

CONTENTS

UNIT I Pathophysiologic Processes

1 Introduction to Pathophysiology, 1

Lee-Ellen Charlotte Kirkhorn

- Framework for Pathophysiology, 2
- Concepts of Normality in Health and Disease, 4
- Patterns of Disease in Populations, 6

2 Homeostasis, Allostasis, and Adaptive Responses to Stressors, 12

Debra A. Jansen, Roberta J. Emerson

- Homeostasis and Allostasis, 12
- Stress as a Concept, 13
- Neurohormonal Mediators of Stress and Adaptation, 17
- Adaptation, Coping, and Illness, 20

UNIT II Cellular Function

3 Cell Structure and Function, 27

Brianne Nicole Banasik, Jacquelyn Banasik

- Plasma Membrane, 28
- Organization of Cellular Compartments, 31
- Cellular Metabolism, 36
- Functions of the Plasma Membrane, 40
- Intercellular Communication and Growth, 49

4 Cell Injury, Aging, and Death, 62

Jacquelyn Banasik

- Reversible Cell Injury, 62
- Cellular Adaptation, 66
- Irreversible Cell Injury, 67
- Etiology of Cellular Injury, 71
- Cellular Aging, 77
- Somatic Death, 78

5 Genome Structure, Regulation, and Tissue Differentiation, 80

Brent Andrew Banasik

- Structure and Function of Deoxyribonucleic Acid, 81
- Regulation of the Genome, 87
- Differentiation of Tissues, 89

6 Genetic and Developmental Disorders, 97

Brent Andrew Banasik

- Principles of Inheritance, 98

Genetic Disorders, 101

- Chromosomal Abnormalities, 102
- Mendelian Single-Gene Disorders, 105
- Nonmendelian Single-Gene Disorders, 109
- Polygenic and Multifactorial Disorders, 113
- Environmentally Induced Congenital Disorders, 114
- Diagnosis, Counseling, and Gene Therapy, 116

7 Neoplasia, 120

Joni D. Marsh

- Benign Versus Malignant Growth, 121
- Epidemiology and Cancer Risk Factors, 122
- Genetic Mechanisms of Cancer, 125
- Multistep Nature of Carcinogenesis, 131
- Invasion and Metastasis, 134
- Effects of Cancer on the Body, 138
- Cancer Therapy, 140

UNIT III Defense

8 Infectious Processes, 146

Jeffrey S. Sartin

- Host–Microbe Relationship, 146
- Transmission of Infection, 151
- Types of Pathogenic Organisms, 154

9 Inflammation and Immunity, 163

Jacquelyn Banasik

Components of the Immune System, 164

- Epithelial Barriers, 164
- Mononuclear Phagocyte System, 164
- Lymphoid System, 165
- Leukocytes, 166
- Chemical Mediators of Immune Function, 173

Innate Defenses and Inflammation, 176

- Inflammation, 177
- Healing, 181
- Inflammatory Exudates, 182
- Systemic Manifestations of Inflammation, 182

Specific Adaptive Immunity, 183

- Major Histocompatibility Complex, 183
- Antigen Presentation by Major Histocompatibility Complex, 183
- Mechanisms of Cell-Mediated Immunity, 186
- Mechanisms of Humoral Immunity, 187
- Antibody Structure, 189
- Passive and Active Immunity, 192

Integrated Function and Regulation of the Immune System, 195

- Integrated Response to Microbial Antigen, 196
- Integrated Response to Viral Antigen, 197
- Regulation of Immune Function, 198

10 Alterations in Immune Function, 200

Carol L. Danning

Excessive Immune Responses, 201

- Autoimmunity, 201
- Hypersensitivity, 204

Deficient Immune Responses, 216

- Primary Immunodeficiency Disorders, 216
- Secondary Immunodeficiency Disorders, 219

11 Malignant Disorders of White Blood Cells, 222

Joni D. Marsh

- Classification of Hematologic Neoplasms, 222
- Etiology of Myeloid and Lymphoid Neoplasms, 223
- General Principles of Management, 225
- Myeloid Neoplasms, 228
- Lymphoid Neoplasms, 230

12 HIV Disease and AIDS, 240

Faith Young Peterson

- Epidemiology, 241
- Etiology, 246
- Pathogenesis, 249
- Diagnostic Testing, 253
- Monitoring the Progression of HIV, 254
- Clinical Manifestations, 255
- Treatment, 263

Unit IV Oxygen Transport, Blood Coagulation, Blood Flow, and Blood Pressure

- 13 Alterations in Oxygen Transport, 269**
Marie Kotter
 Composition of Blood, 270
 Structure and Function of Red Blood Cells, 275
 Gas Transport and Acid–Base Balance, 279
 Anemia, 284
 Anemia Related To Decreased Red Cell Production, 284
 Anemia Related to Inherited Disorders of the Red Cell, 290
 Anemia Related to Extrinsic Red Cell Destruction or Loss, 294
 Transfusion Therapy, 297
 Polycythemia, 297
- 14 Alterations in Hemostasis and Blood Coagulation, 304**
Jacquelyn Banasik
 The Process of Hemostasis, 304
 Evaluation of Hemostasis and Coagulation, 306
 Vascular and Platelet Disorders, 309
 Coagulation Disorders, 314
- 15 Alterations in Blood Flow, 319**
Jacquelyn Banasik
 Organization of the Circulatory and Lymphatic Systems, 321
 Principles of Flow, 323
 Control of Flow, 328
 General Mechanisms That Cause Altered Flow, 329
 Alterations in Arterial Flow, 332
 Alterations in Venous Flow, 338
 Alterations in Lymphatic Flow, 339
- 16 Alterations in Blood Pressure, 343**
Benjamin J. Miller
 Arterial Blood Pressure, 343
 Mechanisms of Blood Pressure Regulation, 347
 Hypertension, 349
 Low Blood Pressure, 357

UNIT V Cardiac Function

- 17 Cardiac Function, 361**
Jacquelyn Banasik
 Cardiovascular Anatomy, 362
 Cardiac Cycle, 364
 Coronary Circulation, 367
 Cardiac Myocytes, 369
 Molecular Basis of Contraction, 373
 Cardiac Energy Metabolism, 375
 Cardiac Electrophysiology, 376
 Electrocardiography, 379
 Determinants of Cardiac Output, 381
 Endocrine Function of the Heart, 383
 Tests of Cardiac Function, 383
- 18 Alterations in Cardiac Function, 389**
Benjamin J. Miller
 Coronary Heart Disease, 390
 Endocardial and Valvular Diseases, 401
 Myocardial Diseases, 407
 Pericardial Diseases, 409
 Congenital Heart Diseases, 410

- 19 Heart Failure and Dysrhythmias: Common Sequelae of Cardiac Diseases, 420**
Benjamin J. Miller
 Heart Failure, 421
 Cardiac Dysrhythmias, 431
- 20 Shock, 443**
Benjamin J. Miller
 Pathogenesis of Shock, 443
 Types of Shock, 448
 Assessment and Hemodynamic Monitoring, 456
 Complications of Shock, 458

UNIT VI Respiratory Function

- 21 Respiratory Function and Alterations in Gas Exchange, 461**
Benjamin J. Miller
 Functional Anatomy, 462
 Ventilation, 469
 Pulmonary Blood Flow, 473
 Diffusion and Transport of Respiratory Gases, 476
 Alterations in Pulmonary Function, 478
 Diagnostic Tests, 481
 Alterations in Pulmonary Vasculature, 481
 Pulmonary Malignancies, 484
- 22 Obstructive Pulmonary Disorders, 487**
Benjamin J. Miller
 Obstruction From Conditions in the Wall of the Lumen, 488
 Obstruction Related to Loss of Lung Parenchyma, 498
 Obstruction of the Airway Lumen, 500
- 23 Restrictive Pulmonary Disorders, 508**
Benjamin J. Miller
 Lung Parenchyma Disorders, 509
 Atelectatic Disorders, 514
 Pleural Space Disorders, 518
 Neuromuscular, Chest Wall, and Obesity Disorders, 521
 Infection or Inflammation of the Lung, 524

UNIT VII Fluid, Electrolyte, and Acid-Base Homeostasis

- 24 Fluid and Electrolyte Homeostasis and Imbalances, 531**
Linda Felver
 Body Fluid Homeostasis, 532
 Fluid Imbalances, 535
 Principles of Electrolyte Homeostasis, 539
 Electrolyte Imbalances, 541
- 25 Acid–Base Homeostasis and Imbalances, 551**
Linda Felver
 Acid–Base Homeostasis, 551
 Acid–Base Imbalances, 555

UNIT VIII Renal and Bladder Function

- 26 Renal Function, 561**
Jacquelyn Banasik
 Renal Anatomy, 562
 Overview of Nephron Structure and Function, 564
 Regulation of Glomerular Filtration, 569
 Transport Across Renal Tubules, 574

- Regulation of Blood Volume and Osmolality, 577
- Endocrine Functions, 579
- Age-Related Changes in Renal Function, 580
- Tests of Renal Structure and Function, 580

27 Intrarenal Disorders, 584

Kristen Childress

- Common Manifestations of Kidney Disease, 584
- Congenital Abnormalities, 586
- Neoplasms, 588
- Infection, 590
- Obstruction, 592
- Glomerular Disorders (Glomerulopathies), 595

28 Acute Kidney Injury and Chronic Kidney Disease, 603

Kristen Childress

- Acute Kidney Injury, 603
- Chronic Kidney Disease, 610
- Clinical Management, 613

29 Disorders of the Lower Urinary Tract, 620

Cheryl L. Brandt

- Lower Urinary Tract, 620
- Lower Urinary Tract Symptoms and Syndromes, 622
- Neurogenic Bladder, 625
- Congenital Disorders, 626
- Neoplasms, 628
- Inflammation and Infection, 630
- Obstruction, 632

UNIT IX Genital and Reproductive Function

30 Male Genital and Reproductive Function, 636

Michael Grodesky

- Anatomy, 636
- Embryology, 641
- Male Reproductive Physiology, 644

31 Alterations in Male Genital and Reproductive Function, 651

Michael Grodesky

- Disorders of the Penis and Male Urethra, 651
- Disorders of the Scrotum and Testes, 658
- Disorders of the Prostate, 661

32 Female Genital and Reproductive Function, 667

Rosemary A. Jadack

- Reproductive Structures, 667
- Menstrual Cycle, 669
- Breast, 673
- Pregnancy, 674
- Menopause, 679

33 Alterations in Female Genital and Reproductive Function, 682

Rosemary A. Jadack

- Menstrual Disorders, 683
- Alterations in Uterine Position and Pelvic Support, 685
- Inflammation and Infection of the Female Reproductive Tract, 687
- Benign Growths and Aberrant Tissue of the Female Reproductive Tract, 689
- Cancer of the Female Genital Structures, 691
- Disorders of Pregnancy, 693
- Disorders of the Breast, 694

34 Sexually Transmitted Infections, 701

Rosemary A. Jadack

- Urethritis, Cervicitis, Salpingitis, and Pelvic Inflammatory Disease, 702
- Diseases With Systemic Involvement, 703
- Diseases With Localized Lesions, 706
- Enteric Infections, 707

UNIT X Gastrointestinal Function

35 Gastrointestinal Function, 709

Jeffrey S. Sartin

- Structure and Organization of the Gastrointestinal Tract, 710
- Gastrointestinal Motility, 715
- Secretory Function, 723
- Digestion and Absorption, 724
- Gastrointestinal Function Across the Life Span, 728

36 Gastrointestinal Disorders, 732

Jeffrey S. Sartin

- Manifestations of Gastrointestinal Tract Disorders, 733
- Disorders of the Mouth and Esophagus, 736**
 - Oral Infections, 736
 - Esophageal Disorders, 736
- Alterations in the Integrity of the Gastrointestinal Tract Wall, 738**
 - Inflammation of the Stomach and Intestines, 738
 - Inflammatory Bowel Disease, 741
 - Enterocolitis, 743

Alterations in Motility and Malabsorption of the Gastrointestinal Tract, 745

- Motility Disorders, 745
- Mucosal Malabsorption Disorders, 747
- Malabsorption Disorders After Surgical Intervention, 748

Neoplasms of the Gastrointestinal Tract, 749

- Esophageal, Gastric, and Small Intestinal Cancers, 749
- Colonic Polyps and Colon Cancer, 750
- Psychosocial Aspects of Gastrointestinal Disorders, 752

37 Alterations in Function of the Gallbladder and Exocrine Pancreas, 755

Jeffrey S. Sartin

- Structure and Function of the Pancreaticobiliary System, 755
- Embryology of the Pancreaticobiliary System, 755
- Physiology of Bile, 756
- Functional Anatomy of the Pancreas, 756
- Disorders of the Gallbladder, 757
- Disorders of the Pancreas, 761

38 Liver Diseases, 767

Jeffrey S. Sartin

- Structure and Function of the Liver, 768
- General Manifestations of Liver Disease, 770
- Disorders of the Liver, 780
- Cirrhosis, 786
- Toxic Liver Disorders, 787
- Other Structural Liver Conditions, 789
- Transplantation, 790
- Liver Diseases and Pediatric Considerations, 792
- Liver Diseases and Geriatric Considerations, 794

UNIT XI Endocrine Function, Metabolism, and Nutrition

39 Endocrine Physiology and Mechanisms of Hypothalamic-Pituitary Regulation, 797

Jacquelyn Banasik

- Hormone Structure and Action, 798
- Hormone Regulation, 800
- Hypothalamic-Pituitary Endocrine System, 802
- Thyroid Hormones, 807
- Steroid Hormones, 808
- Categories of Endocrine Disease, 811

40 Disorders of Endocrine Function, 813

Jacquelyn Banasik

- Basic Concepts of Endocrine Disorders, 813
- Growth Hormone Disorders, 815
- Thyroid Hormone Disorders, 817
- Adrenocortical Hormone Disorders, 820
- Adrenal Medulla Disorder, 824
- Parathyroid Gland Disorders, 825
- Antidiuretic Hormone Disorders, 826

41 Diabetes Mellitus, 830

Benjamin J. Miller

- Regulation of Glucose Metabolism, 831
- Glucose Intolerance Disorders, 835
- Clinical Manifestations and Complications, 840
- Treatment and Education, 842
- Pediatric Considerations, 849
- Geriatric Considerations, 850

42 Alterations in Metabolism and Nutrition, 854

Brent Andrew Banasik

- Metabolic Processes, 854
- Nutrient Metabolism, 855
- Regulation of Appetite and Nutrient Metabolism, 857
- Obesity and Metabolic Syndrome, 860
- Metabolic Responses to Starvation and Physiologic Stress, 860
- Nutritional Considerations for Aging and Altered Health States, 862

UNIT XII Neural Function

43 Structure and Function of the Nervous System, 866

Jacquelyn Banasik

Structural Organization, 867

- Central Nervous System, 867
- Peripheral Nervous System, 877
- Autonomic Nervous System, 879

Neuronal Structure and Function, 883

- Neurons and Supportive Cells, 883
- Neuronal Communication, 886
- Neural Development, Aging, and Injury, 894

Sensory Function, 898

- Sensory Receptors, 898
- Sensory Pathways, 899
- Somatosensory Cortex, 899

Motor Function, 899

- Motor Neurons, 899
- Spinal Reflexes, 901
- Central Control of Motor Function, 901

Consciousness, Memory, and Sleep, 903

- Consciousness and Memory, 903
- Sleep, 905

44 Acute Disorders of Brain Function, 907

Dean A. Hamilton, Jacquelyn Banasik

- Mechanisms of Brain Injury, 908
- Manifestations of Brain Injury, 916

Traumatic Brain Injury, 918

- Epidemiology, 919
- Types of Traumatic Brain Injury, 919
- Primary Injury, 919
- Secondary Injury, 921
- Treatment, 921

Cerebrovascular Disease and Stroke, 922

- Epidemiology, 922
- Ischemic Stroke, 922
- Hemorrhagic Stroke, 924
- Treatment, 925
- Stroke Sequelae, 925

Cerebral Aneurysm and Arteriovenous Malformation, 927

- Cerebral Aneurysms, 927
- Arteriovenous Malformation, 928

Central Nervous System Infections, 929

- Meningitis, 929
- Encephalitis, 930
- Brain Abscess, 931

45 Chronic Disorders of Neurologic Function, 934

Daniel D. Cline

- Brain and Cerebellar Disorders, 935
- Spinal Cord and Peripheral Nerve Disorders, 945

46 Alterations in Special Sensory Function, 957

Joni D. Marsh

Hearing and Balance, 958

- Structure and Function of the Ear, 958
- General Manifestations Of Hearing Impairment, 959
- Hearing Impairment Disorders, 960
- Otitis Media, 962
- Interventions for Individuals With Hearing Impairment, 963

Vision, 963

- Structure of the Eye, 963
- Visual Pathways, 964
- General Manifestations of Visual Impairment, 965
- Disorders of the Eye, 965
- Interventions for Individuals With Vision Impairment, 971

Smell and Taste, 972

47 Pain, 976

Joni D. Marsh

- Physiology of Pain, 976

Types of Pain, 982

- Acute Pain, 982
- Chronic Pain, 984
- Cancer-Related Pain, 986
- Neuropathic Pain, 986
- Ischemic Pain, 987
- Referred Pain, 987
- Physiologic Responses to Pain, 987
- Pain in the Young and the Elderly, 988

Treatment Modalities, 988

- Pharmacologic and Nonpharmacologic Pain Management, 988

UNIT XIII Neuropsychological Function

48 Neurobiology of Psychotic Illnesses, 991

Carrie Holliday

- Schizophrenia, 992
- Major Depressive and Persistent Depressive Disorders, 998
- Bipolar Disorder, 1002
- Population Considerations, 1004

49 Neurobiology of Nonpsychotic Illnesses, 1009

Carrie Holliday

- Anxiety Disorders, 1009
- Neurodevelopmental Disorders, 1015

Unit XIV Musculoskeletal Support and Movement

50 Structure and Function of the Musculoskeletal System, 1021

Carol L. Danning

- Structure and Function of Bone, 1022
- Structure and Function of Joints, 1026
- Structure and Function of Articular Cartilage, 1031
- Structure and Function of Tendons and Ligaments, 1032
- Structure and Function of Skeletal Muscle, 1033
- Mechanics of Muscle Contraction, 1035

51 Alterations in Musculoskeletal Function: Trauma, Infection, and Disease, 1040

Carol L. Danning

Soft Tissue Injuries, 1041

- Inert Soft Tissue Injuries, 1041
- Contractile Soft Tissue Injuries, 1043

Bone Injuries and Infections, 1045

- Bone and Joint Trauma, 1045
- Infections of the Bone, 1050

Alterations in Bone Structure and Mass, 1052

- Bone Structure Disorders, 1052
- Metabolic Bone Diseases, 1053
- Bone Tumors, 1056

Diseases of Skeletal Muscle, 1058

- Idiopathic Inflammatory Myopathy, 1058
- Muscular Dystrophy, 1059

Other Disorders of Muscle, 1059

- Myasthenia Gravis, 1059
- Chronic Muscle Pain, 1060

52 Alterations in Musculoskeletal Function: Rheumatic Disorders, 1062

Carol L. Danning

- Local Disorders of Joint Function, 1062
- Systemic Disorders of Joint Function, 1066
- Joint Dysfunction Secondary to Other Diseases, 1074
- Pediatric Joint Disorders, 1077

UNIT XV Integumentary System

53 Alterations in the Integumentary System, 1080

Lee-Ellen Charlotte Kirkhorn

- Age-Related Changes, 1081
- Evaluation of the Integumentary System, 1084

Selected Skin Disorders, 1084

- Infectious Processes, 1085
- Inflammatory Conditions, 1088
- Allergic Skin Responses, 1094
- Parasitic Infestations, 1097
- Other Disorders of the Dermis, 1099
- Special Characteristics of Dark Skin, 1103
- Integumentary Manifestations of Systemic Disease, 1103
- Treatment Implications, 1108
- Developmental Considerations, 1109

54 Burn Injuries, 1115

Sarah Ogle, Nirav Patel

- Thermal Injury, 1116
- Electrical Injury, 1128
- Chemical Injury, 1130
- Special Populations, 1131

Glossary, 1136

Index, 1167