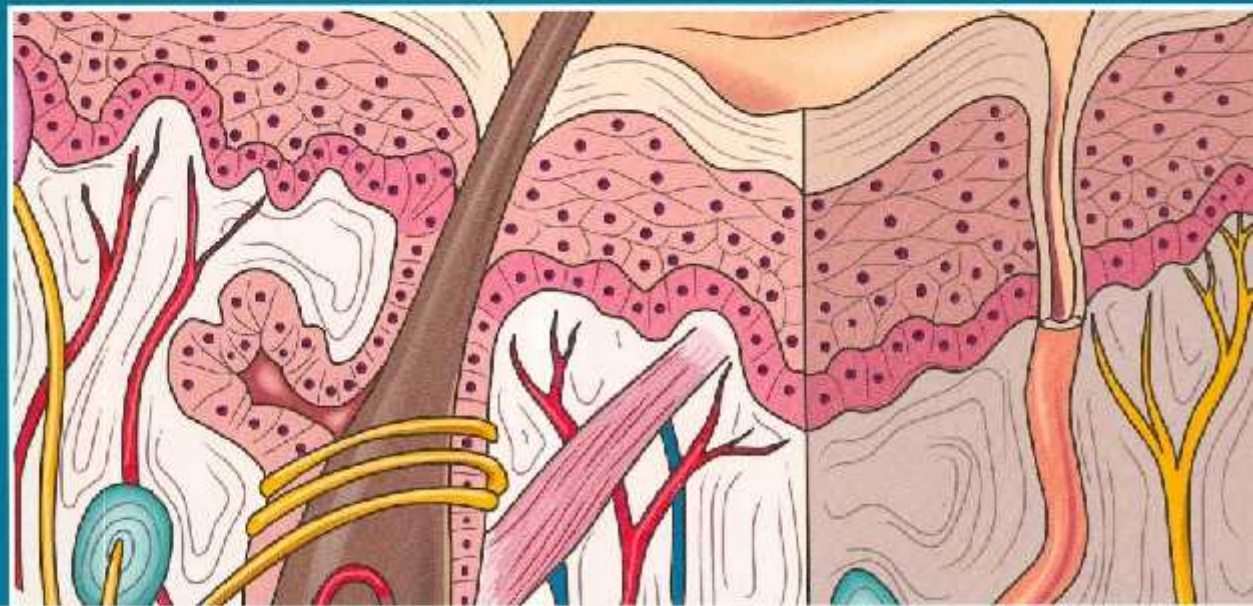


EDITION

6

The Human Body in Health and Illness

Herlihy



ELSEVIER



EVOLVE STUDY RESOURCES
FREE WITH TEXTBOOK PURCHASE
EVOLVE.ELSEVIER.COM

Contents

1 Introduction to the Human Body, 1

- Anatomy and Physiology: What They Are, 1
 - What's It Mean?*, 1
- Why Do I Need to Know This? 2
- The Body's Levels of Organization, 2
 - Major Organ Systems*, 2
- Homeostasis: Staying the Same, 6
- Anatomical Terms: Talking About the Body, 6
 - Anatomical Position*, 6
 - Relative Positions*, 6
 - Planes of the Body*, 7
 - Regional Terms*, 8
- Cavities of the Body, 9
 - Dorsal Cavity*, 10
 - Ventral Cavity*, 10

2 Basic Chemistry, 15

- Matter, Elements, and Atoms, 15
 - Matter*, 15
 - Elements*, 16
 - Atoms*, 16
- Chemical Bonds, 18
 - Ionic Bonds*, 18
 - Covalent Bonds*, 18
 - Hydrogen Bonds*, 18
 - Polarity*, 19
- Ions, 20
 - Cations, Anions, and Electrolytes*, 20
 - Ion Formation*, 20
 - Ionization*, 20
- Molecules and Compounds, 21
 - Molecules*, 21
 - Compounds*, 21
 - Some Important Compounds and Molecules*, 21
- Chemical Reactions, 22
- Acids and Bases, 22
 - Acids*, 23
 - Bases*, 23
- Neutralization of Acids and Bases, 23
 - Measurement: The pH Scale*, 23
- Energy, 24
 - Forms of Energy*, 25
 - Conversion of Energy*, 25
 - Energy Transfer: The Role of Adenosine Triphosphate*, 25
- Mixtures, Solutions, Suspensions, and Precipitates, 25
 - Mixtures*, 26

- Solutions*, 26
- Suspensions*, 26
- Precipitates*, 27

3 Cells, 30

- Typical Cell, 30
 - Cell Membrane*, 31
 - Inside the Cell*, 31
 - On the Cell Membrane*, 35
- Movement Across the Cell Membrane, 36
 - Passive Transport Mechanisms*, 36
 - Active Transport Mechanisms*, 40
- Cell Division, 40
 - Cell Cycle*, 41
- Cell Differentiation, 43
 - Stem Cells*, 43
- Order, Disorder, and Death, 43

4 Cell Metabolism, 48

- Metabolism, 48
- Carbohydrates, 48
 - Monosaccharides*, 48
 - Disaccharides*, 49
 - Polysaccharides*, 49
 - Uses of Glucose*, 50
 - The Breakdown of Glucose*, 50
 - The Making of Glucose*, 51
- Lipids (Fats), 52
 - Uses of Lipids*, 52
- Proteins, 54
 - Amino Acids*, 54
 - Uses of Proteins*, 55
- Protein Synthesis and DNA, 56
 - DNA Structure*, 56
 - Steps in Protein Synthesis*, 58

5 Microbiology Basics, 65

- What Is Disease? 65
- Types of Pathogens, 66
 - Microorganisms (Microbes)*, 66
 - Other (Multicellular) Disease-Causing Organisms*, 69
- Laboratory Identification of Pathogens, 69
- The Spread of Infection, 70
 - Portals of Entry and Exit*, 70
- Five Germ-Laden Stories, 71
 - Dr. Semmelweis Screams, "Wash Those Mitts!", 72*
 - Flora and Her Vaginal Ichi*, 74

- Rick, Nick, and the Sick Tick, 75*
- Why Typhoid Mary Needed to Lose Her Gallbladder, 75*
- A Pox News Alert!, 75*

6 Tissues and Membranes, 78

- Epithelial Tissue, 78
 - Where Is It Found? 78*
 - What Does It Do? 78*
 - What Is It Like? 78*
 - Classification, 79*
 - Simple Epithelia, 79*
 - Stratified Epithelia, 80*
 - Glandular Epithelia, 82*
- Connective Tissue, 82
 - Where Is It Found? 82*
 - What Does It Look Like? 82*
 - Types of Connective Tissue, 83*
- Nervous Tissue, 86
 - Neurons, 86*
- Muscle Tissue, 86
 - Skeletal Muscle, 86*
 - Smooth Muscle, 86*
 - Cardiac Muscle, 86*
- Tissue Repair, 88
- Membranes, 88
 - Classification of Membranes, 88*
 - Epithelial Membranes, 88*

7 Integumentary System and Body Temperature, 94

- Functions of the Integumentary System, 94
- Structure of the Skin, 95
 - Layers of the Skin, 95*
 - Skin Color, 97*
- Accessory Structures of the Skin, 98
 - Hair, 98*
 - Nails, 100*
 - Glands, 100*
- Body Temperature, 102
 - Heat Production, 102*
 - Heat Loss, 102*
 - Regulation, 102*
 - When Skin Is Burned, 104*
 - A Note About Skin Care, 106*

8 Skeletal System, 112

- Arrangement and Functions of Bones, 112
 - The Skeletal System: What It Does, 112*
 - Many Sizes and Shapes of Bones, 117*
- Bone Tissue and Bone Formation, 114
 - Compact and Spongy Bone, 114*
 - Long Bones, 116*
 - Ossification, 116*
 - Growing Bones, 117*
- Divisions of the Skeletal System, 118
 - Axial Skeleton, 118*
 - Appendicular Skeleton, 128*

- Joints (Articulations), 134
 - Joint Classification, 134*
 - Naming Joints, 135*
 - Moving Synovial Joints, 135*
 - Clinically "Big" Synovial Joints, 137*

9 Muscular System, 143

- Types and Functions of Muscles, 143
 - Skeletal Muscle, 143*
 - Smooth Muscle, 143*
 - Cardiac Muscle, 144*
- Structure of the Whole Muscle, 145
 - Muscle, 145*
 - Layers of Connective Tissue, 145*
 - Muscle Attachments, 146*
- Structure and Function of a Single Muscle Fiber, 146
- How Muscles Contract, 146
 - Sliding Filament Mechanism, 146*
 - The Role of Calcium and Adenosine Triphosphate, 147*
- Skeletal Muscles and Nerves, 148
 - Somatic Motor Neuron, 148*
 - The Motor Unit, 148*
 - The Neurovascular Junction, 148*
- Muscle Responses, 151
 - Energy Source for Muscle Contraction, 152*
 - Muscle Fatigue, 153*
- Muscle Terms, 153
 - Origin and Insertion, 153*
 - Prime Mover, Synergist, and Antagonist, 153*
 - Muscle Overuse and Underuse Terms, 153*
- How Skeletal Muscles are Named, 154
 - Size, 154*
 - Shape, 154*
 - Orientation of Fibers, 154*
 - Location, 154*
 - Number of Origins, 154*
 - Origin and Insertion, 154*
 - Muscle Action, 154*
- Muscles From Head to Toe, 154
 - Muscles of the Head, 154*
 - Muscles of the Neck, 161*
 - Muscles of the Trunk, 161*
 - Muscles of the Shoulder (Pectoral) Girdle and Arm, 162*
 - Muscles That Move the Forearm, 163*
 - Muscles That Move the Wrist, Hand, and Fingers, 163*
 - Muscles That Move the Thigh, Leg, and Foot, 164*
 - Muscles That Move the Leg, 165*
 - Muscles That Move the Foot, 165*

10 Nervous System: Nervous Tissue and Brain, 173

- The Nervous System: Structure and Function, 173
 - Divisions of the Nervous System, 173*
 - Functions of the Nervous System, 173*

- Cells That Make Up the Nervous System, 174
 - Neuroglia*, 174
 - Neuron*, 175
 - White Matter Versus Gray Matter*, 177
 - The Neuron Carrying Information, 177
 - The Nerve Impulse: What It Is*, 177
 - The Nerve Impulse: What Causes It*, 177
 - The Nerve Impulse: What Causes It to Move*, 180
 - The Nerve Impulse: What Causes It to Move Quickly*, 181
 - Synapse Across Neurons, 181
 - Parts of a Synapse*, 181
 - Events at the Synapse*, 182
 - Brain: Structure and Function, 183
 - Cerebrum*, 183
 - Diencephalon*, 188
 - Brain Stem*, 188
 - Cerebellum*, 189
 - Structures Across Divisions of the Brain*, 190
 - Protecting the Central Nervous System, 191
 - Bone: First Layer of Protection*, 191
 - Meninges: Second Layer of Protection*, 191
 - Cerebrospinal Fluid: Third Layer of Protection*, 191
 - Blood-Brain Barrier: Fourth Layer of Protection*, 193
- 11 Nervous System: Spinal Cord and Peripheral Nerves, 201**
-
- What the Spinal Cord Is, 201
 - Location and Size*, 201
 - Gray on the Inside, White on the Outside*, 201
 - What the Spinal Cord Does, 204
 - Reflexes, 204
 - What Reflexes Are*, 204
 - The Reflex Arc*, 205
 - Many, Many Reflexes*, 205
 - Peripheral Nervous System, 207
 - Nerves*, 207
 - Classifying the Peripheral Nervous System*, 207
 - Spinal Nerves Attached to the Spinal Cord*, 210
- 12 Autonomic Nervous System, 219**
-
- Autonomic (Visceral) Reflexes, 219
 - What They Do*, 219
 - Pathway*, 219
 - Organization and Function of the Autonomic Nervous System, 220
 - Division of the Autonomic Nervous System*, 220
 - Autonomic Tone and Vaso motor Tone*, 222
 - Autonomic Nervous System Neurons, 222
 - Numbers and Ganglia*, 222
 - Neurons of the Sympathetic Nervous System*, 223
 - Neurons of the Parasympathetic Nervous System*, 223
 - Naming Fibers and Neurotransmitters*, 224
 - Neurotransmitters: Termination of Activity*, 225
 - Receptors of the Autonomic Nervous System*, 225
 - Cholinergic Receptors*, 225
 - Adrenergic Receptors*, 226
 - Autonomic Terminology: "Doing" Autonomic Pharmacology*, 227
- 13 Sensory System, 232**
-
- Receptors and Sensation, 232
 - Cells That Detect Stimuli*, 232
 - Sensation and Perception*, 233
 - Experiencing a Sensation*, 233
 - The General Senses, 234
 - Pain*, 234
 - Touch and Pressure*, 236
 - Temperature*, 236
 - Proprioception*, 237
 - The Special Senses, 237
 - Sense of Smell: The Nose*, 237
 - Sense of Taste: The Tongue*, 238
 - Sense of Sight: The Eye*, 239
 - Sense of Hearing: The Ear*, 249
 - Sense of Balance: The Ear*, 251
- 14 Endocrine System, 260**
-
- Endocrine Glands, 260
 - Classification of Hormones*, 260
 - Targets*, 262
 - Hormone Receptors*, 262
 - Control of Hormone Secretion*, 263
 - Pituitary Gland and the Hypothalamus, 264
 - Anterior Pituitary Gland*, 264
 - Posterior Pituitary Gland*, 267
 - Thyroid Gland, 268
 - Thyroid Follicle*, 268
 - What Thyroid Hormones (T_3 and T_4) Do*, 268
 - Regulation of Secretion*, 269
 - The Need for Iodine*, 269
 - Calcitonin*, 269
 - Parathyroid Glands, 270
 - PTH Deficiency and Hypocalcemic Tetany*, 270
 - Adrenal Glands, 271
 - Adrenal Medulla*, 271
 - Adrenal Cortex*, 273
 - Pancreas, 274
 - Insulin*, 274
 - Glucagon*, 276
 - Gonads, 277
 - Thymus Gland, 277
 - Pineal Gland, 277
 - Other Hormones, 277
 - Organ-Specific Hormones*, 277
 - Prostaglandins*, 277
 - Adipose Tissue Hormones*, 277
- 15 Blood, 284**
-
- What Blood Does, 284
 - Composition of Blood, 285
 - Characteristics*, 285
 - Blood Has Two Parts*, 285

Origin of Blood Cells, 286

Beve Merzova Waest: Too Little, Too Much, 286

Blood Cells, 287

Red Blood Cells, 287

White Blood Cells, 291

Platelets, 294

Blood Counts, 294

Hemostasis: Prevention of Blood Loss, 294

Blood Vessel Spasm, 294

Formation of a Platelet Plug, 294

Blood Coagulation, 294

Blood Types, 298

Antigens and Blood Types, 298

Antibodies and Blood Type, 298

Antigen–Antibody Interaction, 298

Compatibility and Incompatibility of Blood Types, 298

Rh Classification System, 300

16 Anatomy of the Heart, 308

Function, Location, and Size of the Heart, 308

Layers and Covering of the Heart, 309

Endocardium, 310

Myocardium, 310

Epicardium, 310

Pericardium, 310

A Double Pump and Two Circulations, 311

The Heart's Chambers and Great Vessels, 312

Right Atrium, 312

Right Ventricle, 313

Left Atrium, 313

Left Ventricle, 313

Great Vessels of the Heart, 313

Heart Valves, 313

Atrioventricular Valves, 313

Semilunar Valves, 314

Heart Sounds, 315

Pathway of Blood Flow Through the Heart, 315

Blood Supply to the Myocardium, 315

Ischemia and Infarction, 316

Cardiac Enzymes and Leaky Cells, 317

Cardiac Conduction System, 318

Parts of the Cardiac Conduction System, 318

Automaticity and Rhythmicity, 319

Electrocardiogram, 319

17 Function of the Heart, 325

The Coordinated and Adaptable Pump, 325

Cardiac Cycle, 325

Autonomic Control of the Heart, 326

Heart Talk, 331

Heart Talk: Clinical Terms, 331

Heart Talk: Receptor Language, 332

The Failing Heart: When the Heart Can't Pump, 333

Left Heart Failure, 333

Right Heart Failure, 334

18 Anatomy of the Blood Vessels and Special Circulations, 342

Circles, Circuits, and Circulations, 342

Blood Vessels, 343

Naming the Blood Vessels, 343

Blood Vessel Walls: The Layered Look, 343

Blood Vessels: What They Do, 345

Major Arteries of the Systemic Circulation, 346

Aorta, 346

Branches of the Aorta, 347

Major Veins of the Systemic Circulation, 349

Venae Cavae, 349

Special Circulations, 351

Blood Supply to the Head and Brain, 351

Blood Supply to the Liver and the Hepatic Portal Circulation, 353

Fetal Circulation, 353

Pulse, 356

What is a Pulse? 356

What Can You Learn About a Patient by Feeling the Pulse? 356

19 Functions of the Blood Vessels, 361

Blood Vessels Deliver, 361

Blood Vessels Regulate Blood Pressure, 361

Blood Pressure: Normal and Abnormal, 362

Blood Pressure in Different Blood Vessels, 362

What Determines Blood Pressure? 362

How Blood Pressure Stays Within Normal Limits, 365

Blood Vessels Act as Exchange Vessels, 367

What Is an Exchange Vessel? 367

Why Capillaries Are Good Exchange Vessels, 367

Capillary Forces: Exchange, 368

Blood Vessels Distribute Blood, 370

Blood Vessels Regulate Body Temperature, 370

20 Lymphatic System, 376

Lymph and Lymphatic Circulation, 376

Lymph: What It Is, Where It Comes From, 376

Lymphatic Vessels, 376

What Causes Lymph to Move? 377

Lymphatic Tissue, 378

Lymphatic Organs, 378

Lymph Nodes, 378

Thymus Gland, 379

Spleen, 379

Lymphatic Nodules, 381

21 Immune System, 385

Classification of the Immune System, 385

Non-specific Immunity, 385

Specific Immunity: Third Line of Defense, 389

Types of Immunity, 394

Generic Immunity, 394

Acquired Immunity, 394

Other Immune Responses, 396

Allergic Reactions, 396

22 Respiratory System, 403

- Structure: Organs of the Respiratory System, 403
 - Upper and Lower Respiratory Tracts*, 403
 - Nose and Nasal Cavities*, 404
 - Pharynx*, 405
 - Larynx*, 405
 - Trachea*, 408
 - Bronchial Tree: Bronchi, Bronchioles, and Alveoli*, 408
 - Lungs*, 410
 - Pleural Membranes*, 411
- Collapsed and Expanded Lungs, 411
 - Why Lungs Collapse*, 411
 - Why Lungs Expand*, 412
 - Saying It Another Way: Compliance*, 414
- Respiratory Function, 414
 - Three Steps in Respiration*, 414
 - Amounts of Air*, 421
 - Control of Breathing*, 422

23 Digestive System, 432

- Overview of the Digestive System, 433
 - Digestion and Absorption*, 433
 - Layers and Membranes of the Digestive Tract*, 434
- Structures and Organs, 435
 - Mouth*, 435
 - Pharynx*, 437
 - Esophagus*, 438
 - Stomach*, 438
 - Small Intestine*, 440
 - Large Intestine*, 442
- Accessory Digestive Organs, 445
 - Liver*, 445
 - Gallbladder*, 448
 - Pancreas*, 448
- Digestion and Absorption, 449
 - Carbohydrates and Carbohydrate-Splitting Enzymes*, 449
 - Proteins and Protein-Splitting Enzymes*, 449
 - Fats, Bile, and Fat-Splitting Enzymes*, 450
- Nutrition: Concepts to Know, 453
 - Carbohydrates*, 453
 - Proteins*, 454
 - Fats (Lipids)*, 454
 - Vitamins*, 454
 - Minerals*, 455
 - Health and a Balanced Diet*, 456

24 Urinary System, 463

- Excretion, 463
 - Organs of Excretion*, 463
 - Urinary System Organs*, 463
 - Urinary System Terms*, 464
- Kidneys, 465
 - Location*, 465
 - Structure*, 465
 - Blood Supply*, 465

- Nerve Supply*, 465
- Functions of the Kidneys*, 465
- Urine Making: The Nephron Unit, 465
 - Structures*, 465
 - Urine Formation*, 466
- Hormones That Work on the Kidneys, 468
 - Aldosterone*, 468
 - Antidiuretic Hormone*, 470
 - Natriuretic Peptides*, 470
 - Parathyroid Hormone and Calcitonin*, 471
- Composition of Urine, 471
 - Uremia and Dialysis*, 472
- Your Plumbing, 473
 - Ureters*, 473
 - Urinary Bladder*, 473
 - Urination*, 475
 - Urethra*, 475
 - An Autonomic Moment*, 476

25 Water, Electrolyte, and Acid-Base Balance, 482

- Body Fluids: Distribution and Composition, 482
 - Fluid Compartments*, 482
 - Composition of Body Fluids*, 483
- Water Balance, 483
 - Water Intake*, 483
 - Water Output*, 483
- Water Imbalances, 484
 - Why Does Fluid Shift?* 485
 - Fluid Spacing—in Other Words*, 485
- Electrolyte Balance, 485
 - Quick Reference: Electrolytes*, 485
 - Most Important Ions*, 486
- Acid-Base Balance, 487
 - Quick Reference: Acids and Bases*, 487
 - Where the Acid Comes From*, 487
 - How the Body Regulates pH*, 487
 - Respiratory Activity as the Cause of Changes in pH*, 489
 - Respiratory Activity as the Correction for Changes in pH*, 489
- Acid-Base Imbalances, 490
 - Acidosis*, 490
 - Alkalosis*, 491

26 Reproductive Systems, 496

- Male Reproductive System, 496
 - Testes*, 496
 - Genital Ducts*, 499
 - Accessory Glands*, 500
 - Semen*, 500
 - External Genitals*, 500
 - Male Sexual Response: Erection, Emission, Ejaculation, and Orgasm*, 501
 - Male Sex Hormones*, 501
- Female Reproductive System, 502
 - Ovaries*, 502
 - Genital Tract*, 504

- External Genitals*, 505
- Female Sexual Response*, 506
- Hormonal Control of the Reproductive Cycles*, 506
- Two Reproductive Cycles*, 507
- Female Breast and Lactation, 510
 - Structure of a Breast: The Mammary Glands*, 510
 - Hormones of Lactation...Got Milk?* 510
- Methods of Birth Control, 510

27 Human Development and Heredity, 519

- Fertilization, 519
 - When Fertilization Occurs*, 519
 - Where Fertilization Occurs*, 520
 - How Fertilization Occurs*, 520
- Human Development, 520
- Prenatal Development, 520
 - Early Embryonic Period*, 520
 - Embryonic Period*, 522
 - Fetal Period*, 526

- Changes in the Mother's Body During Pregnancy, 527
- Birth, 528
- Postnatal Changes and Developmental Stages, 529
 - Immediate Adjustments*, 529
 - Development as a Lifelong Process*, 529
- Heredity, 529
 - DNA, Genes, and Chromosomes*, 530
 - It's a Boy; It's a Girl: How the Sex of the Child Is Determined*, 532
 - Congenital and Hereditary Disease*, 533

Appendix: Answers to Review Your Knowledge and Go Figure Questions, 537

Glossary, 541

Index, 554
