

Guyton and Hall Textbook of Medical Physiology

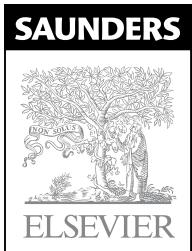
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TWELFTH EDITION

Guyton and Hall Textbook of Medical Physiology

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TEXTBOOK OF MEDICAL PHYSIOLOGY

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To
My Family

For their abundant support, for their patience and
understanding, and for their love

To
Arthur C. Guyton

For his imaginative and innovative research
For his dedication to education
For showing us the excitement and joy of physiology
And for serving as an inspirational role model

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Preface

The first edition of the *Textbook of Medical Physiology* was written by Arthur C. Guyton almost 55 years ago. Unlike most major medical textbooks, which often have 20 or more authors, the first eight editions of the *Textbook of Medical Physiology* were written entirely by Dr. Guyton, with each new edition arriving on schedule for nearly 40 years. The *Textbook of Medical Physiology*, first published in 1956, quickly became the best-selling medical physiology textbook in the world. Dr. Guyton had a gift for communicating complex ideas in a clear and interesting manner that made studying physiology fun. He wrote the book to help students learn physiology, not to impress his professional colleagues.

I worked closely with Dr. Guyton for almost 30 years and had the privilege of writing parts of the 9th and 10th editions. After Dr. Guyton's tragic death in an automobile accident in 2003, I assumed responsibility for completing the 11th edition.

For the 12th edition of the *Textbook of Medical Physiology*, I have the same goal as for previous editions—to explain, in language easily understood by students, how the different cells, tissues, and organs of the human body work together to maintain life.

This task has been challenging and fun because our rapidly increasing knowledge of physiology continues to unravel new mysteries of body functions. Advances in molecular and cellular physiology have made it possible to explain many physiology principles in the terminology of molecular and physical sciences rather than in merely a series of separate and unexplained biological phenomena.

The *Textbook of Medical Physiology*, however, is not a reference book that attempts to provide a compendium of the most recent advances in physiology. This is a book that continues the tradition of being written for students. It focuses on the basic principles of physiology needed to begin a career in the health care professions, such as medicine, dentistry and nursing, as well as graduate studies in the biological and health sciences. It should also be useful to physicians and health care professionals who wish to review the basic principles needed for understanding the pathophysiology of human disease.

I have attempted to maintain the same unified organization of the text that has been useful to students in the past and to ensure that the book is comprehensive enough that students will continue to use it during their professional careers.

My hope is that this textbook conveys the majesty of the human body and its many functions and that it stimulates students to study physiology throughout their careers. Physiology is the link between the basic sciences and medicine. The great beauty of physiology is that it integrates the individual functions of all the body's different cells, tissues, and organs into a functional whole, the human body. Indeed, the human body is much more than the sum of its parts, and life relies upon this total function, not just on the function of individual body parts in isolation from the others.

This brings us to an important question: How are the separate organs and systems coordinated to maintain proper function of the entire body? Fortunately, our bodies are endowed with a vast network of feedback controls that achieve the necessary balances without which we would be unable to live. Physiologists call this high level of internal bodily control *homeostasis*. In disease states, functional balances are often seriously disturbed and homeostasis is impaired. When even a single disturbance reaches a limit, the whole body can no longer live. One of the goals of this text, therefore, is to emphasize the effectiveness and beauty of the body's homeostasis mechanisms as well as to present their abnormal functions in disease.

Another objective is to be as accurate as possible. Suggestions and critiques from many students, physiologists, and clinicians throughout the world have been sought and then used to check factual accuracy as well as balance in the text. Even so, because of the likelihood of error in sorting through many thousands of bits of information, I wish to issue a further request to all readers to send along notations of error or inaccuracy. Physiologists understand the importance of feedback for proper function of the human body; so, too, is feedback important for progressive improvement of a textbook of physiology. To the many persons who have already helped, I express sincere thanks.

A brief explanation is needed about several features of the 12th edition. Although many of the chapters have been revised to include new principles of physiology, the text length has been closely monitored to limit the book size so that it can be used effectively in physiology courses for medical students and health care professionals. Many of the figures have also been redrawn and are in full color. New references have been chosen primarily for their presentation of physiologic principles, for the quality of their own references, and for their easy accessibility. The selected bibliography at the end of the chapters lists papers mainly from recently published scientific journals that can be freely accessed from the PubMed internet site at <http://www.ncbi.nlm.nih.gov/sites/entrez/>. Use of these references, as well as cross-references from them, can give the student almost complete coverage of the entire field of physiology. The effort to be as concise as possible has, unfortunately, necessitated a more simplified and dogmatic presentation of many physiologic principles than I normally would have desired. However, the bibliography can be used to learn more about the controversies and unanswered questions that remain in understanding the complex functions of the human body in health and disease.

Another feature is that the print is set in two sizes. The material in large print constitutes the fundamental physiologic information that students will require in virtually all of their medical activities and studies.

The material in small print is of several different kinds: first, anatomic, chemical, and other information that is

needed for immediate discussion but that most students will learn in more detail in other courses; second, physiologic information of special importance to certain fields of clinical medicine; and, third, information that will be of value to those students who may wish to study particular physiologic mechanisms more deeply.

I wish to express sincere thanks to many persons who have helped to prepare this book, including my colleagues in the Department of Physiology and Biophysics at the University of Mississippi Medical Center who provided valuable suggestions. The members of our faculty and a brief description of the research and educational activities of the department can be found at the web site: <http://physiology.umc.edu/>. I am also grateful to Stephanie Lucas and Courtney Horton Graham for their excellent secretarial services, to Michael Schenk and Walter (Kyle) Cunningham for their expert artwork, and to William Schmitt, Rebecca Grulio, Frank Morales, and the entire Elsevier Saunders team for continued editorial and production excellence.

Finally, I owe an enormous debt to Arthur Guyton for the great privilege of contributing to the *Textbook of Medical Physiology*, for an exciting career in physiology, for his friendship, and for the inspiration that he provided to all who knew him.

John E. Hall

Contents

UNIT I			
Introduction to Physiology: The Cell and General Physiology			
CHAPTER 1			
Functional Organization of the Human Body and Control of the "Internal Environment"	3	Apoptosis—Programmed Cell Death	40
Cells as the Living Units of the Body	3	Cancer	40
Extracellular Fluid—The "Internal Environment"	3		
"Homeostatic" Mechanisms of the Major Functional Systems	4		
Control Systems of the Body	6		
Summary—Automaticity of the Body	9		
CHAPTER 2			
The Cell and Its Functions	11	CHAPTER 4	
Organization of the Cell	11	Transport of Substances Through Cell Membranes	45
Physical Structure of the Cell	12	The Lipid Barrier of the Cell Membrane, and Cell Membrane Transport Proteins	45
Comparison of the Animal Cell with Precellular Forms of Life	17	Diffusion	46
Functional Systems of the Cell	18	"Active Transport" of Substances Through Membranes	52
Locomotion of Cells	23		
CHAPTER 3			
Genetic Control of Protein Synthesis, Cell Function, and Cell Reproduction	27	CHAPTER 5	
Genes in the Cell Nucleus	27	Membrane Potentials and Action Potentials	57
The DNA Code in the Cell Nucleus Is Transferred to an RNA Code in the Cell Cytoplasm—The Process of Transcription	30	Basic Physics of Membrane Potentials	57
Synthesis of Other Substances in the Cell	35	Measuring the Membrane Potential	58
Control of Gene Function and Biochemical Activity in Cells	35	Resting Membrane Potential of Nerves	59
The DNA-Genetic System Also Controls Cell Reproduction	37	Nerve Action Potential	60
Cell Differentiation	39	Roles of Other Ions During the Action Potential	64
		Propagation of the Action Potential	64
		Re-establishing Sodium and Potassium Ionic Gradients After Action Potentials Are Completed—Importance of Energy	65
		Metabolism	65
		Plateau in Some Action Potentials	66
		Rhythmicity of Some Excitable Tissues—Repetitive Discharge	66
		Special Characteristics of Signal Transmission in Nerve Trunks	67
		Excitation—The Process of Eliciting the Action Potential	68
		Recording Membrane Potentials and Action Potentials	69

CHAPTER 6		CHAPTER 11	
Contraction of Skeletal Muscle	71	The Normal Electrocardiogram	121
Physiologic Anatomy of Skeletal Muscle	71	Characteristics of the Normal	
General Mechanism of Muscle Contraction	73	Electrocardiogram	121
Molecular Mechanism of Muscle Contraction	74	Methods for Recording Electrocardiograms	123
Energetics of Muscle Contraction	78	Flow of Current Around the Heart	
Characteristics of Whole Muscle		during the Cardiac Cycle	123
Contraction	79	Electrocardiographic Leads	124
CHAPTER 7		CHAPTER 12	
Excitation of Skeletal Muscle:		Electrocardiographic Interpretation of	
Neuromuscular Transmission and		Cardiac Muscle and Coronary Blood Flow	
Excitation-contraction Coupling	83	Abnormalities: Vectorial Analysis	129
Transmission of Impulses from Nerve Endings		Principles of Vectorial Analysis of	
to Skeletal Muscle Fibers: The Neuromuscular		Electrocardiograms	129
Junction	83	Vectorial Analysis of the Normal	
Molecular Biology of Acetylcholine Formation		Electrocardiogram	131
and Release	86	Mean Electrical Axis of the Ventricular	
Drugs That Enhance or Block Transmission		QRS—and Its Significance	134
at the Neuromuscular Junction	86	Conditions That Cause Abnormal Voltages	
Myasthenia Gravis Causes Muscle Paralysis	86	of the QRS Complex	137
Muscle Action Potential	87	Prolonged and Bizarre Patterns of the QRS	
Excitation-contraction Coupling	88	Complex	137
CHAPTER 8		Current of Injury	138
Excitation and Contraction of Smooth Muscle	91	Abnormalities in the T Wave	141
Contraction of Smooth Muscle	91	CHAPTER 13	
Nervous and Hormonal Control of Smooth		Cardiac Arrhythmias and Their	
Muscle Contraction	94	Electrocardiographic Interpretation	143
UNIT III		Abnormal Sinus Rhythms	143
The Heart		Abnormal Rhythms That Result from Block	
CHAPTER 9		of Heart Signals Within the Intracardiac	
Cardiac Muscle; The Heart as a Pump and		Conduction Pathways	144
Function of the Heart Valves	101	Premature Contractions	146
Physiology of Cardiac Muscle	101	Paroxysmal Tachycardia	148
Cardiac Cycle	104	Ventricular Fibrillation	149
Relationship of the Heart Sounds to Heart		Atrial Fibrillation	151
Pumping	107	Atrial Flutter	152
Work Output of the Heart	107	Cardiac Arrest	153
Chemical Energy Required for Cardiac Contraction:		UNIT IV	
Oxygen Utilization by the Heart	109	The Circulation	
Regulation of Heart Pumping	110	CHAPTER 14	
CHAPTER 10		Overview of the Circulation; Biophysics of	
Rhythmic Excitation of the Heart	115	Pressure, Flow, and Resistance	157
Specialized Excitatory and Conductive System		Physical Characteristics of the Circulation	157
of the Heart	115	Basic Principles of Circulatory Function	158
Control of Excitation and Conduction in the		Interrelationships of Pressure, Flow, and	
Heart	118	Resistance	159

CHAPTER 15		CHAPTER 20	
Vascular Distensibility and Functions of the Arterial and Venous Systems	167	Cardiac Output, Venous Return, and Their Regulation	229
Vascular Distensibility	167	Normal Values for Cardiac Output at Rest and During Activity	229
Arterial Pressure Pulsations	168	Control of Cardiac Output by Venous Return—Role of the Frank-Starling Mechanism of the Heart	229
Veins and Their Functions	171	Pathologically High or Low Cardiac Outputs	232
		Methods for Measuring Cardiac Output	240
CHAPTER 16		CHAPTER 21	
The Microcirculation and Lymphatic System: Capillary Fluid Exchange, Interstitial Fluid, and Lymph Flow	177	Muscle Blood Flow and Cardiac Output During Exercise; the Coronary Circulation and Ischemic Heart Disease	243
Structure of the Microcirculation and Capillary System	177	Blood Flow Regulation in Skeletal Muscle at Rest and During Exercise	243
Flow of Blood in the Capillaries—Vasomotion	178	Coronary Circulation	246
Exchange of Water, Nutrients, and Other Substances Between the Blood and Interstitial Fluid	179		
Interstitial and Interstitial Fluid	180	CHAPTER 22	
Fluid Filtration Across Capillaries Is Determined by Hydrostatic and Colloid Osmotic Pressures, as Well as Capillary Filtration Coefficient	181	Cardiac Failure	255
Lymphatic System	186	Circulatory Dynamics in Cardiac Failure	255
		Unilateral Left Heart Failure	259
CHAPTER 17		Low-Output Cardiac Failure—Cardiogenic Shock	259
Local and Humoral Control of Tissue Blood Flow	191	Edema in Patients with Cardiac Failure	259
Local Control of Blood Flow in Response to Tissue Needs	191	Cardiac Reserve	261
Mechanisms of Blood Flow Control	191		
Humoral Control of the Circulation	199	CHAPTER 23	
		Heart Valves and Heart Sounds; Valvular and Congenital Heart Defects	265
CHAPTER 18		Heart Sounds	265
Nervous Regulation of the Circulation, and Rapid Control of Arterial Pressure	201	Abnormal Circulatory Dynamics in Valvular Heart Disease	268
Nervous Regulation of the Circulation	201	Abnormal Circulatory Dynamics in Congenital Heart Defects	269
Role of the Nervous System in Rapid Control of Arterial Pressure	204	Use of Extracorporeal Circulation During Cardiac Surgery	271
Special Features of Nervous Control of Arterial Pressure	209	Hypertrophy of the Heart in Valvular and Congenital Heart Disease	272
CHAPTER 19			
Role of the Kidneys in Long-Term Control of Arterial Pressure and in Hypertension: The Integrated System for Arterial Pressure Regulation	213	CHAPTER 24	
Renal-Body Fluid System for Arterial Pressure Control	213	Circulatory Shock and Its Treatment	273
The Renin-Angiotensin System: Its Role in Arterial Pressure Control	220	Physiologic Causes of Shock	273
Summary of the Integrated, Multifaceted System for Arterial Pressure Regulation	226	Shock Caused by Hypovolemia—Hemorrhagic Shock	274
		Neurogenic Shock—Increased Vascular Capacity	279
		Anaphylactic Shock and Histamine Shock	280
		Septic Shock	280

Physiology of Treatment in Shock	280	Abnormalities of Micturition	310
Circulatory Arrest	281	Urine Formation Results from Glomerular Filtration, Tubular Reabsorption, and Tubular Secretion	310
UNIT V			
The Body Fluids and Kidneys			
CHAPTER 25			
The Body Fluid Compartments: Extracellular and Intracellular Fluids; Edema	285	Glomerular Filtration—The First Step in Urine Formation	312
Fluid Intake and Output Are Balanced During Steady-State Conditions	285	Determinants of the GFR	314
Body Fluid Compartments	286	Renal Blood Flow	316
Extracellular Fluid Compartment	287	Physiologic Control of Glomerular Filtration and Renal Blood Flow	317
Blood Volume	287	Autoregulation of GFR and Renal Blood Flow	319
Constituents of Extracellular and Intracellular Fluids	287	CHAPTER 27	
Measurement of Fluid Volumes in the Different Body Fluid Compartments—the Indicator-Dilution Principle	287	Urine Formation by the Kidneys: II. Tubular Reabsorption and Secretion	323
Determination of Volumes of Specific Body Fluid Compartments	289	Renal Tubular Reabsorption and Secretion	323
Regulation of Fluid Exchange and Osmotic Equilibrium Between Intracellular and Extracellular Fluid	290	Tubular Reabsorption Includes Passive and Active Mechanisms	323
Basic Principles of Osmosis and Osmotic Pressure	290	Reabsorption and Secretion Along Different Parts of the Nephron	329
Osmotic Equilibrium Is Maintained Between Intracellular and Extracellular Fluids	291	Regulation of Tubular Reabsorption	334
Volume and Osmolality of Extracellular and Intracellular Fluids in Abnormal States	292	Use of Clearance Methods to Quantify Kidney Function	340
Glucose and Other Solutions Administered for Nutritive Purposes	294	CHAPTER 28	
Clinical Abnormalities of Fluid Volume Regulation: Hyponatremia and Hypernatremia	294	Urine Concentration and Dilution; Regulation of Extracellular Fluid Osmolarity and Sodium Concentration	345
Edema: Excess Fluid in the Tissues	296	Kidneys Excrete Excess Water by Forming Dilute Urine	345
Fluids in the "Potential Spaces" of the Body	300	Kidneys Conserve Water by Excreting Concentrated Urine	346
CHAPTER 26		Quantifying Renal Urine Concentration and Dilution: "Free Water" and Osmolar Clearances	354
Urine Formation by the Kidneys: I. Glomerular Filtration, Renal Blood Flow, and Their Control	303	Disorders of Urinary Concentrating Ability	354
Multiple Functions of the Kidneys	303	Control of Extracellular Fluid Osmolarity and Sodium Concentration	355
Physiologic Anatomy of the Kidneys	304	Osmoreceptor-ADH Feedback System	355
Micturition	307	Importance of Thirst in Controlling Extracellular Fluid Osmolarity and Sodium Concentration	357
Physiologic Anatomy of the Bladder	307	Salt-Appetite Mechanism for Controlling Extracellular Fluid Sodium Concentration and Volume	360
Transport of Urine from the Kidney Through the Ureters and into the Bladder	308	CHAPTER 29	
Filling of the Bladder and Bladder Wall Tone; the Cystometrogram	309	Renal Regulation of Potassium, Calcium, Phosphate, and Magnesium; Integration of Renal Mechanisms for Control of Blood Volume and Extracellular Fluid Volume	361
Micturition Reflex	309	Regulation of Extracellular Fluid Potassium Concentration and Potassium Excretion	361

Control of Renal Calcium Excretion and Extracellular Calcium Ion Concentration	367	CHAPTER 31	
Control of Renal Magnesium Excretion and Extracellular Magnesium Ion Concentration	369	Diuretics, Kidney Diseases	397
Integration of Renal Mechanisms for Control of Extracellular Fluid	370	Diuretics and Their Mechanisms of Action	397
Importance of Pressure Natriuresis and Pressure Diuresis in Maintaining Body Sodium and Fluid Balance	371	Kidney Diseases	399
Distribution of Extracellular Fluid Between the Interstitial Spaces and Vascular System	373	Acute Renal Failure	399
Nervous and Hormonal Factors Increase the Effectiveness of Renal–Body Fluid Feedback Control	373	Chronic Renal Failure: An Irreversible Decrease in the Number of Functional Nephrons	401
Integrated Responses to Changes in Sodium Intake	376	Specific Tubular Disorders	408
Conditions That Cause Large Increases in Blood Volume and Extracellular Fluid Volume	376	Treatment of Renal Failure by Transplantation or by Dialysis with an Artificial Kidney	409
Conditions That Cause Large Increases in Extracellular Fluid Volume but with Normal Blood Volume	377		
CHAPTER 30			
Acid-Base Regulation	379	UNIT VI	
H ⁺ Concentration Is Precisely Regulated	379	Blood Cells, Immunity, and Blood Coagulation	
Acids and Bases—Their Definitions and Meanings	379		
Defending Against Changes in H ⁺ Concentration: Buffers, Lungs, and Kidneys	380	CHAPTER 32	
Buffering of H ⁺ in the Body Fluids	380	Red Blood Cells, Anemia, and Polycythemia	413
Bicarbonate Buffer System	381	Red Blood Cells (Erythrocytes)	413
Phosphate Buffer System	383	Anemias	420
Proteins Are Important Intracellular Buffers	383	Polycythemia	421
Respiratory Regulation of Acid-Base Balance	384		
Renal Control of Acid-Base Balance	385	CHAPTER 33	
Secretion of H ⁺ and Reabsorption of HCO ₃ ⁻ by the Renal Tubules	386	Resistance of the Body to Infection: I. Leukocytes, Granulocytes, the Monocyte-Macrophage System, and Inflammation	423
Combination of Excess H ⁺ with Phosphate and Ammonia Buffers in the Tubule Generates "New" HCO ₃ ⁻	388	Leukocytes (White Blood Cells)	423
Quantifying Renal Acid-Base Excretion	389	Neutrophils and Macrophages Defend Against Infections	425
Renal Correction of Acidosis—Increased Excretion of H ⁺ and Addition of HCO ₃ ⁻ to the Extracellular Fluid	391	Monocyte-Macrophage Cell System (Reticuloendothelial System)	426
Renal Correction of Alkalosis—Decreased Tubular Secretion of H ⁺ and Increased Excretion of HCO ₃ ⁻	391	Inflammation: Role of Neutrophils and Macrophages	428
Clinical Causes of Acid-Base Disorders	392	Eosinophils	430
Treatment of Acidosis or Alkalosis	393	Basophils	431
Clinical Measurements and Analysis of Acid-Base Disorders	393	Leukopenia	431
		Leukemias	431
CHAPTER 34			
		CHAPTER 34	
		Resistance of the Body to Infection: II. Immunity and Allergy Innate Immunity	433
		Acquired (Adaptive) Immunity	433
		Allergy and Hypersensitivity	443
CHAPTER 35			
		CHAPTER 35	
		Blood Types; Transfusion; Tissue and Organ Transplantation	445
		Antigenicity Causes Immune Reactions of Blood	445
		O-A-B Blood Types	445
		Rh Blood Types	447
		Transplantation of Tissues and Organs	449

CHAPTER 36		CHAPTER 40	
Hemostasis and Blood Coagulation	451	Transport of Oxygen and Carbon Dioxide in Blood and Tissue Fluids	495
Events in Hemostasis	451	Transport of Oxygen from the Lungs to the Body Tissues	495
Vascular Constriction	451	Transport of Carbon Dioxide in the Blood	502
Mechanism of Blood Coagulation	453	Respiratory Exchange Ratio	504
Conditions That Cause Excessive Bleeding in Humans	457	CHAPTER 41	
Thromboembolic Conditions in the Human Being	459	Regulation of Respiration	505
Anticoagulants for Clinical Use	459	Respiratory Center	505
Blood Coagulation Tests	460	Chemical Control of Respiration	507
UNIT VII		Peripheral Chemoreceptor System for Control of Respiratory Activity—Role of Oxygen in Respiratory Control	508
Respiration		Regulation of Respiration During Exercise	510
CHAPTER 37		Other Factors That Affect Respiration	512
Pulmonary Ventilation	465	CHAPTER 42	
Mechanics of Pulmonary Ventilation	465	Respiratory Insufficiency—Pathophysiology, Diagnosis, Oxygen Therapy	515
Pulmonary Volumes and Capacities	469	Useful Methods for Studying Respiratory Abnormalities	515
Minute Respiratory Volume Equals Respiratory Rate Times Tidal Volume	471	Pathophysiology of Specific Pulmonary Abnormalities	517
Alveolar Ventilation	471	Hypoxia and Oxygen Therapy	520
Functions of the Respiratory Passageways	472	Hypercapnia—Excess Carbon Dioxide in the Body Fluids	522
CHAPTER 38		Artificial Respiration	522
Pulmonary Circulation, Pulmonary Edema, Pleural Fluid	477	UNIT VIII	
Physiologic Anatomy of the Pulmonary Circulatory System	477	Aviation, Space, and Deep-Sea Diving Physiology	
Pressures in the Pulmonary System	477	CHAPTER 43	
Blood Volume of the Lungs	478	Aviation, High-Altitude, and Space Physiology	527
Blood Flow Through the Lungs and Its Distribution	479	Effects of Low Oxygen Pressure on the Body	527
Effect of Hydrostatic Pressure Gradients in the Lungs on Regional Pulmonary Blood Flow	479	Effects of Acceleratory Forces on the Body in Aviation and Space Physiology	531
Pulmonary Capillary Dynamics	481	"Artificial Climate" in the Sealed Spacecraft	533
Fluid in the Pleural Cavity	483	Weightlessness in Space	533
CHAPTER 39		CHAPTER 44	
Physical Principles of Gas Exchange; Diffusion of Oxygen and Carbon Dioxide Through the Respiratory Membrane	485	Physiology of Deep-Sea Diving and Other Hyperbaric Conditions	535
Physics of Gas Diffusion and Gas Partial Pressures	485	Effect of High Partial Pressures of Individual Gases on the Body	535
Compositions of Alveolar Air and Atmospheric Air Are Different	487	Scuba (Self-Contained Underwater Breathing Apparatus) Diving	539
Diffusion of Gases Through the Respiratory Membrane	489	Special Physiologic Problems in Submarines	540
Effect of the Ventilation-Perfusion Ratio on Alveolar Gas Concentration	492	Hyperbaric Oxygen Therapy	540

UNIT IX			
The Nervous System: A. General Principles and Sensory Physiology			
CHAPTER 45			
Organization of the Nervous System, Basic Functions of Synapses, and Neurotransmitters	543	Pain Receptors and Their Stimulation	583
General Design of the Nervous System	543	Dual Pathways for Transmission of Pain	584
Major Levels of Central Nervous System Function	545	Signals into the Central Nervous System	584
Comparison of the Nervous System with a Computer	546	Pain Suppression ("Analgesia") System in the Brain and Spinal Cord	586
Central Nervous System Synapses	546	Referred Pain	588
Some Special Characteristics of Synaptic Transmission	557	Visceral Pain	588
CHAPTER 46			
Sensory Receptors, Neuronal Circuits for Processing Information	559	Some Clinical Abnormalities of Pain and Other Somatic Sensations	590
Types of Sensory Receptors and the Stimuli They Detect	559	Headache	590
Transduction of Sensory Stimuli into Nerve Impulses	560	Thermal Sensations	592
Nerve Fibers That Transmit Different Types of Signals and Their Physiologic Classification	563		
Transmission of Signals of Different Intensity in Nerve Tracts—Spatial and Temporal Summation	564		
Transmission and Processing of Signals in Neuronal Pools	564		
Instability and Stability of Neuronal Circuits	569		
CHAPTER 47			
Somatic Sensations: I. General Organization, the Tactile and Position Senses	571		
Classification of Somatic Senses	571		
Detection and Transmission of Tactile Sensations	571		
Sensory Pathways for Transmitting Somatic Signals into the Central Nervous System	573		
Transmission in the Dorsal Column–Medial Lemniscal System	573		
Transmission of Less Critical Sensory Signals in the Anterolateral Pathway	580		
Some Special Aspects of Somatosensory Function	581		
CHAPTER 48			
Somatic Sensations: II. Pain, Headache, and Thermal Sensations	583		
Types of Pain and Their Qualities—Fast Pain and Slow Pain	583		
UNIT X			
The Nervous System: B. The Special Senses			
CHAPTER 49			
The Eye: I. Optics of Vision	597		
Physical Principles of Optics	597		
Optics of the Eye	600		
Ophthalmoscope	605		
Fluid System of the Eye—Intraocular Fluid	606		
CHAPTER 50			
The Eye: II. Receptor and Neural Function of the Retina	609		
Anatomy and Function of the Structural Elements of the Retina	609		
Photochemistry of Vision	611		
Color Vision	615		
Neural Function of the Retina	616		
CHAPTER 51			
The Eye: III. Central Neurophysiology of Vision	623		
Visual Pathways	623		
Organization and Function of the Visual Cortex	624		
Neuronal Patterns of Stimulation During Analysis of the Visual Image	626		
Fields of Vision; Perimetry	627		
Eye Movements and Their Control	627		
Autonomic Control of Accommodation and Pupillary Aperture	631		
CHAPTER 52			
The Sense of Hearing	633		
Tympanic Membrane and the Ossicular System	633		
Cochlea	634		
Central Auditory Mechanisms	639		
Hearing Abnormalities	642		

CHAPTER 53			
The Chemical Senses—Taste and Smell	645	Function of the Brain in Communication— Language Input and Language Output	703
Sense of Taste	645	Function of the Corpus Callosum and Anterior Commissure to Transfer Thoughts, Memories, Training, and Other Information Between the Two Cerebral Hemispheres	704
Sense of Smell	648	Thoughts, Consciousness, and Memory	705
UNIT XI			
The Nervous System: C. Motor and Integrative Neurophysiology			
CHAPTER 54			
Motor Functions of the Spinal Cord; the Cord Reflexes	655	CHAPTER 58	
Organization of the Spinal Cord for Motor Functions	655	Behavioral and Motivational Mechanisms of the Brain—The Limbic System and the Hypothalamus	711
Muscle Sensory Receptors—Muscle Spindles and Golgi Tendon Organs—And Their Roles in Muscle Control	657	Activating-Driving Systems of the Brain	711
Flexor Reflex and the Withdrawal Reflexes	661	Limbic System	714
Crossed Extensor Reflex	663	Functional Anatomy of the Limbic System; Key Position of the Hypothalamus	714
Reciprocal Inhibition and Reciprocal Innervation	663	Hypothalamus, a Major Control Headquarters for the Limbic System	715
Reflexes of Posture and Locomotion	663	Specific Functions of Other Parts of the Limbic System	718
Scratch Reflex	664	CHAPTER 59	
Spinal Cord Reflexes That Cause Muscle Spasm	664	States of Brain Activity—Sleep, Brain Waves, Epilepsy, Psychoses	721
Autonomic Reflexes in the Spinal Cord	665	Sleep	721
Spinal Cord Transection and Spinal Shock	665	Epilepsy	725
CHAPTER 55		Psychotic Behavior and Dementia—Roles of Specific Neurotransmitter Systems	726
Cortical and Brain Stem Control of Motor Function	667	Schizophrenia—Possible Exaggerated Function of Part of the Dopamine System	727
Motor Cortex and Corticospinal Tract	667	CHAPTER 60	
Role of the Brain Stem in Controlling Motor Function	673	The Autonomic Nervous System and the Adrenal Medulla	729
Vestibular Sensations and Maintenance of Equilibrium	674	General Organization of the Autonomic Nervous System	729
Functions of Brain Stem Nuclei in Controlling Subconscious, Stereotyped Movements	678	Basic Characteristics of Sympathetic and Parasympathetic Function	731
CHAPTER 56		Autonomic Reflexes	738
Contributions of the Cerebellum and Basal Ganglia to Overall Motor Control	681	Stimulation of Discrete Organs in Some Instances and Mass Stimulation in Other Instances by the Sympathetic and Parasympathetic Systems	738
Cerebellum and Its Motor Functions	681	Pharmacology of the Autonomic Nervous System	739
Basal Ganglia—Their Motor Functions	689	CHAPTER 61	
Integration of the Many Parts of the Total Motor Control System	694	Cerebral Blood Flow, Cerebrospinal Fluid, and Brain Metabolism	743
CHAPTER 57		Cerebral Blood Flow	743
Cerebral Cortex, Intellectual Functions of the Brain, Learning, and Memory	697	Cerebrospinal Fluid System	746
Physiologic Anatomy of the Cerebral Cortex	697	Brain Metabolism	749
Functions of Specific Cortical Areas	698		

UNIT XII		
Gastrointestinal Physiology		
CHAPTER 62		
General Principles of Gastrointestinal Function—Motility, Nervous Control, and Blood Circulation	753	Disorders of the Stomach 799
General Principles of Gastrointestinal Motility	753	Disorders of the Small Intestine 801
Neural Control of Gastrointestinal Function—Enteric Nervous System	755	Disorders of the Large Intestine 802
Functional Types of Movements in the Gastrointestinal Tract	759	General Disorders of the Gastrointestinal Tract 803
Gastrointestinal Blood Flow—"Splanchnic Circulation"	759	
CHAPTER 63		
Propulsion and Mixing of Food in the Alimentary Tract	763	UNIT XIII
Ingestion of Food	763	Metabolism and Temperature Regulation
Motor Functions of the Stomach	765	CHAPTER 67
Movements of the Small Intestine	768	Metabolism of Carbohydrates, and Formation of Adenosine Triphosphate 809
Movements of the Colon	770	Central Role of Glucose in Carbohydrate Metabolism 810
Other Autonomic Reflexes That Affect Bowel Activity	772	Transport of Glucose Through the Cell Membrane 810
		Glycogen Is Stored in Liver and Muscle 811
		Release of Energy from Glucose by the Glycolytic Pathway 812
		Release of Energy from Glucose by the Pentose Phosphate Pathway 816
		Formation of Carbohydrates from Proteins and Fats—"Gluconeogenesis" 817
		Blood Glucose 817
CHAPTER 64		CHAPTER 68
Secretory Functions of the Alimentary Tract	773	Lipid Metabolism 819
General Principles of Alimentary Tract Secretion	773	Transport of Lipids in the Body Fluids 819
Secretion of Saliva	775	Fat Deposits 821
Esophageal Secretion	776	Use of Triglycerides for Energy: Formation of Adenosine Triphosphate 822
Gastric Secretion	777	Regulation of Energy Release from Triglycerides 825
Pancreatic Secretion	780	Phospholipids and Cholesterol 826
Secretion of Bile by the Liver; Functions of the Biliary Tree	783	Atherosclerosis 827
Secretions of the Small Intestine	786	CHAPTER 69
Secretion of Mucus by the Large Intestine	787	Protein Metabolism 831
CHAPTER 65		Basic Properties 831
Digestion and Absorption in the Gastrointestinal Tract	789	Transport and Storage of Amino Acids 831
Digestion of the Various Foods by Hydrolysis	789	Functional Roles of the Plasma Proteins 833
Basic Principles of Gastrointestinal Absorption	793	Hormonal Regulation of Protein Metabolism 835
Absorption in the Small Intestine	794	CHAPTER 70
Absorption in the Large Intestine: Formation of Feces	797	The Liver as an Organ 837
		Physiologic Anatomy of the Liver 837
CHAPTER 66		Hepatic Vascular and Lymph Systems 837
Physiology of Gastrointestinal Disorders	799	Metabolic Functions of the Liver 839
Disorders of Swallowing and of the Esophagus	799	Measurement of Bilirubin in the Bile as a Clinical Diagnostic Tool 840

CHAPTER 71		CHAPTER 75	
Dietary Balances; Regulation of Feeding; Obesity and Starvation; Vitamins and Minerals	843	Pituitary Hormones and Their Control by the Hypothalamus	895
Energy Intake and Output Are Balanced Under Steady-State Conditions	843	Pituitary Gland and Its Relation to the Hypothalamus	895
Dietary Balances	843	Hypothalamus Controls Pituitary Secretion	897
Regulation of Food Intake and Energy Storage	845	Physiological Functions of Growth Hormone	898
Obesity	850	Posterior Pituitary Gland and Its Relation to the Hypothalamus	904
Inanition, Anorexia, and Cachexia	851		
Starvation	852		
Vitamins	852		
Mineral Metabolism	855		
CHAPTER 72		CHAPTER 76	
Energetics and Metabolic Rate	859	Thyroid Metabolic Hormones	907
Adenosine Triphosphate (ATP) Functions as an "Energy Currency" in Metabolism	859	Synthesis and Secretion of the Thyroid Metabolic Hormones	907
Control of Energy Release in the Cell	861	Physiological Functions of the Thyroid Hormones	910
Metabolic Rate	862	Regulation of Thyroid Hormone Secretion	914
Energy Metabolism—Factors That Influence Energy Output	863	Diseases of the Thyroid	916
CHAPTER 73		CHAPTER 77	
Body Temperature Regulation, and Fever	867	Adrenocortical Hormones	921
Normal Body Temperatures	867	Synthesis and Secretion of Adrenocortical Hormones	921
Body Temperature Is Controlled by Balancing Heat Production and Heat Loss	867	Functions of the Mineralocorticoids—Aldosterone	924
Regulation of Body Temperature—Role of the Hypothalamus	871	Functions of the Glucocorticoids	928
Abnormalities of Body Temperature Regulation	875	Adrenal Androgens	934
		Abnormalities of Adrenocortical Secretion	934
CHAPTER 78		CHAPTER 78	
		Insulin, Glucagon, and Diabetes Mellitus	939
		Insulin and Its Metabolic Effects	939
		Glucagon and Its Functions	947
		Somatostatin Inhibits Glucagon and Insulin Secretion	949
		Summary of Blood Glucose Regulation	949
		Diabetes Mellitus	950
UNIT XIV			
Endocrinology and Reproduction		CHAPTER 79	
CHAPTER 74		Parathyroid Hormone, Calcitonin, Calcium and Phosphate Metabolism, Vitamin D, Bone, and Teeth	955
Introduction to Endocrinology	881	Overview of Calcium and Phosphate Regulation in the Extracellular Fluid and Plasma	955
Coordination of Body Functions by Chemical Messengers	881	Bone and Its Relation to Extracellular Calcium and Phosphate	957
Chemical Structure and Synthesis of Hormones	881	Vitamin D	960
Hormone Secretion, Transport, and Clearance from the Blood	884	Parathyroid Hormone	962
Mechanisms of Action of Hormones	886	Calcitonin	966
Measurement of Hormone Concentrations in the Blood	891	Summary of Control of Calcium Ion Concentration	966

Pathophysiology of Parathyroid Hormone, Vitamin D, and Bone Disease	967	Function of the Placenta	1005
Physiology of the Teeth	969	Hormonal Factors in Pregnancy	1007
CHAPTER 80		Response of the Mother's Body to Pregnancy	1009
Reproductive and Hormonal Functions of the Male (and Function of the Pineal Gland)	973	Parturition	1011
Physiologic Anatomy of the Male Sexual Organs	973	Lactation	1014
Spermatogenesis	973	CHAPTER 83	
Male Sexual Act	978	Fetal and Neonatal Physiology	1019
Testosterone and Other Male Sex Hormones	979	Growth and Functional Development of the Fetus	1019
Abnormalities of Male Sexual Function	984	Development of the Organ Systems	1019
Erectile Dysfunction in the Male	985	Adjustments of the Infant to Extrauterine Life	1021
Pineal Gland—Its Function in Controlling Seasonal Fertility in Some Animals	986	Special Functional Problems in the Neonate	1023
		Special Problems of Prematurity	1026
		Growth and Development of the Child	1027
CHAPTER 81		UNIT XV	
Female Physiology Before Pregnancy and Female Hormones	987	Sports Physiology	
Physiologic Anatomy of the Female Sexual Organs	987	CHAPTER 84	
Female Hormonal System	987	Sports Physiology	1031
Monthly Ovarian Cycle; Function of the Gonadotropic Hormones	988	Muscles in Exercise	1031
Functions of the Ovarian Hormones—Estradiol and Progesterone	991	Respiration in Exercise	1036
Regulation of the Female Monthly Rhythm—Interplay Between the Ovarian and Hypothalamic-Pituitary Hormones	996	Cardiovascular System in Exercise	1038
Abnormalities of Secretion by the Ovaries	999	Body Heat in Exercise	1039
Female Sexual Act	1000	Body Fluids and Salt in Exercise	1040
Female Fertility	1000	Drugs and Athletes	1040
		Body Fitness Prolongs Life	1041
CHAPTER 82		Index	1043
Pregnancy and Lactation	1003		
Maturation and Fertilization of the Ovum	1003		
Early Nutrition of the Embryo	1005		

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