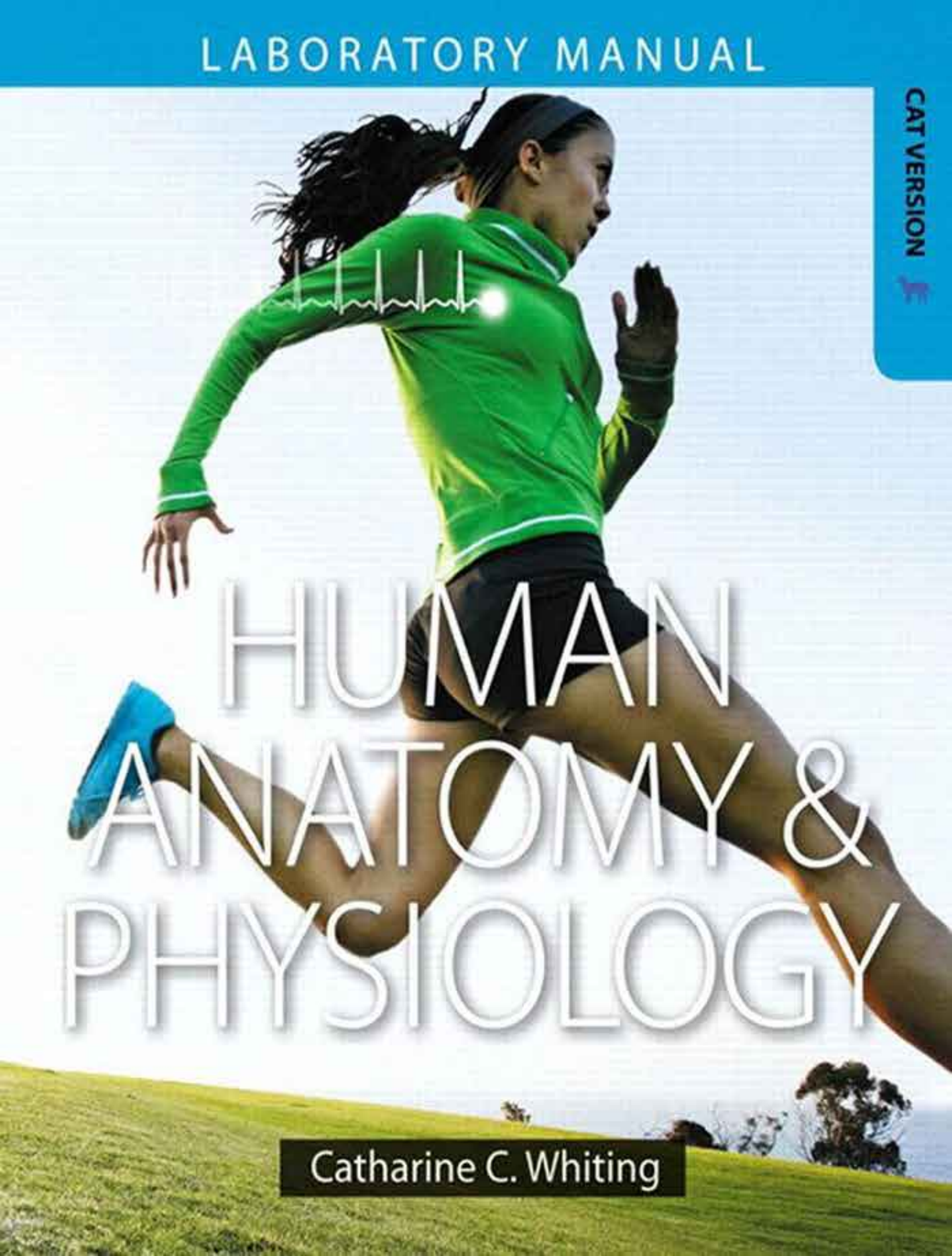


LABORATORY MANUAL

CAT VERSION



HUMAN
ANATOMY &
PHYSIOLOGY

Catharine C. Whiting

Human Anatomy & Physiology Laboratory Manual

MAKING CONNECTIONS

CAT VERSION

Catharine C. Whiting

University of North Georgia

With contributions by

Karen L. Keller

Frostburg State University

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About the Author



Catharine C. Whiting, *University of North Georgia*

Cathy Whiting began her college career at Waycross Junior College before transferring to the University of Georgia and earning a B.S. in biology. She earned both an M.S.T. and a Ph.D. at the University of Florida, training under an extraordinary mentor, Dr. Louis J. Guillette, a brilliant researcher, author, and educator who taught her how to do science and, more importantly, how to teach. With 20 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. 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.

Contributor



Karen L. Keller, *Frostburg State University*

Karen Keller earned both her B.S. and M.S. degrees in biology from Frostburg State University and her Ph.D. in physiology from the University of Georgia, College of Veterinary Medicine. She has taught at community college and four-year college levels and has extensive experience teaching introductory biology, anatomy and physiology, musculoskeletal anatomy, microbiology, comparative vertebrate anatomy, histology, and parasitology courses. In addition, she advises students interested in pursuing careers in the health professions and is a member of the American Association of Anatomists, the Human Anatomy and Physiology Society, and the Northeast Association of Advisors for the Health Professions.

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Preface

Why Did I Write This Lab Manual?

I have been teaching in a wide variety of settings since I graduated from the University of Georgia—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 a small liberal arts university, and, currently, as a professor of biology at the University of North Georgia. 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 life-long 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 laboratory settings. 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 around 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.

Examples of Active Learning in This Lab Manual

Unit	Activity	How it facilitates active learning
Unit 2 Introduction to Organ Systems	Activity 3—Studying Homeostasis and Organ System Interactions	Students work together to research and explain how organ systems interact during the patellar reflex; high engagement factor; challenging task that requires students to think critically and discuss their ideas with lab group members
Unit 6 Histology	Activity 4—Tissue Identification Concept Map	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 to just memorize them; high engagement and high energy; demands critical-thinking and problem-solving skills
Unit 10 The Appendicular Skeleton	Activity 2—Identifying Bones-in-a-Bag	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
Unit 13 Gross Anatomy of the Muscular System	Activity 1—Determining How Skeletal Muscles Are Named	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

(continued)

Examples of Active Learning in This Lab Manual (continued)

Unit	Activity	How it facilitates active learning
Unit 15 The Central Nervous System: Brain and Spinal Cord	Activity 3—Identifying the Meninges/Ventricles and Tracing the Flow of Cerebrospinal Fluid	Students engage in a high-energy, interactive cerebrospinal fluid “dance” as they learn about the production, flow, and return of CSF to venous circulation
Unit 19 The Endocrine System	Activity 3—Investigating Endocrine Case Studies: Clinician’s Corner	Mini case studies encourage students to apply the information that they have learned in Activity 1 and Activity 2; builds critical-thinking and problem-solving skills
Unit 24 Blood Vessel Physiology	Activity 1—Tracing Blood Flow—General Systemic Pathways	Students use their knowledge of heart and blood vessel anatomy obtained in previous units along with anatomical models to trace the pathway of blood from the left ventricle to four peripheral sites (eye, forearm, abdomen, and leg) and back to the right atrium; they work together to diagram, label, and explain the exchange of materials at the capillary bed
Unit 25 The Lymphatic System	Activity 4—Using a Pregnancy Test to Demonstrate Antigen–Antibody Reactions	An interactive “wet lab” that engages students as they perform an enzyme-linked immunosorbent assay (ELISA) to detect the presence of an antigen (human chorionic gonadotropin) in unknown samples
Unit 28 Anatomy of the Digestive System	Activity 3—Examining the Histology of Selected Digestive Organs	Interactive question set encourages student engagement and challenges students to make predictions and draw conclusions concerning the relationship between structure and function at the histological level
Unit 31 Physiology of the Urinary System	Activity 2—Simulating the Events of Urine Production and Urine Concentration	Hands-on activity using beads to simulate renal function; a question set takes students through a step-by-step process with increasingly challenging questions to help them better understand the role of the kidneys in maintaining homeostasis, as well as to further identify structure/function relationships

Key features of *Human Anatomy & Physiology Laboratory Manual: Making Connections* that help facilitate active learning include:

- **Lab Boosts** invite students to do hands-on demonstrations of key concepts.

LabBOOST >>>

Anatomy of the Renal Corpuscle

Understanding the anatomy of the renal corpuscle can be confusing. Here is a trick to help you learn the anatomy of the visceral layer of the glomerular capsule. Draw or tape a “nucleus” to the back of each of your hands. Your hands represent podocytes. Now, wiggle your fingers. Your fingers represent pedicels which are foot-like processes of the podocytes. Bring your fingers together so that they interdigitate (palms facing you). Note the slit-like openings between your fingers. These openings represent filtration slits. This visceral layer of the glomerular capsule overlies the glomerulus and its fenestrations to form the renal corpuscle.



- **Making Connections charts** within activities encourage students to apply previously learned concepts.
- **Guided questions** within 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.

QUICK TIP The following mnemonic device can help you remember the relative abundance of each leukocyte type, from most abundant to least: **never let monkeys eat bananas (neutrophils, lymphocytes, monocytes, eosinophils, basophils).**

- **Clinical Connection boxes** highlight relevant diseases or conditions and help reinforce learning of key concepts.

CLINICAL CONNECTION

During **childbirth**, a woman might receive an **epidural block**. During this procedure, an anesthetic drug is inserted into the **epidural space** between two lumbar vertebrae. The drug reduces the **pain** experienced during **labor and childbirth** by numbing the **spinal nerves** of the pelvis and **lower limbs**.

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 MasteringA&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 that begin each unit and **Making Connections** charts within activities. **Post-lab Assignments** also include **Bloom's Level II Review Questions** and **Concept Mapping**.

PRE-LAB ASSIGNMENTS

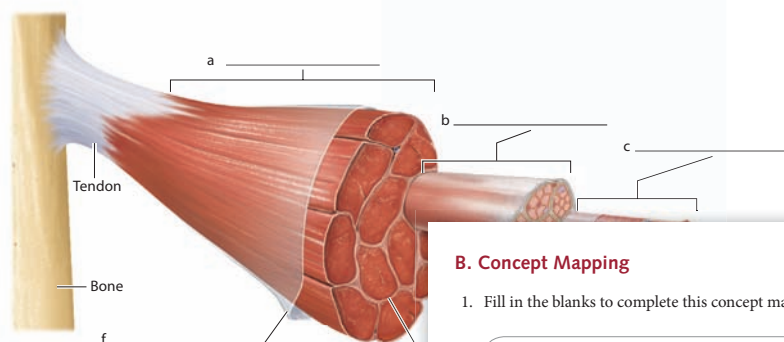
Pre-lab quizzes are also assignable in **MasteringA&P**®

To maximize learning, BEFORE your lab period carefully read this entire lab unit and complete these pre-lab assignments using your textbook, lecture notes, and prior knowledge.

PRE-LAB Activity 1: Identifying the Structural Components of a Skeletal Muscle

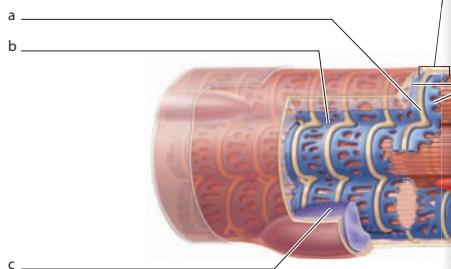
1. Use the list of terms provided to label the accompanying illustration of a skeletal muscle; check off each term as you label it.

- endomysium
- fascicle
- muscle
- epimysium
- perimysium
- muscle fiber



2. Use the list of terms provided to label the accompanying illustration; check off each term as you label it.

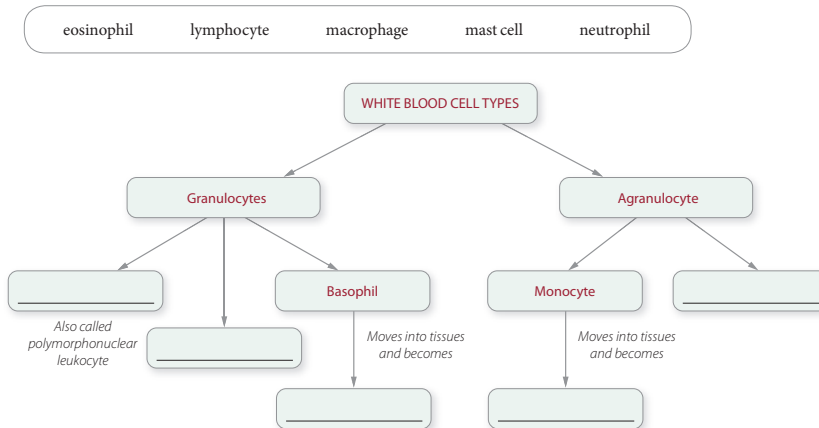
- mitochondrion
- sarcolemma
- myofibrils
- sarcoplasmic reticulum
- nucleus
- T-tubule



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B. Concept Mapping

1. Fill in the blanks to complete this concept map outlining the white blood cell types.



2. Construct a unit concept map to show the relationships among the following set of terms. Include all of the terms in your diagram. Your instructor may choose to assign additional terms.

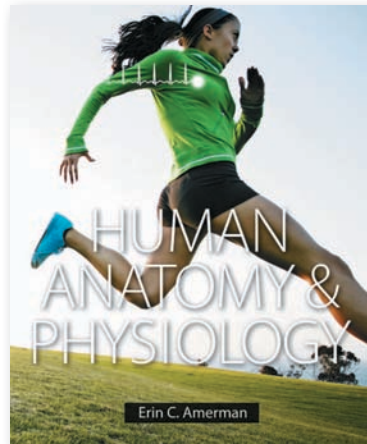
- agglutination
- antibody
- antigen
- anucleate
- diapedesis
- eosinophil
- hemoglobin
- hormone
- lymphocyte
- macrophage
- mast cell
- neutrophil
- plasma
- plasma membrane
- spectrin

Other Key Features

Human Anatomy & Physiology Laboratory Manual: Making Connections features a rich and varied art program and integration of key media and equipment used in the lab.

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

This lab manual reflects the terminology and explanations found in the Amerman textbook.



Superb Art from Amerman Textbook

The art from the Amerman textbook includes anatomical illustrations, photos, histology photomicrographs, and physiology sequence figures.

Table 13-1 Muscles of Facial Expression			
Muscle	Action(s)	Origin/Insertion/Nerve(s)	Concept Figures
Frontalis	Raises eyebrows; wrinkles skin of forehead horizontally	O: Epicranial aponeurosis I: Skin of eyebrows N: Facial nerve	Frontalis
Occipitalis	Pulls scalp posteriorly	O: Occipital bone I: Epicranial aponeurosis N: Facial nerve	Occipitalis
Corrugator supercilii	Pulls eyebrows inferiorly and medially (as in squinting)	O: Medial supraorbital margin of frontal bone I: Skin of medial eyebrows N: Facial nerve	Corrugator supercilii
Orbicularis oculi	Closes eye; pulls skin around the eyes, as in blinking and winking	O: Orbital portions of the frontal bone and maxilla I: Skin of the orbital area and eyelids N: Facial nerve	Orbicularis oculi
Levator labii superioris	Elevates the upper lip; everts and furrows upper lip (as in sneering)	O: Zygomatic and upper maxilla near orbit I: Skin and muscle of the upper lip N: Facial nerve	Levator labii superioris
Zygomaticus minor	Raises lateral portion of the upper lip to expose upper teeth (as in smiling)	O: Zygomatic I: Skin and muscle of the lateral upper lip N: Facial nerve	Zygomaticus minor
Zygomaticus major	Pulls the angle of the mouth superiorly and laterally (as in smiling or sneering)	O: Zygomatic I: Lateral muscle fibers of corner/angle of mouth N: Facial nerve	Zygomaticus major
			Risorius
			Depressor anguli oris
			Buccinator
			Platysma

Glomerulus (glomerular capillaries covered by podocytes)

Glomerular capsule:
Squamous epithelium (parietal layer)
Capsular space
Podocyte (visceral layer)

Proximal tubule

Efferent arteriole
Afferent arteriole

Podocyte Filtration slits Capillary Pedicels

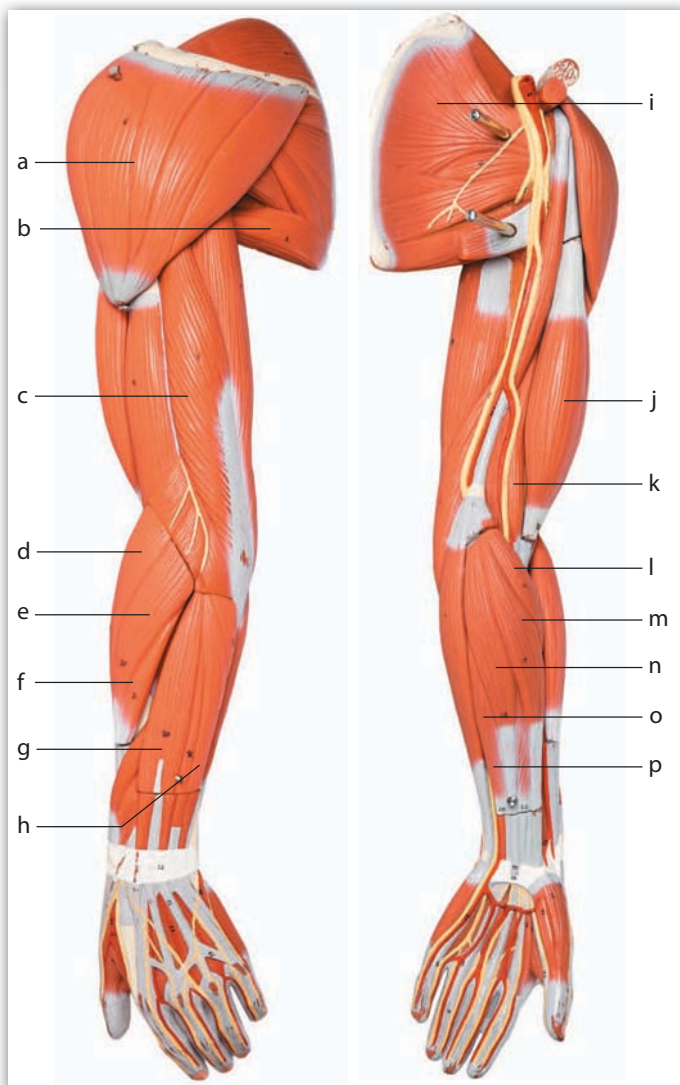
SEM (92,000x)

(a) The renal corpuscle **(b) SEM of capillary surrounded by podocytes**

Figure 30-9 The renal corpuscle.

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

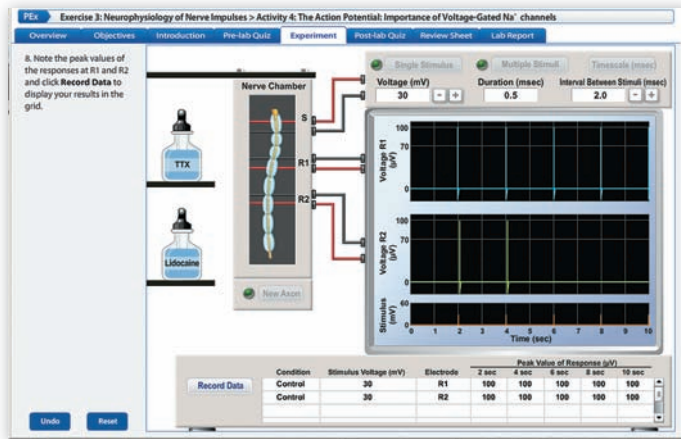


PhysioEx™ 9.1 is an easy-to-use physiology lab simulation program that allows students to repeat labs as often as they like, perform experiments without animals, and conduct experiments that are difficult to perform in a wet lab environment because of time, cost, or safety concerns. Every exercise includes an overview and every activity includes objectives, an introduction, a pre-lab quiz, the experiment, a post-lab quiz, review sheet questions, and a lab report that students can save as a PDF and print and/or email to their instructor. The online format with easy step-by-step instructions includes everything students need in one convenient place.

Each exercise and activity is referenced in the lab manual where students are directed to access PhysioEx in MasteringA&P. Pre-lab and post-lab quizzes and review sheets for PhysioEx are assignable in MasteringA&P.

PhysioEx 9.1 includes 12 exercises containing a total of 63 physiology lab activities. The program features:

- **Input data variability** allows students to change variables and test various hypotheses for the experiments.
- **Step-by-step instructions** put everything students need to do to complete the lab in one convenient place. Students gather data, analyze results, and check their understanding, all on screen.
- **Stop & Think Questions** and **Predict Questions** help students think about the connections between the activities and the physiological concepts they demonstrate.
- **Greater data variability in the results** reflects more realistically the results that students would encounter in a wet lab experiment.
- **Pre-lab and Post-lab Quizzes** and short-answer **Review Sheets** are offered to help students prepare for and review each activity.
- **Students can save their Lab Report as a PDF**, which they can print and/or email to their instructor.
- **A Test Bank of assignable pre-lab and post-lab quizzes** for use with TestGen or its course management system is provided for instructors.
- **Seven videos of lab experiments** demonstrate the actual experiments simulated on screen, making it easy for students to understand and visualize the content of the simulations. Videos demonstrate the following experiments: Skeletal Muscle, Blood Typing, Cardiovascular Physiology, Use of a Water-Filled Spirometer, Nerve Impulses, BMR Measurement, and Cell Transport.



PhysioEx 9.1 topics include:

- 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 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*. Simulates 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.

Note: In addition to being available in MasteringA&P, PhysioEx 9.1 is also available as a CD-ROM packaged with this lab manual for no additional charge. Please contact your Pearson representative for ordering information.

Biopac®

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 22, *Physiology of the Heart*; and Unit 27, *Physiology of the Respiratory System*.

Instructions for other data acquisitions systems including **iWorx**, **Intellitool**, and **PowerLab** are available in the Instructor Resources in MasteringA&P.

Practice Anatomy Lab™ (PAL™) 3.0



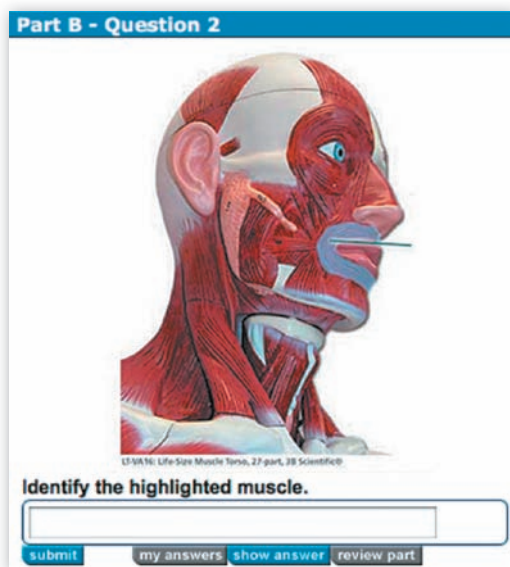
Practice Anatomy Lab 3.0 (PAL) correlations are indicated by the PAL logo and presented as optional activities. These direct students to related content in the PAL 3.0 software in MasteringA&P.

Note: In addition to being available in MasteringA&P, Practice Anatomy Lab 3.0 is also available as a DVD packaged with this lab manual for no additional charge. Please contact your Pearson representative for ordering information.

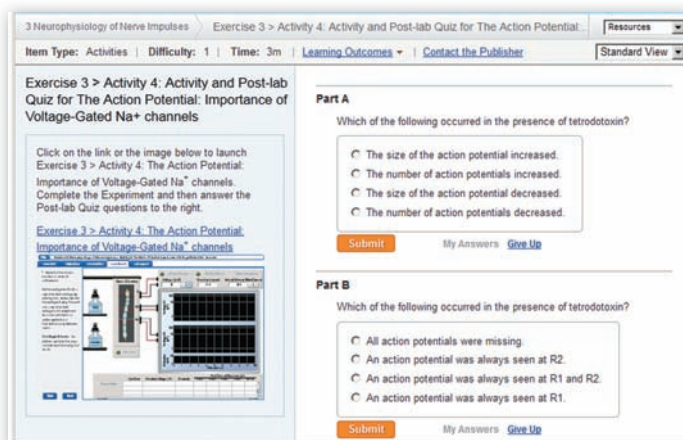
Assignable Content in MasteringA&P®

MasteringA&P is an online learning and assessment system proven to help students learn. It helps instructors maximize lab time with customizable, easy-to-assign, automatically graded assessments that motivate students to learn outside of class and arrive prepared for lab. The powerful gradebook provides unique insight into student and class performance. Instructors can easily assign the following:

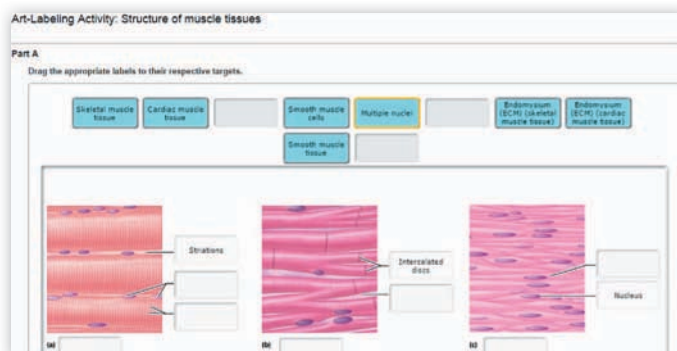
- **Pre-lab and Post-lab Quizzes for each activity** in the lab manual
- **Clinical Coaching Activities** for select units that include a brief clinical scenario with Bloom's Level II questions with feedback and hints
- **Quizzes and Lab Practicals from PAL 3.0 Test Bank**



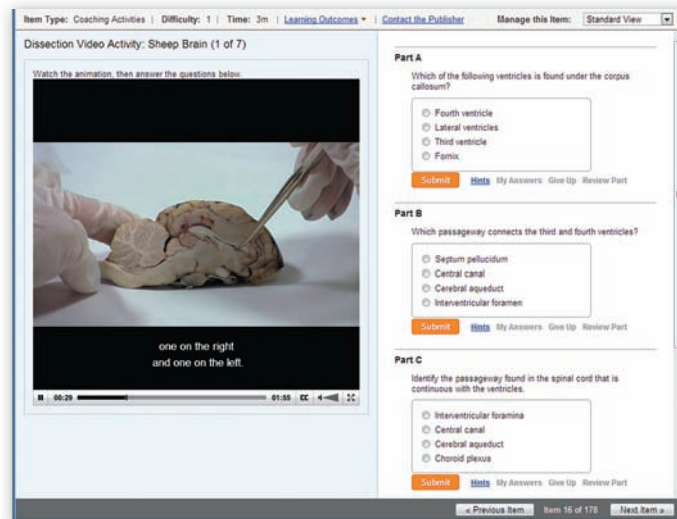
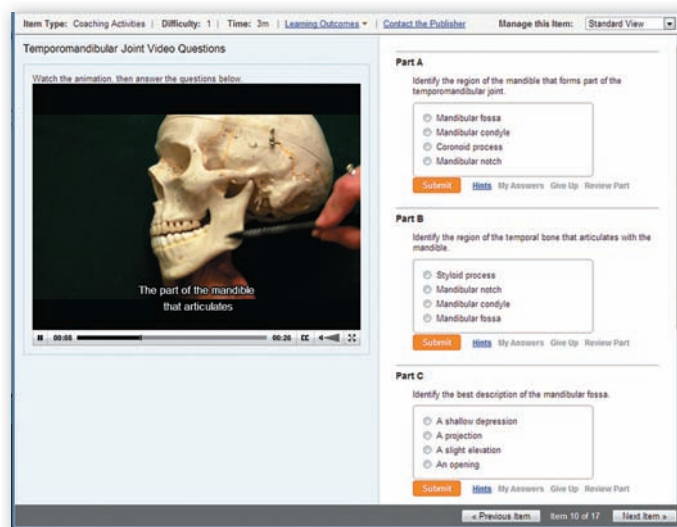
- **Pre-lab and Post-lab Quizzes and Review Sheets for PhysioEx 9.1**



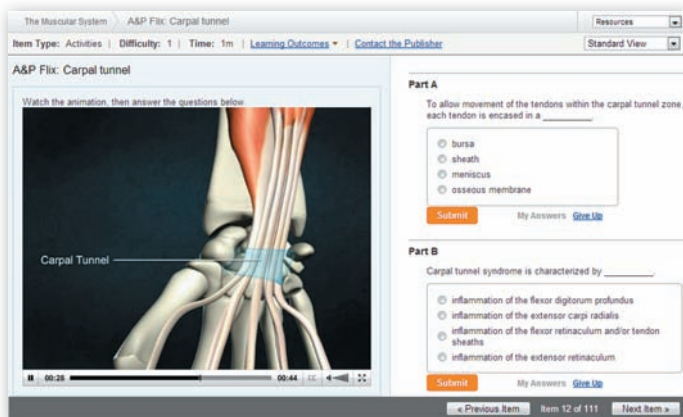
- **Drag-and-Drop Art Labeling Activities and Art Based Questions**



- **Bone and Dissection Video Coaching Activities** help students identify bones and learn how to do organ dissections

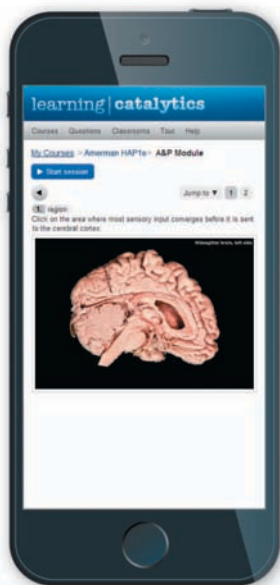


- **A&P Flix™ Animations** are 3D movie-quality anatomy animations that include self-paced tutorials and gradable quizzes. Students learn structures and functions from two sets of anatomy topics:
 - Origins, insertions, actions, and innervations (over 60 animations)
 - Group muscle actions and joints (over 50 animations)



- **Clinical Case Study Coaching Activities** increase problem-solving skills and prepare students for future careers in allied health. Corresponding Teaching Strategies, available in the Instructor Resources in MasteringA&P, enable instructors to “flip” the classroom by providing valuable tips on when and how to use case studies. The worksheets and case studies are also available in the Study Area of MasteringA&P.

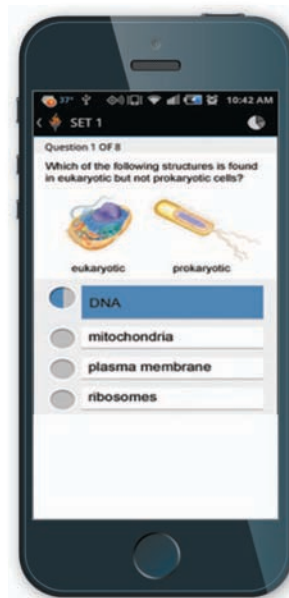
- **Learning Catalytics™** is a “bring your own device” student engagement, assessment, and classroom intelligence system. With this classroom lecture tool, instructors can flip the classroom and assess students in real time using open-ended tasks to probe student understanding. Students use their smartphone, tablet, or laptop to respond to questions in class.



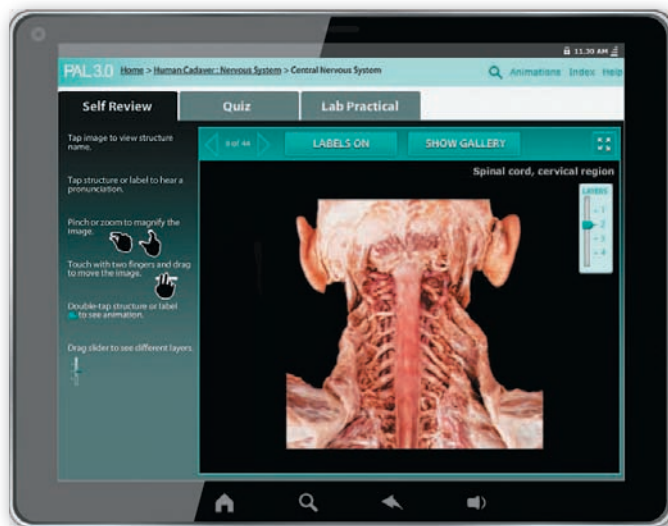
Study Tools in MasteringA&P®

Students get quick access to the following study tools in MasteringA&P:

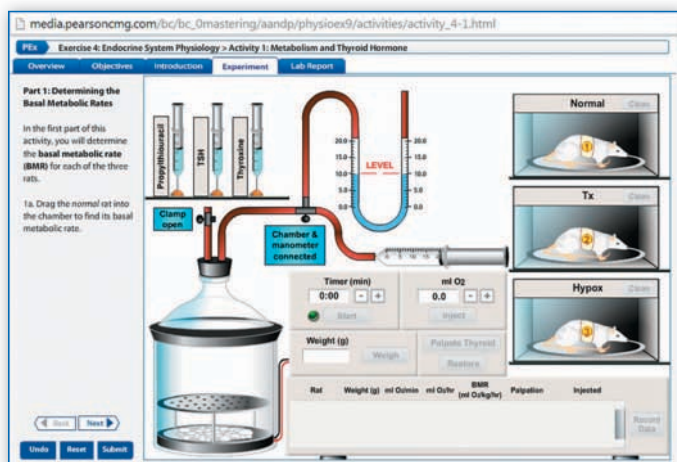
- **Pre-lab and Post-lab Quizzes** are provided for each activity.
- **Bone and Dissection videos** aid review of key bones and organ dissections found in the lab manual.
- **Dynamic Study Modules** are designed to enable students to study effectively on their own, and to help them quickly access and learn the concepts they need to be more successful on quizzes and exams. These flashcard-style questions adapt to the student’s performance and include art and explanations from this lab manual to cement the student’s understanding.



- **Practice Anatomy Lab™ (PAL™) 3.0** is an indispensable virtual anatomy study and practice tool that gives students 24/7 access to the most widely used lab specimens including human cadaver, anatomical models, histology, cat, and fetal pig. PAL 3.0 is easy to use and includes built-in audio pronunciations, rotatable bones, multiple-choice quizzes, and simulated fill-in-the-blank lab practical exams. PAL 3.0 is also accessible on mobile devices.



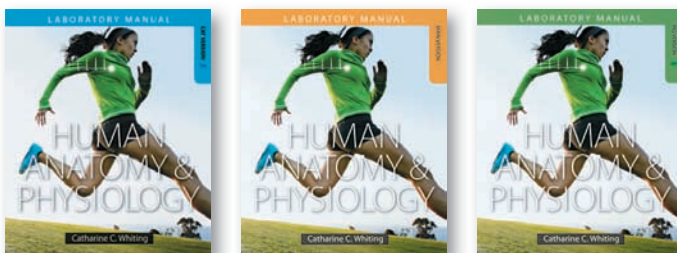
- **PhysioEx™ 9.1** is easy-to-use physiology laboratory simulation software. Every exercise includes an overview and every activity includes objectives, an introduction, a pre-lab quiz, the experiment, a post-lab quiz, review sheet questions, and a lab report that students can save as a PDF and print and/or email to their instructor.



- Videos of lab experiments
- A&P Flix animations
- Clinical Case Studies with worksheets
- Terminology Challenge worksheets
- Histology Atlas
- eText also available in *MasteringA&P with eText*

Three Versions

Human Anatomy & Physiology Laboratory Manual: Making Connections is available in three versions for your students: **Main**, **Cat**, and **Fetal Pig**. The Cat and Fetal Pig versions are identical to the Main version except that they include seven additional cat dissection exercises and nine additional fetal pig dissection exercises, respectively, at the back of the lab manual.



Cat Version

0-321-78700-5 /
978-0-321-78700-2

Main Version

0-13-395247-9 /
978-013-395247-6

Fetal Pig Version

0-13-399679-4 /
978-013-399679-1

Customization Options

An enhanced custom program allows instructors to pick and choose content to tailor the lab manual *at the activity level*, selecting only those activities they assign. Each activity includes relevant background information, full-color figures, tables, and charts.

For information on creating a custom version of this manual, visit www.pearsonlearningsolutions.com, or contact your Pearson representative for details.

Additional Instructor Resources

Instructor Guide

0-13-405738-4 / 978-013-405738-5

This guide includes detailed instructions for setting up the laboratory, time allotments for each activity, and answers to the pre-lab assignments, activity questions, and post-lab assignments. Additionally, it describes strategies that encourage active learning, including sample concept maps and an overview of using concept mapping to increase student engagement. Finally, it discusses helpful hints for running an effective lab, ways to avoid common pitfalls, and extension activities that can be used to expand activities when time allows.

Instructor Resources in MasteringA&P®

These resources include: editable pre-lab and post-lab quizzes, the Instructor's Guide, instructions for each PhysioEx activity, Terminology Challenge Worksheets, Clinical Case Studies and Teaching Strategies for each case, A&P Flix (anatomy) in PPT, A&P Flix (anatomy) in MPEG, and instructions for other data acquisition systems including iWorx, Intelli-tool, and Powerlab.

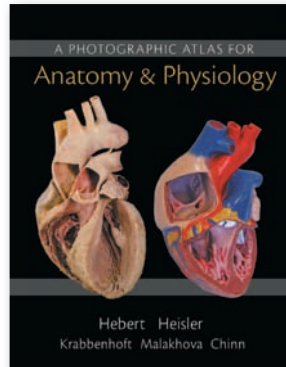
Student Supplements

NEW! A Photographic Atlas for Anatomy & Physiology

0-321-86925-7 / 978-0-321-86925-8

by Nora Hebert, Ruth E. Heisler, Jett Chinn, Karen M. Krabbenhoft, Olga Malakhova

This brand new photo atlas is the perfect lab study tool that helps students learn and identify key anatomical structures. Featuring photos from Practice Anatomy Lab™ 3.0 and other sources, the Atlas includes over 250 cadaver dissection photos, histology photomicrographs, and cat dissection photos plus over 50 photos of anatomical models from leading manufacturers such as 3B Scientific®, SOMSO®, and Denoyer-Geppert Science Company.

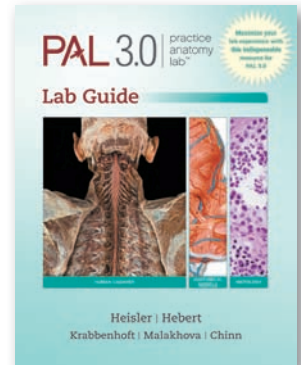


Practice Anatomy Lab 3.0 Lab Guide

0-321-84025-9 / 978-0-321-84025-7 (standalone)
0-321-85767-4 / 978-0-321-85767-5 (with PAL 3.0 DVD)

by Ruth Heisler, Nora Hebert, Jett Chinn, Karen Krabbenhoft, Olga Malakhova

Written to accompany PAL 3.0, the new *Practice Anatomy Lab 3.0 Lab Guide* contains exercises that direct the student to select images and features in PAL 3.0, and then assess their understanding with labeling, matching, short-answer, and fill-in-the-blank questions. Exercises cover three key lab specimens in PAL 3.0—human cadaver, anatomical models, and histology.



Practice Anatomy Lab™ (PAL™) 3.0

0-321-68211-4 / 978-0-321-68211-6 (DVD)

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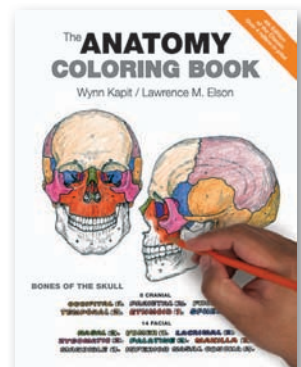


The Anatomy Coloring Book, Fourth Edition

0-321-83201-9 / 978-0-321-83201-6

by Wynn Kapit and Lawrence M. Elson

For more than 35 years, *The Anatomy Coloring Book* has been the best-selling human anatomy coloring book! A useful tool for anyone with an interest in learning anatomical structures, this concisely written text features precise, extraordinary hand-drawn figures that were crafted especially for easy coloring and interactive study. The Fourth Edition features user-friendly two-page spreads with enlarged art, clearer, more concise text descriptions, and new boldface headings that make this classic coloring book accessible to a wider range of learners.



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1

Introduction to Anatomy and Physiology

Anatomy and physiology (A&P) is a fascinating subject, but learning it can be very challenging. Even though learning A&P involves a great deal of memorization, memorizing is only the first step. True learning requires you to apply the knowledge you attain in critical-thinking and problem-solving activities.

True learning requires a tremendous level of discipline, motivation, and determination. It is hard work, and it demands a commitment to daily study. You will encounter a wide variety of study strategies designed to motivate you to become engaged in the learning process. You will be encouraged to participate fully in your lab group, to establish a regular study group, and to be willing to try new study techniques—all so that you can learn more information than you ever thought possible in one or two semesters.

We will begin building this foundation by learning the basic anatomical terminology that you will use throughout the course and when communicating with health care professionals throughout your career.

THINK ABOUT IT *The relationship between structure and function is a key concept in anatomy and physiology. In fact, structure often determines function. How is the structure of the heart related to its function?*

UNIT OUTLINE

Anatomical Terminology

Activity 1: Identifying Body Regions and Exploring Surface Anatomy

Body Cavities and Membranes

Activity 2: Identifying Body Cavities and Abdominopelvic Regions

Body Planes of Section

Activity 3: Demonstrating and Identifying Body Planes of Section

Applying Anatomical Terminology

Activity 4: Assisting the Coroner

Ace your Lab Practical!

Go to **MasteringA&P**®.

There you will find:

- Practice Anatomy Lab 3.0 including Lab Practicals **PAL**
- PhysioEx 9.1 **PhysioEx**
- A&P Flix 3D animations **A&PFlix**
- Bone and Dissection videos
- Practice quizzes

PRE-LAB ASSIGNMENTS

Pre-lab quizzes are also assignable in **MasteringA&P**®

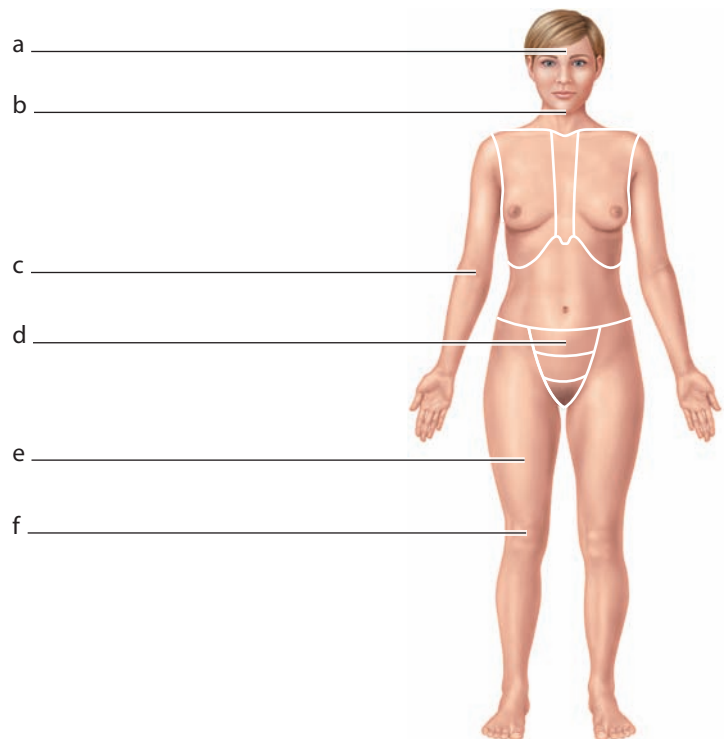
To maximize learning, BEFORE your lab period carefully read this entire lab unit and complete these pre-lab assignments using your textbook, lecture notes, and prior knowledge.

PRE-LAB Activity 1: Identifying Body Regions and Exploring Surface Anatomy

- Which of the following descriptions of the anatomical position is *incorrect*?
 - arms straight
 - palms facing posteriorly
 - toes facing forward
 - feet slightly apart
- Match each of the following descriptions with the correct directional term.

a. The sternum is _____ to the vertebrae.	1. posterior/dorsal
b. The feet are _____ to the hands.	2. distal
c. The elbows are _____ to the abdomen.	3. anterior/ventral
d. The skin is _____ to the skeleton.	4. deep
e. The heart is _____ to the sternum.	5. lateral
f. The lungs are _____ to the ribs.	6. superficial
g. The chest is _____ to the abdomen.	7. inferior
h. The knee is _____ to the hip.	8. superior
i. The little finger is _____ to the thumb.	9. proximal
j. The elbow is _____ to the wrist.	10. medial
- Use the list of terms provided to label the accompanying illustration; check off each term as you label it.

- antecubital
- cervical
- frontal
- patellar
- pelvic
- femoral



PRE-LAB Activity 2: Identifying Body Cavities and Abdominopelvic Regions

- The dorsal body cavity is subdivided into the _____ cavity and the _____ cavity.
- The ventral body cavity is subdivided into the _____ cavity and the _____ cavity.
- Which abdominopelvic region(s) is(are) located:
 - inferior to the umbilical region? _____
 - lateral to the epigastric region? _____
 - superior to the right iliac region? _____
 - inferior to the left hypochondriac region? _____
 - lateral to the hypogastric region? _____
- The innermost layer of the serous membrane surrounding the lungs is called the _____ pleura.
- The outermost layer of the serous membrane surrounding the heart is called the _____ pericardium.

PRE-LAB Activity 3: Demonstrating and Identifying Body Planes of Section

- Which plane of section divides the body into anterior and posterior parts? _____
- Which plane of section divides the body into superior and inferior parts? _____
- Which plane of section divides the body into right and left parts? _____

PRE-LAB Activity 4: Assisting the Coroner

- The pelvis is _____ to the ribs.
 - superior
 - lateral
 - inferior
 - distal
- Which of the following descriptions best applies to the term medial?
 - nose relative to the ears
 - knee relative to the ankle
 - lips relative to the nose
 - ears relative to the eyes
- Which of the following descriptions best applies to the term superior?
 - sternum relative to the lungs
 - wrist relative to the elbow
 - eyebrows relative to the eyes
 - fingers relative to the palm
- The visceral pericardium is _____ (superficial/deep) to the parietal pericardium.

Anatomical Terminology

Learning anatomy is sometimes compared to learning a new language because of the vast number of terms that are specific to the study of the human body. However, because these terms are widely used in health care professions, it is essential that you become fluent in them.

Anatomical Position

Anatomical position is the universally accepted standard position that scientists and medical professionals use to communicate information concerning parts of the body. In anatomical position (**Figure 1-1**), the body is erect and facing forward; the arms are straight and at the sides of the body, with the palms facing forward; and the feet are slightly apart, with the toes pointing forward.

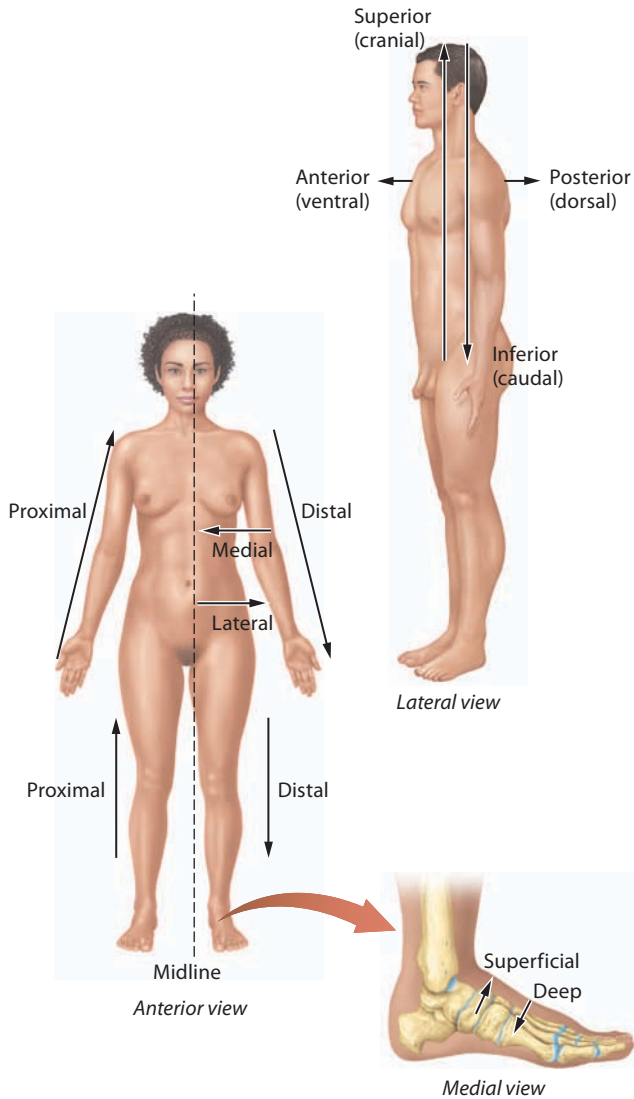


Figure 1-1 Anatomical position.

Directional Terms

Another effective way of communicating in anatomy is to use directional terms, which describe the locations of body

structures in relationship to other structures. **Figure 1-2** illustrates the most common directional terms, plus their definitions and some examples of how each might be used.



TERM	DEFINITION	EXAMPLES
Anterior (ventral)	Toward the front	<ul style="list-style-type: none"> The palms are on the anterior side of the body. The esophagus is anterior to the spinal cord.
Posterior (dorsal)	Toward the back	<ul style="list-style-type: none"> The occipital bone is on the posterior cranium (skull). The spinal cord is posterior to the esophagus.
Superior (cranial)	Toward the head	<ul style="list-style-type: none"> The nose is superior to the mouth. The neck is superior to the chest.
Inferior (caudal)	Toward the tail	<ul style="list-style-type: none"> The nose is inferior to the forehead. The umbilicus (belly button) is inferior to the chest.
Proximal	Closer to the point of origin (generally the trunk)	<ul style="list-style-type: none"> The knee is proximal to the ankle. The shoulder is proximal to the elbow.
Distal	Farther away from the point of origin (generally the trunk)	<ul style="list-style-type: none"> The foot is distal to the hip. The wrist is distal to the elbow.
Medial	Closer to the midline of the body or a body part; on the inner side of	<ul style="list-style-type: none"> The ear is medial to the shoulder. The index finger is medial to the thumb.
Lateral	Farther away from the midline of the body or a body part; on the outer side of	<ul style="list-style-type: none"> The shoulder is lateral to the chest. The thumb is lateral to the index finger.
Superficial	Closer to the surface	<ul style="list-style-type: none"> The skin is superficial to the muscle. Muscle is superficial to bone.
Deep	Farther below the surface	<ul style="list-style-type: none"> Bone is deep to the skin. Bone is deep to muscle.

Figure 1-2 Common directional terms.

Surface Anatomy/Body Regions

Regional terms are used to identify specific areas on the surface of the body. **Figure 1-3** illustrates the most common terms describing various body regions, and **Table 1-1** provides definitions of each of the regional terms.

In the following lab activity, you will explore the anatomical terms that describe various regions of the surface of the body.

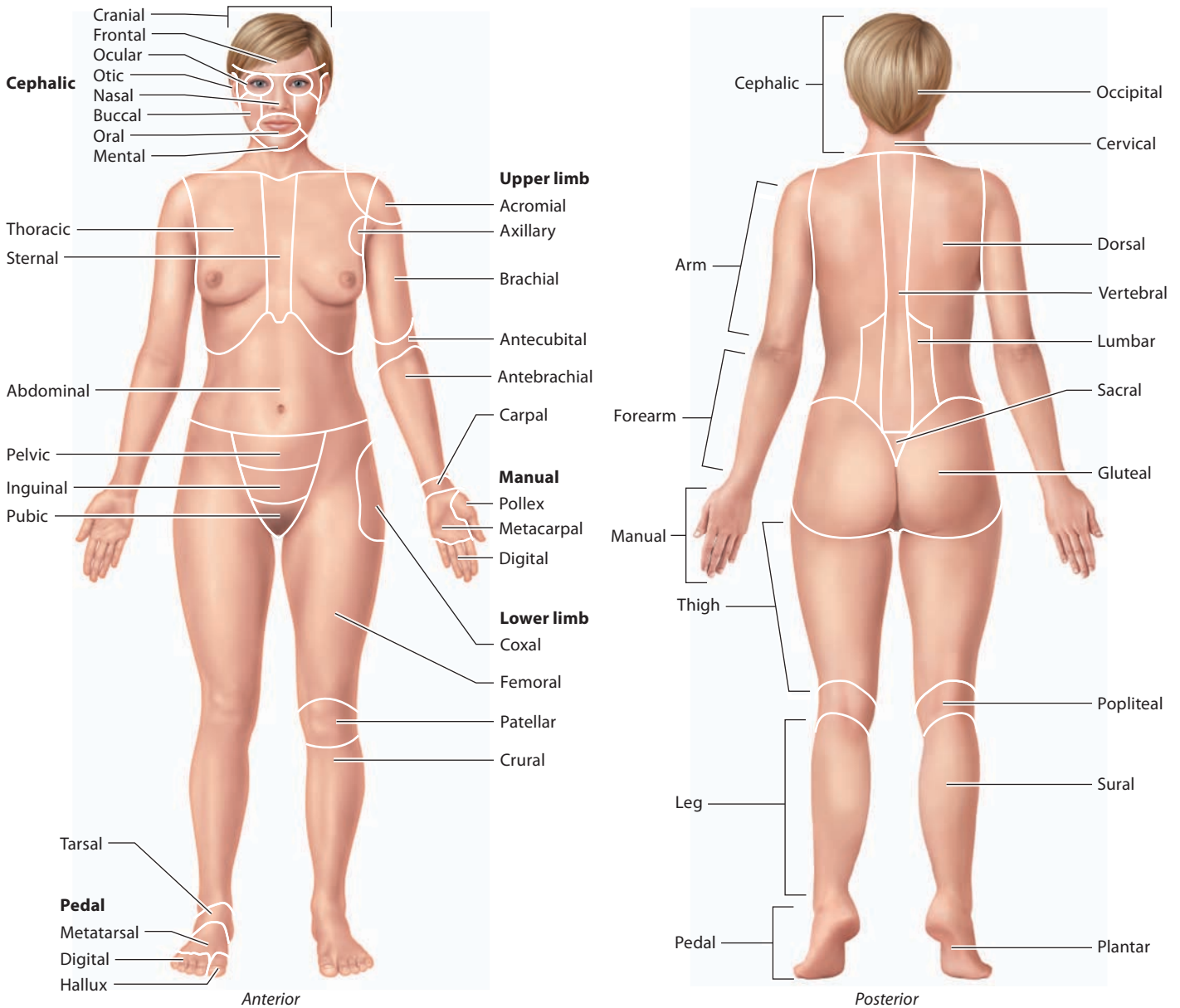


Figure 1-3 Common terms that describe the regions of the body surface.

Table 1-1 Surface Anatomy/Regional Terms**Anterior and Posterior Regions**

Abdominal	pertaining to the abdomen
Cephalic	pertaining to the head
Cervical	pertaining to the neck
Dorsal	pertaining to the back of the body
Gluteal	pertaining to the buttocks
Inguinal	pertaining to the groin
Lumbar	pertaining to the lower back
Manual	pertaining to the hand
Occipital	pertaining to the back of the head
Palmar	pertaining to the palm
Pedal	pertaining to the foot
Pelvic	pertaining to the pelvis
Plantar	pertaining to the sole of the foot
Popliteal	pertaining to the posterior surface of the knee
Pubic	pertaining to the pubis
Sacral	pertaining to the sacrum
Sural	pertaining to the posterior surface of the leg
Sternal	pertaining to the sternum
Thoracic	pertaining to the chest
Vertebral	pertaining to the spinal column

Regions of the Head and Face

Buccal	pertaining to the cheek
Cranial	pertaining to the cranium
Frontal	pertaining to the forehead
Mental	pertaining to the chin
Nasal	pertaining to the nose
Ocular	pertaining to the bony eye socket
Oral	pertaining to the mouth
Otic	pertaining to the ear

Regions of the Upper Limb

Acromial	pertaining to the point of the shoulder
Antebrachial	pertaining to the forearm
Antecubital	pertaining to the anterior surface of the elbow
Axillary	pertaining to the armpit
Brachial	pertaining to the arm
Carpal	pertaining to the wrist
Digital	pertaining to the fingers
Metacarpal	pertaining to the metacarpals
Pollex	pertaining to the thumb

Regions of the Lower Limb, Anterior View

Coxal	pertaining to the hip
Crural	pertaining to the anterior surface of the leg
Digital	pertaining to the toes
Femoral	pertaining to the thigh
Hallux	pertaining to the great toe
Metatarsal	pertaining to the metatarsals
Patellar	pertaining to the anterior surface of the knee
Tarsal	pertaining to the ankle

ACTIVITY 1**Identifying Body Regions and Exploring Surface Anatomy****Learning Outcomes**

1. Use surface anatomy terms accurately.
2. Use regional terms accurately.

Materials Needed

- Laminated anterior body region poster
- Laminated posterior body region poster
- Water-soluble marking pens
- Muscle models
- Labeling tape

Instructions

1. Spend 10 minutes reviewing regional terms with the members of your lab group. Then, use the two laminated body region posters and water-soluble markers to identify as many regional terms as possible from memory. Your instructor will set a time limit for each poster. When you are finished, use your lab manual to determine the number of body regions correctly identified and report the number to your instructor.
2. For each of the following muscles, write the body region in which it is found. Then using muscle models and model identification keys provided by your instructor, find each muscle and label it with a piece of tape.

rectus abdominis m. _____

brachialis m. _____

biceps femoris m. _____

epicranium m. _____

mentalis m. _____

gluteus maximus m. _____

Body Cavities and Membranes

The human body is divided into several fluid-filled cavities, each containing specific organs. The two major body cavities are the **dorsal** (posterior) **cavity** and the **ventral** (anterior) **cavity** (Figure 1-4). The dorsal body cavity is subdivided into the **cranial cavity**, which houses the brain, and the **vertebral** (spinal) **cavity**, which houses the spinal cord. The ventral body cavity is divided by the diaphragm into the thoracic cavity and the abdominopelvic cavity.

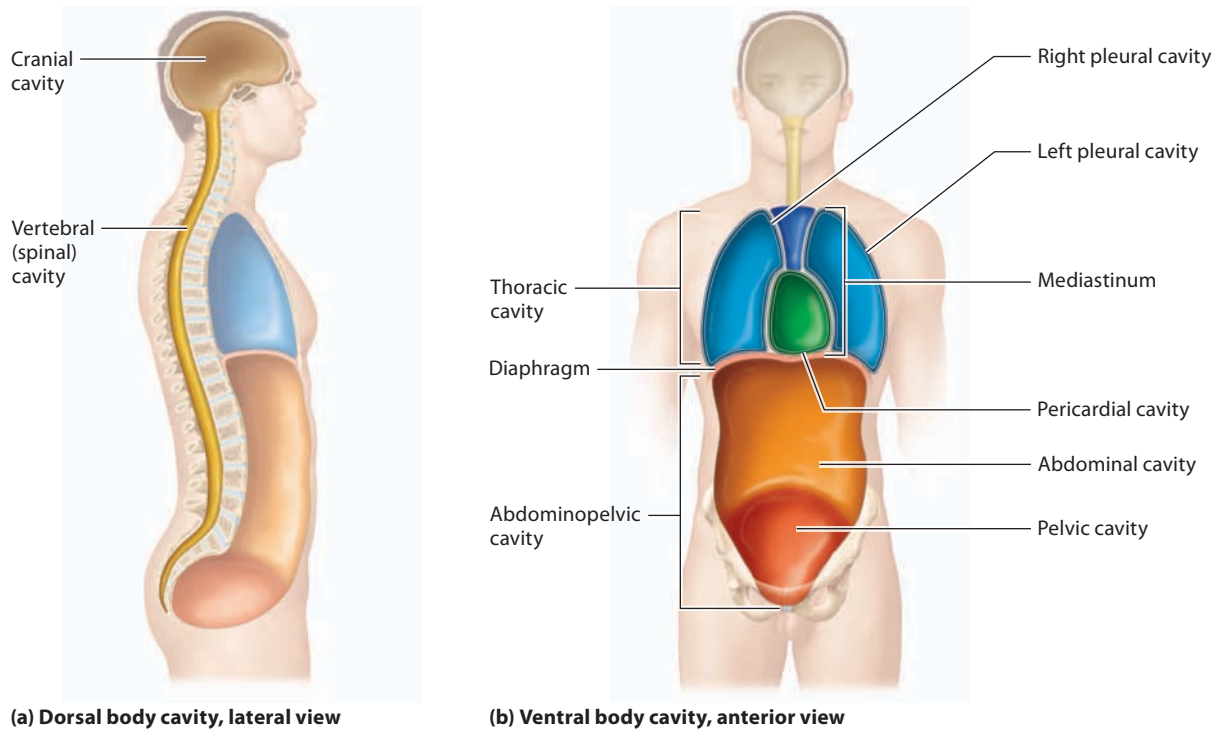


Figure 1-4 The major body cavities.

The **thoracic cavity** can be subdivided into the medial mediastinum and the right and left pleural cavities. The mediastinum contains numerous organs, including the esophagus, trachea, bronchi, and heart, the last of which is enclosed by the **pericardial cavity**. Inferior to the diaphragm is the **abdominopelvic cavity**, consisting of the **abdominal cavity**, which contains the digestive organs, and the **pelvic cavity**, which contains the urinary bladder, reproductive organs, and rectum.

Most of the organs in the ventral body cavity are surrounded by **serous membranes**, which are thin, double-layered sacs. The outer layer of the membrane is the **parietal layer**; the inner layer of the membrane covers the organ and is called the **visceral layer**. The two layers of the serous membranes are separated by a narrow cavity filled with a clear serous (watery) fluid, which is secreted by the membranes and prevents friction as the organs move within the ventral body cavity. The pleura covers the lungs, the pericardium covers the heart, and the peritoneum covers most of the abdominal organs.

The abdominopelvic cavity is typically divided into either four quadrants or nine regions (**Figure 1-5**). Clinicians divide the cavity into four quadrants: the right upper quadrant (RUQ), left upper quadrant (LUQ), right lower quadrant (RLQ), and left lower quadrant (LLQ). Anatomists subdivide the cavity into nine regions: the right hypochondriac, epigastric, left hypochondriac, right lumbar, umbilical, left lumbar, right iliac, hypogastric or pubic, and left iliac regions.

ACTIVITY 2

Identifying Body Cavities and Abdominopelvic Regions

Learning Outcomes

1. Identify the body cavities that make up the dorsal cavity and those that make up the ventral cavity, and list the major organs found in each.
2. Describe the two ways in which the abdominopelvic cavity is commonly subdivided.
3. Explain the structure and function of a serous membrane, and name the serous membranes in the ventral body cavity.

Materials Needed

- Torso model
- Quart-sized Ziploc bag
- Food coloring
- Miscellaneous anatomical models

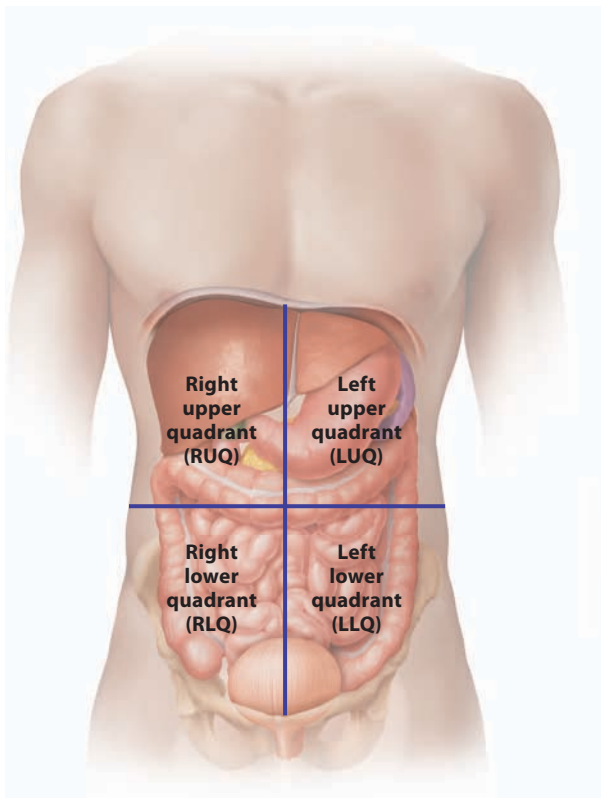
Instructions

A. Body Cavities and Abdominopelvic Regions

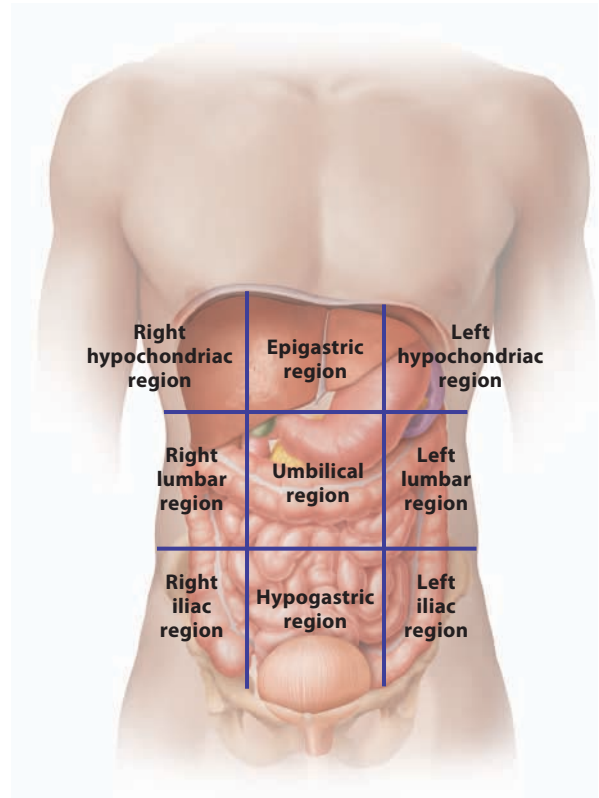
Identify the body cavities and abdominopelvic regions listed in the following charts on an anatomical model. Then, complete the charts as you name the major organs found in each.

Dorsal Body Cavity

Subdivision	Organ(s)
Cranial cavity	
Vertebral cavity	



(a) The four abdominopelvic quadrants



(b) The nine abdominopelvic regions

Figure 1-5 Divisions of the abdominopelvic cavity.

Ventral Body Cavity	
Subdivision	Organ(s)
Thoracic cavity	
Abdominopelvic cavity	
• Right hypochondriac region	
• Epigastric region	
• Left hypochondriac region	
• Right lumbar region	
• Umbilical region	
• Left lumbar region	
• Right iliac region	
• Hypogastric region	
• Left iliac region	

B. Serous Membranes

Use a Ziploc bag containing 2 tablespoons of water plus some food coloring as a model for the parietal layer of a serous membrane, the visceral layer of a serous membrane, and a serous fluid-filled cavity.

1. Place the Ziploc bag on top of the heart model.

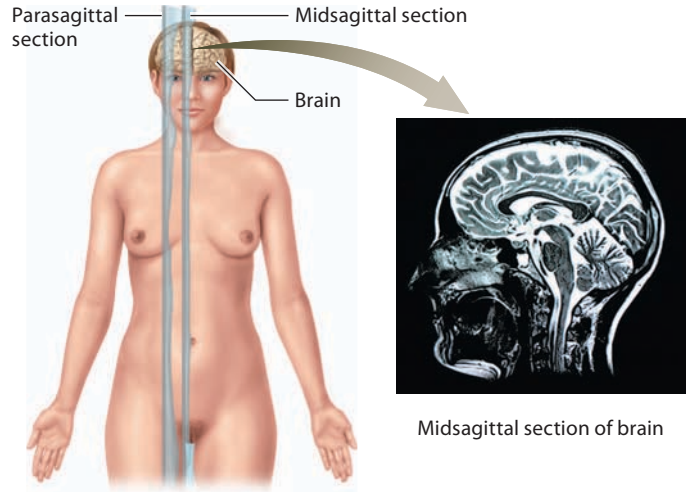
The portion of the bag adjacent to the heart represents the _____, the water-filled space represents the _____, and the outermost portion of the bag represents the _____.

2. Next, place the Ziploc bag on top of the lung model.

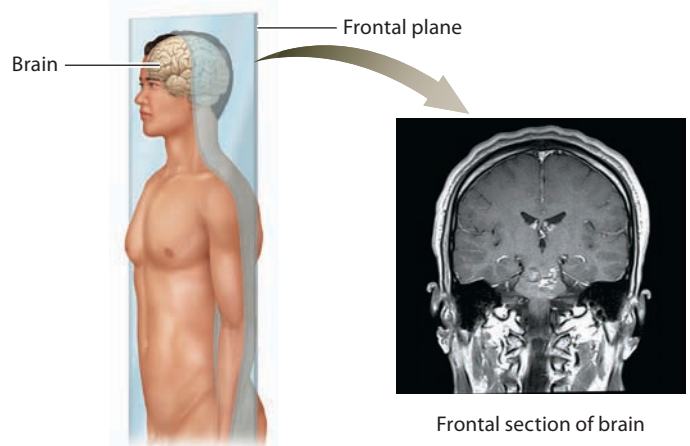
The portion of the bag adjacent to the lung represents the _____, the water-filled space represents the _____, and the outermost portion of the bag represents the _____.

- Finally, place the Ziploc bag on top of the model of the small intestine.

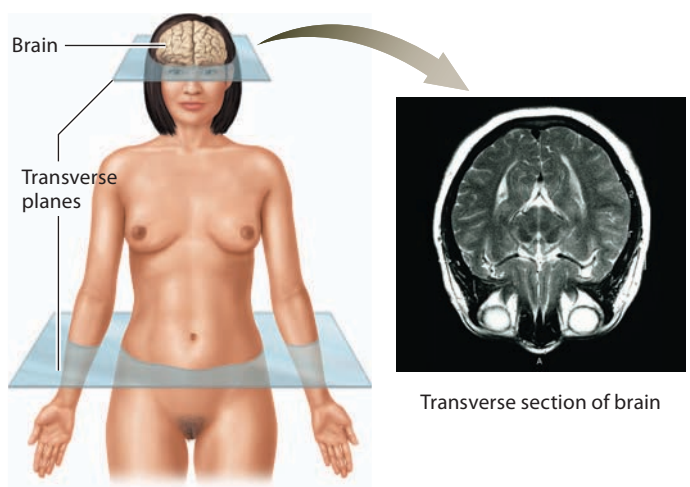
The portion of the bag adjacent to the intestines represents the _____, the water-filled space represents the _____, and the outermost portion of the bag represents the _____.



(a) Sagittal plane



(b) Frontal plane



(c) Transverse plane

Figure 1-6 Planes of section.

Body Planes of Section

When viewing the internal anatomy of organs on models, on diagrams, and in specimens, it is important to understand the various types of cuts, or sections, that have been made to show the internal structures. In the health professions, these planes of section are also observed in various types of images, such as MRI and CT scans. **Figure 1-6** illustrates the three most commonly used planes:

1. A **sagittal plane** is a section made parallel to the body's longitudinal axis; it divides the body into right and left parts. A **midsagittal** (median) **plane** divides the body into equal right and left parts; a **parasagittal plane** divides the body into unequal right and left parts.
2. A **frontal** (coronal) **plane** is a section made parallel to the body's longitudinal axis; it divides the body into anterior and posterior parts.
3. A **transverse plane** (cross-section) is a section made perpendicular to the body's longitudinal axis; it divides the body into superior and inferior parts.

ACTIVITY 3

Demonstrating and Identifying Body Planes of Section

Learning Outcome

1. Demonstrate and describe anatomical planes of section.

Materials Needed

- Modeling clay
- Scalpel
- Anatomical models

Instructions

A. Modeling Clay Activity

1. Assign each member of your lab group one of the following body planes: a sagittal plane, a coronal plane, or a transverse plane.