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Cathy Whiting began her college career at Waycross Junior College before transferring to the University of Georgia and earning a B.S. degree in biology. She earned both M.S.T. and Ph.D. degrees in zoology at the University of Florida, training under an extraordinary mentor, Dr. Louis J. Guillette, a distinguished researcher, author, and educator who taught her how to do science and, more importantly, how to teach. With 25 years of college teaching experience, Whiting seeks to engage her students through active learning in order to facilitate the development of critical-thinking and problem-solving skills. She has discovered that passionate teaching leads to passionate learning and that students don’t care how much you know until they know how much you care. The recipient of several teaching awards including Faculty Member of the Year, Advisor of the Year, and Master Teacher, she considers her greatest reward to be the privilege of teaching and impacting the lives of students.

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Preface

Why Did I Write This Lab Manual?

Since graduating from the University of Georgia with a BS in biology, I have been teaching in a wide variety of settings—as a laboratory assistant, as a high school teacher, as a graduate assistant, as a tutor/mentor for college athletes, as an assistant professor of biology at Wingate University, and, currently, as a professor of biology at the University of North Georgia–Gainesville. Regardless of the setting, I have always regarded teaching as an incredible opportunity and a great privilege. Through the years, I have learned that effective teaching requires much hard work, dedication, and enthusiasm. It involves a lifelong pursuit of both content knowledge and understanding how students learn. It involves challenging students to develop critical-thinking and problem-solving skills. Most importantly, it involves building relationships with students and investing in their lives. As a matter of fact, it was a late afternoon conversation with a group of students after lab in the fall of 2009 that inspired me to pursue writing a lab manual.

I set out to write a lab manual that was first and foremost a tool of engagement. In my experience, engaging students in an active learning environment is the key to student success in both the lecture and the laboratory setting. When students are engaged, exciting things happen. Attendance improves. Students enjoy being in class. Grades soar! Students begin to focus on learning instead of worrying about what is going to be on the test. My hope is that instructors will be able to use and adapt the activities in this manual to cultivate their own active learning environment and to experience the joy of watching students fully engage in the learning process. Imagine having to run students out of the lab so that the next lab can get started. You will be amazed at what your students can accomplish when they are engaged, challenged, and inspired!

How Is This Lab Manual Different?

*Human Anatomy & Physiology Laboratory Manual: Making Connections* distinguishes itself from other A&P lab manuals by focusing heavily on addressing the **three biggest teaching challenges** for A&P lab instructors: getting students to engage in the lab, to prepare for the lab, and to apply concepts in the lab.

**Getting Students Engaged in the Lab**

For many instructors this is the #1 teaching problem in the lab course. The whole active-learning approach of *Human Anatomy & Physiology Laboratory Manual: Making Connections* is centered on getting students engaged in the lab and asking questions. We achieve this by including a rich variety of **hands-on activities** that use **different learning modes** including labeling, sketching, touching, dissecting, observing, conducting experiments, interacting with groups, and making predictions.

This lab manual includes many tried and true lab activities but also has some unique activities to help facilitate **active learning**, including those listed in the table below.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Activity</th>
<th>How it facilitates active learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 2 Introduction to the Organ Systems</td>
<td>Activity 3: Studying Homeostasis and Organ System Interactions</td>
<td>Students work together to research and explain how organ systems interact during the regulation of body temperature; high engagement factor; challenging task that requires students to think critically and discuss their ideas with lab group members</td>
</tr>
<tr>
<td>Unit 6 Histology</td>
<td>Activity 4: Constructing a Tissue Identification Concept Map</td>
<td>Students must interact (discuss, question, argue, etc.) to determine the best set of questions to identify the assigned tissue types; encourages students to think about tissues rather than just memorize them; high engagement and high energy; demands critical thinking and problem-solving skills</td>
</tr>
<tr>
<td>Unit 10 The Appendicular Skeleton</td>
<td>Activity 2: Identifying Bones in a Bag</td>
<td>Students identify bones and their features by touch only; high engagement and interaction as students discuss and review the assigned features of each bone as it is pulled out of the bag</td>
</tr>
<tr>
<td>Unit 13 Gross Anatomy of the Muscular System</td>
<td>Activity 1: Determining How Skeletal Muscles Are Named</td>
<td>Students complete an interactive overview activity that helps them understand how skeletal muscles are named; this activity teaches students a very useful approach to learning specific skeletal muscles (origin, insertion, innervation, and action) and prepares them for the remaining activities in the unit; actively engages students as they perform various muscle actions and locate muscles on different anatomical models throughout the lab</td>
</tr>
</tbody>
</table>

(continued)
Key features of Human Anatomy & Physiology Laboratory Manual: Making Connections that help facilitate active learning include the following.

- **LabBOOSTS** invite students to do hands-on demonstration of key concepts.
- **Making Connections charts** within activities encourage students to apply previously learned concepts.
- **Guided Questions** within the activities help students think about the relevant concepts and how they apply to the activity.
- **Quick Tips** provide hints for performing activities or mnemonics for remembering key terms.
- **Clinical Connection** boxes highlight relevant diseases or conditions and help reinforce learning of key concepts.

### Getting Students to Prepare for Lab

This manual helps address this problem by providing extensive **Pre-Lab Assignments** that include pre-lab activity questions for each activity in the unit. These pre-lab questions are intended to get the student to peruse the lab activities before lab. Assignable Pre-Lab Assessments are also available in Mastering A&P.

### Getting Students to Apply Concepts

A third challenge and goal in the lab course is to get students to see the connections between concepts learned in lecture and their application in the lab. This manual fosters students’ ability to make these connections with unique **Think About It** questions and **Making Connections** charts. **Post-Lab Assignments** also include Bloom’s Level II Review Questions and **Concept Mapping**.

### Other Key Features

**Companion Lab Manual to Erin Amerman’s Human Anatomy & Physiology**

This lab manual was developed as the companion lab manual to Erin Amerman’s *Human Anatomy & Physiology* textbook and reflects the same superb art program and terminology found in the Amerman textbook.

### Additional Photos of Lab Specimens

This lab manual contains additional images not found in the Amerman textbook, including photos of anatomical models, cadaver images, and histology photomicrographs.

### PhysioEx™ 9.1

**PhysioEx 9.1** is an easy-to-use physiology lab simulation program that allows students to repeat labs as often as they like, perform experiments without animals, and conduct experiments that are difficult.
PhysioEx 9.1 topics include the following.

- Exercise 1: *Cell Transport Mechanisms and Permeability*. Explores how substances cross the cell membranes. Topics include simple and facilitated diffusion, osmosis, filtration, and active transport.
- Exercise 2: *Skeletal Muscle Physiology*. Provides insights into the complex physiology of skeletal muscle. Topics include electrical stimulation, isometric contractions, and isotonic contractions.
- Exercise 3: *Neurophysiology of Nerve Impulses*. Investigates stimuli that elicit action potentials, stimuli that inhibit action potentials, and factors affecting the conduction velocity of an action potential.
- Exercise 4: *Endocrine System Physiology*. Investigates the relationship between hormones and metabolism, the effect of estrogen replacement therapy, the diagnosis of diabetes, and the relationship between the levels of cortisol and adrenocorticotropic hormone and a variety of endocrine disorders.
- Exercise 5: *Cardiovascular Dynamics*. Allows students to perform experiments that would be difficult if not impossible to do in a traditional laboratory. Topics include vessel resistance and pump (heart) mechanics.
- Exercise 6: *Cardiovascular Physiology*. Examines variables influencing heart activity. Topics include setting up and recording baseline heart activity, the refractory period of cardiac muscle, and an investigation of factors that affect heart rate and contractility.
- Exercise 7: *Respiratory System Mechanics*. Investigates the physical and chemical aspects of pulmonary function. Students collect data simulating normal lung volumes. Other activities examine factors such as airway resistance and the effect of surfactant on lung function.
- Exercise 8: *Chemical and Physical Processes of Digestion*. Examines factors that affect enzyme activity by manipulating (in compressed time) enzymes, reagents, and incubation conditions.
- Exercise 9: *Renal System Physiology*. Stimulates the function of a single nephron. Topics include factors influencing glomerular filtration, the effect of hormones on urine function, and glucose transport maximum.
- Exercise 10: *Acid-Base Balance*. Topics include respiratory and metabolic acidosis/alkalosis and renal and respiratory compensation.
- Exercise 11: *Blood Analysis*. Topics include hematocrit determination, erythrocyte sedimentation rate determination, hemoglobin determination, blood typing, and total cholesterol determination.
- Exercise 12: *Serological Testing*. Investigates antigen–antibody reactions and their role in clinical tests used to diagnose a disease or an infection.
BIOPAC

Activities that utilize the Biopac Student Labs data acquisition system are included in Unit 12, Introduction to the Muscular System: Muscle Tissue; Unit 15, The Central Nervous System: Brain and Spinal Cord; Unit 21, Physiology of the Heart; and Unit 26, Physiology of the Respiratory System.

What’s New in the Second Edition

Global changes include the following.

- NEW “What You Need to Know Before You Start This Unit” section at the beginning of each unit helps students determine what they need to review before lab.
- Over 30 REVISED illustrations based on the new/revised art in Amerman’s Human Anatomy & Physiology, 2nd edition.
- 12 NEW photos added, including 5 photomicrographs, 3 cadaver, and 4 anatomical models.
- NEW pronunciation guides help reduce frustration associated with learning a new, complex vocabulary.
- REVISED Making Connections charts have been reorganized so they are now easier to complete during lab time.
- REVISED background material helps students come to lab better prepared by summarizing key concepts and reinforcing topics taught in lecture.
- REVISED Pre-Lab and Post-Lab Questions help students focus on key concepts and improve critical-thinking skills.

Unit-by-unit changes include the following.

Unit 1, Introduction to Anatomy and Physiology: Revised Figure 1-3 (common terms that describe the regions of the body surface) to make it more useful and student-friendly

Unit 2, Introduction to the Organ Systems: New and improved Activity 3: Studying Homeostasis and Organ System Interactions to help students better understand how to complete the organ system interaction worksheet

Unit 3, Chemistry: Updated LabBOOST with new photo to increase student understanding of protein structure and function

Unit 5, The Cell: Addition of compare and contrast charts in Activity 5: Exploring Cellular Diversity to stimulate critical thinking

Unit 7, The Integumentary System: Revised activity instructions to improve clarity

Unit 8, Introduction to the Skeletal System: Modified Activity 2: Classifying and Identifying Bones and Bone Markings to stimulate critical thinking; addition of spongy bone histology in Activity 4: Exploring the Microscopic Anatomy of Bone

Unit 9, The Axial Skeleton: Modified activities to increase higher order thinking

Unit 11, Joints: Addition of compare and contrast charts in Activity 3: Comparing and Contrasting the Structure and Function of Selected Synovial Joints to stimulate critical thinking

Unit 12, Introduction to the Muscular System: Muscle Tissue: Updated BIOPAC activities

Unit 14, Introduction to the Nervous System: Expanded Activity 4: Exploring the Histology of Nervous Tissue with new photomicrographs

Unit 15, The Central Nervous System: Brain and Spinal Cord: Reorganized content and modified instructions for Activity 1: Exploring the Functional Anatomy of the Brain to improve flow and clarity; updated BIOPAC activities

Unit 16, The Peripheral Nervous System: Nerves and Autonomic Nervous System: Reorganized content and modified activity instructions to improve flow and clarity

Unit 18, The Endocrine System: Revised question sets in Activity 1: Exploring the Organs of the Endocrine System to improve flow and clarity

Unit 23, Circulatory Pathways and the Physiology of Blood Vessels: Modified activity instructions to improve clarity

Unit 24, The Lymphatic System: Revised and improved Making Connections chart in Activity 1: Exploring the Organs of the Lymphatic System

Unit 25, Anatomy of the Respiratory System: Revised and improved Making Connections chart in Activity 1: Exploring the Organs of the Respiratory System

Unit 28, Physiology of the Digestive System: Expanded Activity 4: Tracing Digestive Pathways to build critical thinking skills

Unit 30, Physiology of the Urinary System: Modified instructions for Activity 2: Simulating the Events of Urine Production and Urine Concentration to improve clarity

Unit 31, Reproduction and Development: Expanded Activity 3: Examining the Microscopic Anatomy of Selected Reproductive Organs to include epididymis, penis, uterine tube, and uterus

What’s New in Mastering A&P

Please see the front of this lab manual for information on the new media and assignments for the second edition of Whiting, found in Mastering A&P.
Acknowledgments

A project of this magnitude is truly a team effort, and I have been a part of an amazing team. I have so many people to thank. I will be forever grateful to Acquisitions Editor Gretchen Puttkamer for bringing me onto the team, for helping me to create a vision for this project, and for having the patience to coach me through those rough beginnings. A heartfelt thanks to Serina Beauparlat, Editor-in-Chief, for her unending support, encouragement, and direction. Her extraordinary dedication to this project inspired me to give this lab manual my all and to keep my eyes on the finish line. Kudos also to Allison Rona, Director of Product Marketing, and Derek Perrigo, Senior Anatomy & Physiology Specialist, for their marketing guidance and advice. I am also grateful to Senior Content Producer Lauren Hill, Media Content Producers Patrice Fabel and Keri Rand, and Videographer Amanda Kaufmann for their excellent work spearheading Mastering A&P and the new media for this edition.

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Words cannot express the depth of my gratitude for the late Dr. Louis J. Guillette and the tremendous impact that he had on my life. He was my mentor, my professor, and my friend. He invested in my life and he taught me how to teach. He believed in me so many years ago, and that belief not only changed the direction of my life but also instilled in me a confidence in my abilities that took root and enabled me to pursue my dreams.

I am deeply grateful to my husband, Mark, and to our three incredible teenagers, Jesse, Eli, and Ashton, for their patience (most of the time) as I managed deadlines amidst the demands of our crazy yet incredible life filled with activities—swimming, football, baseball, basketball, and color guard, just to name a few! Mark, this project would have never happened without you. You are the love of my life—an incredible husband and father—and I am blessed beyond measure. You remind me daily with your words and actions of what is really important in life, and you help me keep my priorities in order.

Finally, I want to express my deepest gratitude to my parents, Dan and Lou Cox. Their unending love and support enabled me to pursue my dream of becoming a college professor. Furthermore, Dad’s dedication to his career as a doctor and Mom’s extraordinary nursing skills taught me that teaching, like medicine, is more about building relationships and service than anything else.
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Acknowledgments IX
Brief Contents

UNIT

1 Introduction to Anatomy and Physiology 1
2 Introduction to the Organ Systems 15
3 Chemistry 31
4 The Microscope 51
5 The Cell 65
6 Histology 85
7 The Integumentary System 109
8 Introduction to the Skeletal System 127
9 The Axial Skeleton 147
10 The Appendicular Skeleton 181
11 Joints 209
12 Introduction to the Muscular System: Muscle Tissue 229
13 Gross Anatomy of the Muscular System 253
14 Introduction to the Nervous System 293
15 The Central Nervous System: Brain and Spinal Cord 313
16 The Peripheral Nervous System: Nerves and Autonomic Nervous System 343
17 General and Special Senses 369
18 The Endocrine System 399
19 Blood 419
20 Anatomy of the Heart 439
21 Physiology of the Heart 455
22 Anatomy of Blood Vessels 471
23 Circulatory Pathways and the Physiology of Blood Vessels 499
24 The Lymphatic System 517
25 Anatomy of the Respiratory System 537
26 Physiology of the Respiratory System 553
27 Anatomy of the Digestive System 571
28 Physiology of the Digestive System 599
29 Anatomy of the Urinary System 613
30 Physiology of the Urinary System 631
31 Reproduction and Development 649

CAT Dissection Exercises

1 Exploring the Muscular System of the Cat C-1
2 Exploring the Spinal Nerves of the Cat C-21
3 Exploring the Respiratory System of the Cat C-27
4 Exploring the Digestive System of the Cat C-33
5 Exploring the Cardiovascular System of the Cat C-41
6 Exploring the Urinary System of the Cat C-49
7 Exploring the Reproductive System of the Cat C-53

INDEX I-1
## Contents

### UNIT 1  Introduction to Anatomy and Physiology  1

**PRE-LAB Assignments**  2  
**Activity 1:** Identifying Body Regions and Exploring Surface Anatomy  6  
**Activity 2:** Identifying Body Cavities and Abdominopelvic Regions  8  
**Activity 3:** Demonstrating and Identifying Body Planes of Section  9  
**Activity 4:** Assisting the Coroner  10  
**POST-LAB Assignments**  11

### UNIT 2  Introduction to the Organ Systems  15

**PRE-LAB Assignments**  16  
**Activity 1:** Locating and Describing Major Organs and Their Functions  18  
**Activity 2:** Using Anatomical Terminology to Describe Organ Locations  22  
**Activity 3:** Studying Homeostasis and Organ System Interactions  24  
**POST-LAB Assignments**  27

### UNIT 3  Chemistry  31

**PRE-LAB Assignments**  32  
**Activity 1:** Exploring the Chemical Properties of Water  36  
**Activity 2:** Determining pH and Interpreting the pH Scale  38  
**Activity 3:** Observing the Role of Buffers  40  
**LabBOOST** Protein Structure  43  
**Activity 4:** Analyzing Enzymatic Activity  44  
**POST-LAB Assignments**  47

### UNIT 4  The Microscope  51

**PRE-LAB Assignments**  52  
**Activity 1:** Identifying the Parts of the Microscope  54  
**Activity 2:** Using the Microscope to View Objects  55  
**Activity 3:** Determining Field Diameter and Estimating the Size of Objects  57  
**LabBOOST** Metric Conversions  59  
**Activity 4:** Perceiving Depth of Field  59  
**Activity 5:** Caring for the Microscope  59  
**POST-LAB Assignments**  61

### UNIT 5  The Cell  65

**PRE-LAB Assignments**  66  
**LabBOOST** Organelles  70  
**Activity 1:** Making a Wet Mount  71  
**Activity 2:** Identifying Cell Structures and Describing Their Functions  71  
**Activity 3:** Examining the Possible Role of Osmosis in Cystic Fibrosis  72  
**Activity 4:** Identifying the Stages of the Cell Cycle  76  
**Activity 5:** Exploring Cellular Diversity  77  
**PhysioEx Exercise 1:** Cell Transport Mechanisms and Permeability  78  
**POST-LAB Assignments**  79

### UNIT 6  Histology  85

**PRE-LAB Assignments**  86  
**Activity 1:** Examining Epithelial Tissue  91  
**Activity 2:** Characterizing Connective Tissue  98  
**Activity 3:** Exploring Nervous and Muscle Tissue  99  
**Activity 4:** Constructing a Tissue Identification Concept Map  101  
**POST-LAB Assignments**  103

### UNIT 7  The Integumentary System  109

**PRE-LAB Assignments**  110  
**Activity 1:** Identifying and Describing Skin Structures  116  
**Activity 2:** Examining the Histology of the Skin  118  
**Activity 3:** Determining Sweat Gland Distribution  120  
**POST-LAB Assignments**  121

### UNIT 8  Introduction to the Skeletal System  127

**PRE-LAB Assignments**  128  
**Activity 1:** Reviewing Skeletal Cartilages  130  
**Activity 2:** Classifying and Identifying Bones and Bone Markings  135
Contents

Activity 3: Examining the Gross Anatomy of a Long Bone 137

LabBOOST Osteon Model 139
Activity 4: Exploring the Microscopic Anatomy of Bone 139
Activity 5: Examining the Chemical Composition of Bone 141
POST-LAB Assignments 143

UNIT 9 The Axial Skeleton 147
PRE-LAB Assignments 148
Activity 1 Studying the Bones of the Skull 158
Activity 2 Examining the Fetal Skull 163
Activity 3 Studying the Bones of the Vertebral Column and Thoracic Cage 169
Activity 4 Identifying Bones in a Bag 173
POST-LAB Assignments 175

UNIT 10 The Appendicular Skeleton 181
PRE-LAB Assignments 182
LabBOOST The Pelvic Bones 187
Activity 1: Studying the Bones of the Appendicular Skeleton 192
Activity 2: Identifying Bones in a Bag 200
POST-LAB Assignments 201

UNIT 11 Joints 209
PRE-LAB Assignments 210
Activity 1: Identifying and Classifying Joints 216
Activity 2: Demonstrating Movements Allowed by Synovial Joints 218
Activity 3: Comparing and Contrasting the Structure and Function of Selected Synovial Joints 222
POST-LAB Assignments 225

UNIT 12 Introduction to the Muscular System: Muscle Tissue 229
PRE-LAB Assignments 230
Activity 1: Identifying the Structural Components of a Skeletal Muscle 233
Activity 2: Examining the Microscopic Anatomy of Skeletal Muscle Tissue and the Neuromuscular Junction 237
LabBOOST Visualizing Sliding Filaments 239

Activity 3: Stimulating Muscle Contraction in Glycerinated Skeletal Muscle Tissue 241
Activity 4: Electromyography in a Human Subject Using BIO PAC 243
PhysioEx Exercise 2: Skeletal Muscle Physiology 246
POST-LAB Assignments 247

UNIT 13 Gross Anatomy of the Muscular System 253
PRE-LAB Assignments 254
Activity 1: Determining How Skeletal Muscles Are Named 257
Activity 2: Mastering the Muscles of the Head and Neck 266
Activity 3: Mastering the Muscles of the Trunk 272
Activity 4: Mastering the Muscles of the Upper Limb 278
Activity 5: Mastering the Muscles of the Lower Limb 284
POST-LAB Assignments 285

UNIT 14 Introduction to the Nervous System 293
PRE-LAB Assignments 294
Activity 1: Calculating Reaction Time 297
Activity 2: Investigating the Motor Neuron 302
Activity 3: Investigating the Chemical Synapse 303
Activity 4: Exploring the Histology of Nervous Tissue 305
PhysioEx Exercise 3: Neurophysiology of Nerve Impulses 306
POST-LAB Assignments 307

UNIT 15 The Central Nervous System: Brain and Spinal Cord 313
PRE-LAB Assignments 314
LabBOOST Visualizing the Brain 322
Activity 1: Exploring the Functional Anatomy of the Brain 322
Activity 2: Electroencephalography in a Human Subject Using BIO PAC 324
Activity 3: Identifying the Meninges/Ventricles and Tracing the Flow of Cerebrospinal Fluid 328
Activity 4: Examining the Functional Anatomy of the Spinal Cord 332
Activity 5: Dissecting a Sheep Brain and Spinal Cord 334

POST-LAB Assignments 337

UNIT 16 The Peripheral Nervous System: Nerves and Autonomic Nervous System 343

PRE-LAB Assignments 344

LabBOOST Learning the Cranial Nerves 350

Activity 1: Learning the Cranial Nerves 351

Activity 2: Evaluating the Function of the Cranial Nerves 352

Activity 3: Identifying the Spinal Nerves and Nerve Plexuses 356

Activity 4: Analyzing a Spinal Reflex 358

Activity 5: Exploring the Autonomic Nervous System 359

POST-LAB Assignments 363

UNIT 17 General and Special Senses 369

PRE-LAB Assignments 370

Activity 1: Identifying General Sensory Receptors and Exploring Their Structure and Function 374

Activity 2: Examining the Structure and Function of Olfactory and Gustatory Receptors 377

Activity 3: Exploring the Structure and Function of the Eye 380

Activity 4: Dissecting a Mammalian Eye 383

Activity 5: Performing Visual Tests 384

Activity 6: Exploring the Structure and Function of the Ear 389

Activity 7: Performing Hearing and Equilibrium Tests 391

POST-LAB Assignments 393

UNIT 18 The Endocrine System 399

PRE-LAB Assignments 400

Activity 1: Exploring the Organs of the Endocrine System 407


LabBOOST Microscopic Anatomy of the Adrenal Cortex 411

Activity 3: Investigating Endocrine Case Studies: Clinician’s Corner 412

PhysioEx Exercise 4: Endocrine System Physiology 413

POST-LAB Assignments 415

UNIT 19 Blood 419

PRE-LAB Assignments 420

Activity 1: Exploring the Formed Elements of Blood 423

Activity 2: Performing a Hematocrit 425

Activity 3: Performing a Differential White Blood Cell Count 426

Activity 4: Determining Coagulation Time 428

Activity 5: Determining Blood Types 430

PhysioEx Exercise 11: Blood Analysis 432

POST-LAB Assignments 433

UNIT 20 Anatomy of the Heart 439

PRE-LAB Assignments 440

Activity 1: Examining the Functional Anatomy of the Heart 444

Activity 2: Dissecting a Mammalian Heart 446

Activity 3: Reviewing the Microscopic Structure of Cardiac Muscle Tissue 448

Activity 4: Tracing Circulatory Pathways 450

POST-LAB Assignments 451

UNIT 21 Physiology of the Heart 455

PRE-LAB Assignments 456

Activity 1: Recording and Interpreting an Electrocardiogram 460

Activity 2: Auscultating Heart Sounds 461

Activity 3: Electrocardiography in a Human Subject Using Biopac 462

PhysioEx Exercise 6: Cardiovascular Physiology 466

POST-LAB Assignments 467

UNIT 22 Anatomy of Blood Vessels 471

PRE-LAB Assignments 472

LabBOOST Blood Vessel Pathways 475

Activity 1: Identifying the Major Arteries That Supply the Head, Neck, Thorax, and Upper Limbs 480

Contents XIII
UNIT 23 Circulatory Pathways and the Physiology of Blood Vessels 499

UNIT 24 The Lymphatic System 517

UNIT 25 Anatomy of the Respiratory System 537

UNIT 26 Physiology of the Respiratory System 553

UNIT 27 Anatomy of the Digestive System 571

UNIT 28 Physiology of the Digestive System 599

UNIT 29 Anatomy of the Urinary System 613