones 577	Pregnancy & Breast Cancer 590
Steroid Hormones 580	Hypertensive Disorders of Pregnancy 591
Maternal Adaptation to Pregnancy 581	Hyperthyroidism in Pregnancy 592
Fetal Endocrinology 584	Hypothyroidism in Pregnancy 593
Endocrine Control of Parturition 586	Diabetes Mellitus & Pregnancy 593
Endocrinology of the Puerperium 587	(by John L. Kitzmiller, MD)

**17. Regulatory Peptides of the Gut . . . . . 603***Sean J. Mulvihill, MD, & Haile T. Debas, MD*

- |  |  |
|--|--|
| Gastrin 607                              | Abnormalities of Regulatory Peptides in Diseases of the Gastrointestinal Tract 614 |
| Cholecystokinin 608                      | Duodenal Ulcer 614   |
| Secretin 609                             | Motility Disorders of the Gastrointestinal Tract 615                               |
| Somatostatin 609                         | Inflammatory Bowel Disease 615   |
| Bombesin & Gastrin-Releasing Peptide 610 | Neuroendocrine Tumors of the Gut 616   |
| Calcitonin Gene-Related Peptide 611      | Multiple Endocrine Neoplasia Syndromes 616   |
| Gastric Inhibitory Peptide 611           | Zollinger-Ellison Syndrome 616   |
| Vasoactive Intestinal Peptide 611        | VIPoma 617   |
| Galanin 612                              | Glucagonoma 617  |
| Substance P 612                          | Carcinoid Tumors & Carcinoid Syndrome 617  |
| Enkephalins 612                          | Miscellaneous Tumors 618   |
| Neurotensin 613                          | Minimally Invasive Approaches to Gut Endocrine Tumors 619                          |
| Motilin 613                              | Clinical Uses of Gut Peptides 619  |
| Pancreatic Polypeptide Family 614        |  |
| Enteroglucagon 614                       |  |

**18. Pancreatic Hormones & Diabetes Mellitus . . . . . 623***Umesh Masharani, MRCP(UK), & John H. Karam, MD*

- |  |   |
|--|---|
| The Endocrine Pancreas 623                   | Intravenous Glucose Tolerance Test 648                  |
| Anatomy & Histology 623                      | Treatment of Diabetes Mellitus 648                      |
| Hormones of the Endocrine Pancreas 624       | Diet 651  |
| Diabetes Mellitus 633                        | Oral Agents for the Treatment of Hyperglycemia 653      |
| Classification 633                           | Insulin 661   |
| Type 1 Diabetes Mellitus 633                 | Steps in the Management of the Diabetic Patient 666     |
| Type 2 Diabetes 636                          | Acute Complications of Diabetes Mellitus 675            |
| Other Specific Types of Diabetes 638         | Hypoglycemia 675  |
| Clinical Features of Diabetes Mellitus 641   | Coma 678  |
| Type 1 Diabetes 641                          | Chronic Complications of Diabetes Mellitus 686          |
| Type 2 Diabetes 642                          | Specific Chronic Complications of Diabetes Mellitus 688 |
| Laboratory Findings in Diabetes Mellitus 643 | Surgery in the Diabetic Patient 694                     |
| Urinalysis 643                               | Diabetics Regulated by Diet Alone 694                   |
| Blood Glucose Testing 644                    | Diabetics Taking Oral Hypoglycemic Agents 694           |
| Serum Ketone Determinations 645              | Diabetics Taking Insulin 694                            |
| Glycosylated Hemoglobin Assays 645           | Prognosis for Patients With Diabetes Mellitus 695       |
| Capillary Morphometry 646                    |   |
| Lipoproteins in Diabetes 646                 |   |
| Diagnosis of Diabetes Mellitus 647           |   |
| Oral Glucose Tolerance Test 647              |   |
| Insulin Levels 648                           |   |

**19. Hypoglycemic Disorders . . . . . 699***John H. Karam, MD*

- |  |  |
|--|--|
| Pathophysiology of the Counterregulatory Response to Neuroglycopenia 699 | Symptomatic Fasting Hypoglycemia Without Hyperinsulinism 712 |
| Classification of Hypoglycemic Disorders 703                             | Nonfasting Hypoglycemia (Reactive Hypoglycemia) 713          |
| Clinical Presentation of Hypoglycemia 704                                |  |
| Specific Hypoglycemic Disorders 706                                      |  |
| Symptomatic Fasting Hypoglycemia With Hyperinsulinism 706                |  |

**20. Disorders of Lipoprotein Metabolism . . . . . 716***Mary J. Malloy, MD, & John P. Kane, MD, PhD*

- |  |  |
|--|--|
| Atherosclerosis 716  | LP(a) Hyperlipoproteinemia 732   |
| Overview of Lipid Transport 717  | Familial Ligand-Defective Apo B 732                                      |
| Differentiation of Disorders of Lipoprotein Metabolism 722                           | Secondary Hypercholesterolemia 732                                       |
| Clinical Descriptions of Primary & Secondary Disorders of Lipoprotein Metabolism 724 | Hypothyroidism 732   |
| The Hypertriglyceridemias 724  | Nephrosis 733  |
| Primary Hypertriglyceridemia 725   | Immunoglobulin Disorders 733   |
| Secondary Hypertriglyceridemia 727   | Anorexia Nervosa 733   |
| The Primary Hypercholesterolemias 731  | Cholestasis 733  |
| Familial Hypercholesterolemia 731  | The Primary Hypolipidemias 733   |
| Familial Combined Hyperlipidemia 732   | Primary Hypolipidemia Due to Deficiency of High-Density Lipoproteins 734 |

Primary Hypolipidemia Due to Deficiency of  
Apo B-Containing Lipoproteins 735  
Secondary Hypolipidemia 736  
Other Disorders of Lipoprotein Metabolism 736  
The Lipodystrophies 736  
Rare Disorders 737  
Treatment of Hyperlipidemia 737  
Dietary Factors in the Management of  
Lipoprotein Disorders 738

Drugs Used in Treatment of  
Hyperlipoproteinemia 739  
Bile Acid Sequestrants 739  
Niacin (Nicotinic Acid) 740  
Fibric Acid Derivatives 741  
HMG-CoA Reductase Inhibitors 741  
Combined Drug Therapy 742  
Possible Untoward Consequences of  
Lipid-Lowering Therapy 743

## 21. Obesity & Overweight . . . . .745

*Marc K. Hellerstein, MD, PhD, & Elizabeth J. Parks, PhD*

Controversies & Uncertainties Regarding the  
Pathogenesis of Obesity 754  
Survey of Treatment Approaches & Their  
Efficacy 755  
Dietary Therapies 755  
Surgical Treatment of Obesity 756  
Pharmacologic Therapies 756  
Other Conditions Affected by Treatment of Obesity  
or Overweight 759

Type 2 Diabetes Mellitus 759  
Hyperlipidemia 759  
Polycystic Ovarian Syndrome 759  
Hypertension 759  
Gallstones 759  
Osteoarthritis & Other Weight-Sensitive  
States 759  
A Systematic Approach to the Treatment of  
Obesity 759

## 22. Hormones & Cancer . . . . .762

*Debasish Tripathy, MD, & Christopher C. Benz, MD*

Hormonal Effects on Tumors 762  
Growth Promotion & Malignant  
Transformation 762  
Tumor Growth Mediated by Autocrine & Paracrine  
Factors 764  
Steroid-Dependent Tumors 765  
Tumors Affecting Endocrine Status 765  
Nonsecretory Tumors 765  
Secretory Tumors 765  
Treatment-Induced Endocrinopathy 766  
Endocrine Therapy for Cancer 767

Steroid Receptors & Treatment 767  
Primary Modalities of Endocrine  
Intervention 768  
Combination Endocrine Therapy 769  
Chemo-Endocrine Therapy 770  
Clinical Problems 770  
Breast Cancer in Women 770  
Breast Cancer in Men 774  
Endometrial Cancer 774  
Prostatic Cancer 775  
Miscellaneous Tumors 776

## 23. Humoral Manifestations of Malignancy . . . . .778

*Dolores Shoback, MD, & Janet Funk, MD*

Ectopic Hormone & Receptor Syndromes 778  
Hypercalcemia of Malignancy 779  
Ectopic Cushing's Syndrome 783  
Syndrome of Inappropriate ADH (SIADH)  
Secretion 785  
Non-Islet Cell Tumors & Hypoglycemia 786

Other Hormones Secreted by Tumors 787  
Oncogenic Osteomalacia 788  
Gut Hormones 789  
Erythropoietin 789  
Renin 789

## 24. Multiple Endocrine Neoplasia . . . . .792

*David G. Gardner, MD*

Multiple Endocrine Neoplasia Type 1  
(MEN 1) 792

Multiple Endocrine Neoplasia Type 2  
(MEN 2) 797

## 25. Geriatric Endocrinology . . . . .802

*Susan L. Greenspan, MD, & Neil M. Resnick, MD*

Thyroid Function & Disease 802  
Disorders of the Thyroid Gland 803  
Carbohydrate Intolerance & Diabetes Mellitus 805  
Aging & the Physiology of Carbohydrate  
Intolerance 805  
Diabetes Mellitus 806  
Nonketotic Hyperosmolar Coma 808  
Osteoporosis & Calcium Homeostasis 808  
Osteoporosis 808  
Hyperparathyroidism 815

Changes in Water Balance 816  
Hypernatremia 816  
Hyponatremia 816  
Hyporeninemic Hypoaldosteronism 816  
Glucocorticoids & Stress 817  
Disorders of the Hypothalamic-Pituitary-Adrenal  
Axis 817  
Changes in Reproductive Function in Men 818  
Benign Prostatic Hyperplasia 819

<b>26. Endocrine Emergencies</b> .....		<b>.823</b>
	<i>David G. Gardner, MD, &amp; Francis S. Greenspan, MD</i>	
Myxedema Coma 823	Diabetic Ketoacidosis 829	
Thyroid Storm 824	Nonketotic Hyperosmolar Coma 832	
Thyrotoxic Periodic Paralysis 825	Hypercalcemic Crisis 835	
Amiodarone Induced Thyrotoxicosis 826	Acute Hypocalcemia 837	
Acute Adrenal Insufficiency 827	Hyponatremia 839	
Pituitary Apoplexy 828	Diabetes Insipidus 841	
<b>27. AIDS Endocrinopathies</b> .....		<b>.846</b>
	<i>Deborah E. Sellmeyer, MD, &amp; Carl Grunfeld, MD, PhD</i>	
Thyroid Disorders 846	Pituitary Disorders 850	
Adrenal Disorders 847	Pancreatic Disorders 850	
Bone & Mineral Disorders 849	Lipid Disorders 851	
Gonadal Disorders 849	Conclusion 851	
<b>Appendix: Table of Normal Hormone Reference Ranges</b> .....		<b>.853</b>
<b>Index</b> .....		<b>.867</b>