Christine M. Eckel

Human Anatomy Laboratory Manual

THIRD EDITION

Mc Graw Hill Education

Christine M. Eckel
Carroll College

HUMAN ANATOMY
Laboratory Manual

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ABOUT THE AUTHOR

This book is dedicated to my best friend, Zelda.

CHRISTINE MARIE ECKEL, Ph.D. received her B.A. in Integrative Biology and M.A. in Human Biodynamics from the University of California, Berkeley, and her Ph.D. in Neurobiology and Anatomy from the University of Utah School of Medicine. Dr. Eckel is Associate Professor of Biology at Carroll College in her hometown of Helena, Montana. There she teaches the two-semester Anatomy and Physiology course for pre-nursing and pre-health-science majors, and an advanced dissection course for premedical students. Dr. Eckel is also the faculty advisor for pre-physician assistant students. Prior to her position at Carroll College, Dr. Eckel was Associate Professor and Course Director for the Medical Gross Anatomy and Medical Microanatomy courses at the West Virginia School of Osteopathic Medicine (WVSOM). While at WVSOM, Dr. Eckel also headed the Body Donor Program. In 2015, Dr. Eckel presented a TEDx talk about the value of human body donors in health sciences education.

In the years prior to her position at WVSOM, Dr. Eckel taught undergraduate Human Anatomy and Human Physiology courses at Salt Lake Community College (SLCC) and the University of California, Berkeley.

Dr. Eckel has received several teaching honors, including an Outstanding Graduate Student Instructor award from U.C. Berkeley, a Teaching Excellence award from SLCC, and the Atlas Club award for Outstanding Teaching at WVSOM. She was awarded the Frank L. Christensen Endowed Fellowship from the University of Utah and was named the Betty Cook Karrh Endowed P.E.O. Scholar for 2004–2005.

Dr. Eckel is the primary author of *Human Anatomy & Physiology Laboratory Manual,* 2e (McGraw-Hill Education). She has also authored several supplements and individual chapters for textbooks in Human Anatomy and Human Physiology. Dr. Eckel's cadaver dissections and photographs are featured in several textbooks and ancillary teaching materials, including this laboratory manual.

Dr. Eckel served as the Western Regional Director for the Human Anatomy & Physiology Society (HAPS) for two terms. She has also served on several committees for both HAPS and the American Association of Anatomists (AAA). Dr. Eckel is an ad hoc reviewer for the journals *Anatomical Sciences Education* and *Medical Education*. Her research is in the field of teaching innovation and educational outcomes research.

With over 25 years of experience engaging with students at all levels; including community college students, students at a 4-year private college, medical students, and medical residents in orthopedic surgery, pathology, and gynecologic surgery, Dr. Eckel has a unique appreciation for the learning challenges experienced by students at each of these levels. Dr. Eckel's passions for human anatomy, classroom and laboratory teaching, biological dissection, and photography are evident throughout the pages of this laboratory manual.

In her spare time, Dr. Eckel loves to hike with her English Setter, Zelda, mountain bike, road bike, skate, ski, and explore the great Montana outdoors—always with her camera in hand.

ACKNOWLEDGMENTS

I would like to thank the entire team at McGraw-Hill for their hard work on this laboratory manual. In particular, I am extremely grateful to Product Developer Mandy Clark and Brand Manager Chloe Bouxsein for finding solutions to layout problems and similar issues. Content Project Manager Mary Jane Lampe and Senior Content Licensing Specialist Carrie Burger worked relentlessly to bring this project to fruition, and they also have my profound thanks. The entire team at McGraw-Hill is a class act and I am grateful to work with such a talented group of people.

As always, I give my most sincere thanks to all the individuals who selflessly donated their bodies after death for medical education and research. Without their generous donations, none of us would have the opportunity to truly learn anatomy. They have given us the most precious gift.

To the end users of this book, thank you in advance for any feedback, suggestions for improvement, or corrections that will help improve future editions. I am dedicated to producing the highest quality laboratory manual that will help students learn and develop a love of this most beautiful and fascinating subject. Thank you!

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Contents

Preface

Human anatomy is a complex but fascinating subject, and is perhaps one of the most personal subjects a student will encounter during his or her education. Yet it is also a subject that can create a great deal of anxiety for students because of the sheer volume of material, and a misconception among students that it's "all about memorization." Too often, confusion in the anatomy laboratory only enhances this misconception and enhances student frustration with the subject. My goal in writing this laboratory manual was to create a manual that guides students through their laboratory experience in an organized and focused way, and to provide them with tools that make the material more relevant to the student's daily experiences with their own bodies and the world around them.

The study of human anatomy really comes to life in the anatomy laboratory. Here is where students get hands-on experience with human cadavers and bones, classroom models, preserved and fresh animal organs, and histology slides of human tissues. Many students are at a loss when it comes to knowing how to proceed in the anatomy laboratory. They are given numerous lists of structures to identify and histology slides to view, but comparatively little direction as to *how* to recognize structures or *how* to relate what they encounter in the laboratory to the material presented in lecture. In addition, most laboratory manuals on the market contain little more than material repeated from anatomy textbooks, which provides no real benefit to a student. All of these things lead to student frustration and take away from the joy that comes from discovering the beauty of the human body through touch, observation, and dissection. This laboratory manual is designed to be a user-friendly *manual* to the human anatomy laboratory that addresses just such issues.

New in the Third Edition

The most exciting change in this edition is the inclusion of an all-new chapter. Chapter 1: The Laboratory Environment introduces safety procedures, use of cadavers in the laboratory, common laboratory equipment, and dissection techniques. A multitude of new photos that familiarize students with laboratory equipment are presented in the context of step-by-step exercises demonstrating proper usage of these tools. All subsequent chapters have been renumbered to accommodate the placement of this new chapter at the very beginning of the book. Another new chapter on the Autonomic Nervous System (Chapter 26) has also been added, and subsequent chapters renumbered to acommodate placement of the chapter within the laboratory manual.

Another major change is the substantial overhaul of bone and histology photos. Of particular note, the author photographed a series of new skull images using a first-grade skull. The high-quality specimen and improved contrast provide much clearer detail than seen in the previous edition. In addition, the author photographed several new tissue slides to obtain photos that coincide with specific steps in the histology activities so students see exactly what is described in the exercises.

Finally, much effort has been spent fine-tuning content accuracy and clarity. Every chapter in the book was carefully scrutinized, resulting in numerous tweaks to table entries, adjustments in terminology, strategic addition and/or reconfiguring of labels and leader lines in the figures, and general polishing to improve readability. Other content changes include the addition of new questions to nearly all of the Pre- and Post-Laboratory Worksheets to make them more challenging and more complete, and continuation of numbering the chapter learning objectives for easier reference and tracking. Post-Laboratory Worksheet questions in the section "Do You Know the Basics?" are keyed to each exercise and learning objective in the chapter. There is at least one question per objective. This organization makes it even easier for instructors to customize the content for their individual course.

In addition to the general changes above, the following list provides a chapter-by-chapter overview highlighting some (but by no means all) of the updates in the third edition.

1. The Laboratory Environment—All-new chapter introducing laboratory equipment and procedures.
2. Orientation to the Human Body—Added body planes to figure 2.1 and directional terms to figure 2.2.
3. The Microscope—More tips regarding microscope usage added to Focus Box: Caring for the Microscope and to table 2.2.
4. Cellular Anatomy—Added illustrations of each cell organelle to table 4.1. Replaced micrograph of interphase in table 4.2.
5. Histology—New micrographs added to the following figures: 5.3*e* (dense irregular connective tissue), 5.17 (elastic connective tissue), 5.19 (hyaline cartilage), 5.27 (smooth muscle). Added multiple new "Study Tip!" boxes, including clarification of basement membrane vs. basal surface, and suggestions for relating tissue appearance to everyday items. Elaborated on description of bone tissue.
6. Integument—Added new micrograph for figure 6.2 (pigmented skin) and a new Study Tip! regarding the tissue types found in leather. Expanded the description of keratinocytes and made various terminology updates for consistency. Added a Clinical View on melanoma.
7. Skeletal System Overview: Bone Anatomy—Enlarged photos in exercise 7.5 to make figures easier to label.
8. The Skeletal System: Axial Skeleton—New photos using better specimens and coloration provided for the following figures: 8.1 (anterior skull), 8.5 (lateral skull), 8.6 (posterior skull), 8.8 (inferior skull), 8.11 (cranial floor), 8.12 (hyoid bone). Improved contrast of existing photos for figures 8.7 (superior skull), 8.13 (fetal skull), 8.16–8.19 (vertebrae), 8.24 (rib).
9. The Skeletal System: Appendicular Skeleton—Improved contrast of photos in figure 9.3 (humerus) and added close-up view of ulnar notch to figure 9.4. New Study Tip! with mnemonic for remembering the carpal bones.
10. Articulations—New Focus box and accompanying photo on hip replacement.
11. Muscle Tissue and Introduction to the Muscular System—New Study Tip! clarifying the difference between flexion and contraction.

12. Axial Muscles—Modified figure 12.11 to indicate location of the linea alba. Provided innervations in table 12.1. New Study Tip! regarding conventions of muscle naming.
13. Appendicular Muscles—Revised muscle actions to refer to limbs rather than joints—for example, "flexes elbow" was changed to "flexes forearm."
14. Nervous Tissues—Minor terminology and table updates.
15. The Nervous System: General and Special Senses—New micrographs for figures 15.3*d* (vallate papilla), 15.3*e* (foliate papilla), 15.8*c* (cochlea cross section). Added close-up photo of cochlea model to figure 15.16. Expanded structures covered in tables 15.7 and 15.8. Clarified descriptions of anterior cavity vs. anterior chamber.
16. The Endocrine System—Added illustrated reference icons to figures 16.7 (adrenal glands) and 16.8 (pancreas), and a new photo showing the hypothalamus and pituitary to figure 16.9 (endocrine organs).
17. The Cardiovascular System: The Heart—Increased size of figure 17.3 (heart in thoracic cavity) for easier labeling. Improved contrast of figure 17.4 (pericardial sac).
18. Vessels and Circulation—New micrographs for figures 18.1*b* (blood vessel wall), 18.2 (elastic artery). Increased size of figure 18.18 for ease of labeling. Modified shading in figure 18.21 (lower limb circulation) to differentiate superficial and deep vessels. Shaded capitate and cuboid bones for clarity in figures 18.20 and 18.23 respectively.
19. The Lymphatic System—Two new micrographs for figure 19.4 (Peyer patches). Added illustrated reference icons to figures 19.6 and 19.9.
20. The Respiratory System—Included a new exercise (exercise 20.3) and table on the histology of the bronchi and bronchioles. Added illustrated reference icons to figures 20.3–20.5. New photomicrograph of bronchus in Post-Laboratory Worksheet.
21. The Digestive System—Modified several anatomic descriptions for clarity. Added illustrated reference icon to figure 21.8, and a new micrograph of the ileum in Post-Laboratory Worksheet.
22. The Urinary System—Reorganized layout of several figures for ease of labeling. New micrographs (ureter, kidney cortex, urinary bladder wall) for Post-Laboratory Worksheet questions.
23. Reproductive System—New micrographs for figure 23.7*b* (epididymis), 23.8*b* (ductus deferens), and 23.11 (penis cross-section). Increased size of micrographs in table 23.6 (menstrual cycle phases) and figure 23.13 (model of female pelvic cavity) to improve visibility. Added new table 23.11, The Female Breast. New micrographs (ductus deferens and ovary) for Post-Laboratory Worksheet questions.
24. The Nervous System: General and Special Senses—Modified layouts of several figures and enlarged figure 24.6 (superior brain) for ease of labeling.
25. The Spinal Cord and Spinal Nerves—Reformatted text and enlarged several figures for easier labeling. Shaded the branches of the trigeminal nerve in figure 25.7*a* to match the sensory distribution map of 25.7*b*.
26. The Autonomic Nervous System—New Study Tip! for distinguishing anterior and posterior horns.
27. The Cardiovascular System: Blood—Minor tweaks for clarity and correctness.

Distinguishing Features

Overall Approach

First and foremost, this laboratory manual was designed *not* to repeat textbook material. However, students still need critical information to proceed in the laboratory. Thus, as much as possible, reference information necessary for completing laboratory activities is presented in summary tables that act as a concise resource for students.

Laboratory exercises are presented in steps that guide students precisely through each activity. Interesting and pertinent points about the structures students are observing or dissecting are provided within the text of each exercise. Detailed anatomical descriptions of structures such as individual bones of the skull are left to the main textbook. Rather, the discussions in this laboratory manual give students alternative ways to understand, organize, and make sense of the material. The text is written in a friendly, conversational tone so as to not be intimidating to students, while at the same time not being overly chatty or brief on details.

Photographs and Illustrations

The photographs in this laboratory manual are intended to truly capture the laboratory experience. The author, an accomplished prosectionist and biomedical photographer, personally prepared and shot the vast majority of the photographs of dissections, bones, human cadavers, and classroom models for this laboratory manual, as well as several of the histology images. While writing the dissection exercises, she performed the dissections herself and photographed each dissection at key stages that would be of most benefit for students as they perform the same steps. This gives each photo a unique perspective that could not be accomplished any other way.

Illustrations and photographs appearing in this manual have been tailored to the specific needs of the associated laboratory exercises, and are generally unique to avoid unnecessary repetition of lecture textbook images.

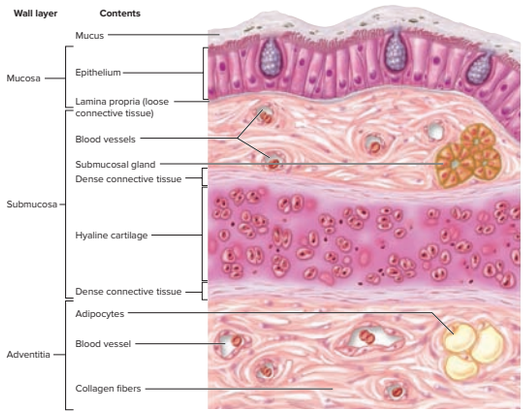


Figure 20.1 Wall Layers of the Trachea. The walls of all structures of the respiratory tract are composed of three layers: mucosa, submucosa, and adventitia. This drawing depicts the wall of the trachea, which has an outer covering of connective tissue referred to as an adventitia.

Organization

Because observation of histology slides and observation of human cadavers and classroom models are usually performed in separate physical spaces or at specific times within each laboratory classroom, chapters in this laboratory manual are similarly separated into two sections: Histology

and Gross Anatomy. Each exercise within these chapter sections has been designed with the student's actual experience in the anatomy laboratory in mind. Thus, each exercise covers only a single histology slide, classroom model, or region of the human body (for example: muscles of the abdominal wall, histology of cardiac muscle, model of the human ear). In addition, organization of each chapter into a series of discreet exercises makes the laboratory manual easily customizable to any anatomy classroom, allowing an instructor to assign certain exercises, while having students skip other exercises.

Changes to the Third Edition

Certain changes to the third edition of this laboratory manual have been applied throughout all chapters.

- Word origins have been added to tables, where relevant.
- Chapter opening pages now include a list of reference tables.
- Pre-Laboratory Worksheets and Post-Laboratory Worksheets include a broader variety of question types.
- Drawing circles have been enlarged and standardized throughout to allow more space for student drawings.
- Tables have been reorganized to include headings and subheadings for ease of learning.
- Safety icons have been added throughout the manual to alert students to potential hazards in the lab.
- New content has been added in numerous places throughout the manual, including:
  - additional new exercises
  - new Concept Connection boxes
  - new Clinical View boxes
  - new Learning Strategy boxes

Changes by Chapter

The following is a list of the most significant changes by chapter in the third edition of this lab manual.

Chapter 1

- New Learning Strategy on studying anatomy and physiology
- Safety icons emphasizing safe dissection techniques

Chapter 2

- New Figure 2.1 The Anatomic Position, Body Planes, and Directional Terms
- New Exercise 2.1B Sectioning a Specimen
- New Figure 2.3 Sections Through a Sheep Heart

Chapter 3

- New Figure 3.3 Loading a Microscope Slide
- Revised Figure 3.5 Estimating Specimen Size

Chapter 4

- New Exercise 4.1A: Preparing a Wet Mount of Human Cheek Cells
- Revised table 4.2 so it takes up only one page. Included space for students to draw the phases of mitosis in each row describing the stage
- Revised Figure 4.3 Classroom Model of a Prototypical Animal Cell
- Revised Exercise 4.3 Observing Classroom Models of Cellular Anatomy to include space for students to sketch a prototypical cell with organelles

Chapter 5

- New Clinical View: Histopathology
- New Clinical View: Functions of epithelial surface modifications
- New Table 5.1 Classification of Epithelial Tissue by Number of Cell Layers
- New Learning Strategy: Differentiating osteoblasts from osteocytes and chondroblasts from chondrocytes
- New Learning Strategy: Differentiating the three types of cartilage from each other
- New Clinical View: Carcinomas and Sarcomas
- New Learning Strategy: "Lookalikes" in Histology, which includes six new histology images
- New Learning Strategy on identifying a histological slide of pseudostratified ciliated columnar epithelial tissue

Chapter 6

- New Learning Strategy: Comparing layers of the skin to their component parts in a piece of leather
- Revised Figure 6.11 Classroom Model of the Integument
- New Learning Strategy comparing apocrine sweat glands and sebaceous glands

Chapter 7

- New Exercise: 7.4: Identifying Classes of Bones Based on Shape
- Converted introductory material on long bones into an exercise: Exercise 7.5 Components of a long bone

Chapter 8

- New introductory text on bone markings
- New Table 8.1 Bone Markings
- New Learning Strategy on relating skeletal structure to function
- New Learning Strategy on the word origins of bones and bone markings
- Revised Table 8.2 The Axial Skeleton: Skull Bones and Important Bony Landmarks to include word origins
- New Learning Strategy on visualizing structures as they travel through the foramina of the skull
- Revised Figure 8.12 The Hyoid Bone
- New Learning Strategy on learning the number of vertebrae in each region of the vertebral column
- Replaced Clinical View: Spina Bifida with new Clinical View: Spondylolisthesis
- New Concept Connection on the atlas and axis
- New Learning Strategy on identifying vertebrae from each region of the vertebral column
- Revised Figure 8.23 A Typical Rib

Chapter 9

- New Concept Connection on learning the bony features of the appendicular skeleton
- Revised Exercise 9.1 Bones of the Pectoral Girdle
- Revised Exercise 9.2 Bones of the Upper Limb
- Revised Figure 9.8 Surface Anatomy of the Pectoral Girdle and Upper Limb
- Revised Exercise 9.4 Bones of the Pelvic Girdle
- Revised Learning Strategy on distinguishing a male versus a female pelvis
- New Learning Strategy on determining distinctive features for each bone
- Revised Exercise 9.5 Bones of the Lower Limb
- New Learning Strategy on remembering the names of the tarsal bones

Chapter 10

- Revised Introduction to more clearly explain joint classification
- New Table 10.1: Structural (Anatomic) Classification of Joints
- Reorganized Exercise 10.1 Fibrous Joints to be consistent with Table 10.3 Classification of Fibrous Joints
- Revised Table 10.5 Components of Synovial Joints to include most relevant terms
- Revised Exercise 10.6 Structural Classification of Synovial Joints to include more detailed description of each type of synovial joint

Chapter 11

- Revised Introduction to more concisely summarize the muscular system and chapter organization
- Reorganized the order of chapter topics and exercises: skeletal, cardiac, and smooth muscle
- New Learning Strategy describing how to distinguish smooth muscle tissue from dense regular connective tissue

Chapter 12

- Reorganized Exercise 12.1 Muscles of Facial Expression
- New Learning Strategy on using word origins to assist with learning muscle attachments
- New Learning Strategy on learning the external and internal oblique muscles
- New Learning Strategy on the rationale behind using directional terms when naming certain muscles

Chapter 13

- Revised Gross Anatomy introductory text: Muscles That Move the Pectoral Girdle/Glenohumeral Joint
- Revised Table 13.1: Muscles That Act About the Pectoral Girdle
- Revised Exercise 13.1: Muscles That Act About the Pectoral Girdle/Glenohumeral Joint to include Exercise 13.1A: Muscles That Move the Pectoral Girdle and Exercise 13.1B: Muscles That Move the Glenohumeral Joint
- New Clinical View: Winged Scapula
- Revised Table 13.2: Muscles That Move the Glenohumeral Joint
- Reorganized Table 13.6: Posterior (Extensor) Compartment of the Forearm
- Revised Gross Anatomy introductory text: Muscles That Move the Hip Joint/Thigh
- New Learning Strategy to aid in remembering muscles in the medial compartment of the thigh
- Revised Table 13.8: Muscles That Act About the Hip Joint/Thigh
- Revised Exercise 13.5: Muscles That Move the Hip
- Revised Exercise 13.6: Compartments of the Thigh
- New Table 13.9: Anterior Compartment of the Thigh
- New Table 13.10: Posterior Compartment of the Thigh

Chapter 15

- Revised Table 15.3 Cells Associated with Taste Buds to include word origins
- Reorganized Table 15.1: Sensory Receptors in Thick Skin
- Revised Figure 15.10 Skin
- Revised Exercise 15.8 Gross Anatomy of the Eye to include Exercise 15.8A Accessory Structures of the Eye and Exercise 15.8B Internal Structures of the Eye
- Revised Figure 15.11 Accessory Structures of the Eye
- Revised Figure 15.12 Classroom Model of the Internal Eye

Chapter 16

- New Learning Strategy on hormones secreted by the anterior pituitary gland
- Revised Figure 16.7 Adrenal Glands

Chapter 17

- Revised Exercise 17.3 Location of the Heart and the Pericardium
- New Learning Strategy on remembering the atrioventricular valves on the right versus the left side of the heart
- Reorganized Table 17.3 Arterial Supply to the Heart

Chapter 18

- New Clinical View: Great Saphenous Vein and Varicose Veins
- Revised Figure 18.11 Circulation to the Thoracic and Abdominal Walls

Chapter 19

- Reorganized the order of chapter topics and exercises: thymus, lymph nodes, and the spleen
- New Clinical View: Appendicitis
- New Table 19.5 Major Lymphatic Vessels of the Body
- Revised Figure 19.8 Lymph Node and Its Components

Chapter 20

- New Learning Strategy to remember the lobes of the right versus the left lung

Chapter 21

- Reorganized Table 21.1 Histological Features of the Kidney to include headings and subheadings

Chapter 22

- New Learning Strategy on distinguishing between gastric pits and gastric glands
- New Learning Strategy on distinguishing the three parts of the small intestine
- Revised Figure 22.5 The Small Intestine
- New Learning Strategy on villi as they relate to the GI Tract
- New Exercise 22.8 Overview of the GI Tract
- New Figure 22.10 Overview of the Digestive System
- Reorganized Table 22.7 Gross Anatomic Regions and Features Associated with the Stomach
- Revised Figure 22.12 Classroom Model of the Stomach
- Reorganized Table 22.8 Gross Anatomic Features of the Liver, Gallbladder, Pancreas, and Their Associated Ducts
- Reorganized Table 22.10 The Cecum, Large Intestine, Rectum, and Anus
- New Figure 22.18 The Cecum, Large Intestine, and Rectum

Chapter 23

- New Learning Strategy on sustentacular cells in the testes
- Reorganized Table 23.4 Components of the Uterine Tube
- Reorganized Table 23.6 Phases of the Menstrual Cycle
- New Learning Strategy: "Lookalikes"—uterine tube and seminal vesicles
- New Concept Connection on lactation

Chapter 24

- Reorganized Table 24.1 to separate meningeal structures into categories (e.g., Dural sinuses and Dural Septa)
- New Exercise 24.3 Circulation of Cerebrospinal Fluid (CSF)
- New Figure 24.5 Cerebrospinal Fluid (CSF) Production and Circulation
- Reorganized Table 24.3 Brain Structures Visible in Superficial Views of Whole or Sagittally Sectioned Brains
- New Learning Strategy on locating the trochlear nerve on models and the brain
- Merged separate chapters on the brain and cranial nerves into a single chapter
- Reorganized the content in Exercise 24.9 so the text and figures are more closely aligned with each other

Chapter 25

- New Clinical View: Additional Nerves of the Brachial Plexus
- Revised Table 25.1 Regional Characteristics of the Spinal Cord to include word origins
- Reorganized Table 25.2 Histology of the Spinal Cord in Cross Section
- Reorganized Table 25.5 Major Nerves of the Brachial Plexus
- Revised Exercise 25.5 The Lumbar and Sacral Plexuses
- Reorganized original Table 25.6 into Table 25.6 Major Nerves of the Lumbar Plexus and Table 25.7 Major Nerves of the Sacral Plexus

Chapter 26

- All new chapter! The Autonomic Nervous System

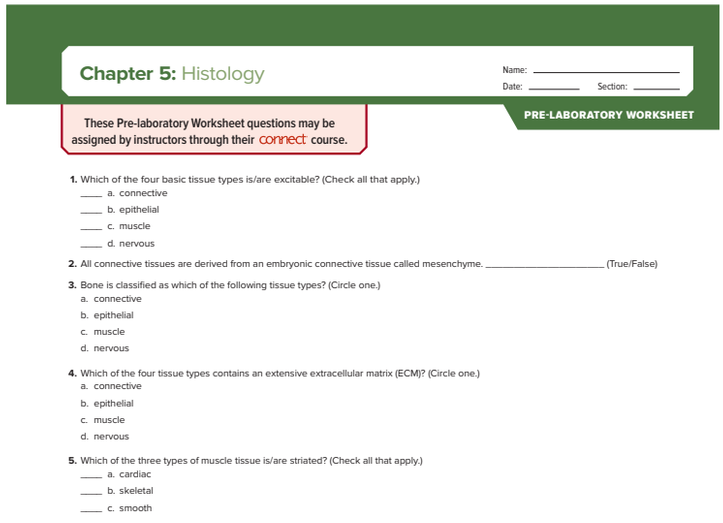
Chapter 27

- Reoriented Table 27.3 Leukocyte Characteristics for better readability
- Inserted "Caution" symbol and text about precautions necessary if using human blood

Pedagogy

This laboratory manual utilizes several pedagogical devices to assist students in learning human anatomy in the laboratory setting.

- **Outline and Objectives** Each chapter begins with an outline that lists the exercises within the chapter. Below each exercise is a list of objectives that conform to the activities the students are asked to complete within each exercise.
- **Pre- and Post-Laboratory Worksheets** Pre-Laboratory Worksheets at the beginning of each chapter are intended to give the student a "warm up" before entering the laboratory classroom. Some questions pertain to previous activities that are relevant to the upcoming activities (for example: review questions about nervous tissues in the Pre-Laboratory Worksheet for the chapter on the brain and cranial nerves), while others are basic questions that students should be able to answer if they have read the chapter from the main textbook before coming into the classroom. The goal of completing these worksheets is simple: have students arrive at the laboratory prepared to deal with the material they will be covering so they do not waste valuable in-class time reviewing necessary background information.



Chapter 5: Histology

Name: _____

Date: _____ Section: _____

PRE-LABORATORY WORKSHEET

These Pre-laboratory Worksheet questions may be assigned by instructors through their connect course.

1. Which of the four basic tissue types is/are excitable? (Check all that apply.)
   ____ a. connective
   ____ b. epithelial
   ____ c. muscle
   ____ d. nervous
2. All connective tissues are derived from an embryonic connective tissue called mesenchyme. _____ (True/False)
3. Bone is classified as which of the following tissue types? (Circle one.)
   a. connective
   b. epithelial
   c. muscle
   d. nervous
4. Which of the four tissue types contains an extensive extracellular matrix (ECM)? (Circle one.)
   a. connective
   b. epithelial
   c. muscle
   d. nervous
5. Which of the three types of muscle tissue is/are striated? (Check all that apply.)
   ____ a. cardiac
   ____ b. skeletal
   ____ c. smooth

Post-Laboratory Worksheets at the end of each chapter help students review the material they just covered, and challenge them to apply the knowledge gained in the laboratory (for example: questions asking students to determine loss of function if a particular nerve or part of the brain is damaged).

The Post-Laboratory Worksheets contain more in-depth, critical thinking types of questions than the Pre-Laboratory Worksheets. Post-Laboratory Worksheets are perforated so they can be torn out of the manual and handed in to the instructor if so desired.

- **In-Chapter Learning Activities** The exercises in this laboratory manual are about *doing*, not just observing. Exercises offer a mixture of activities including labeling exercises, sketching activities, coloring exercises, table completion, data recording, palpation of surface anatomy structures, and the like.

Chapter 5: Histology

Name: _____

Date: _____ Section: _____

POST-LABORATORY WORKSHEET

The 1 corresponds to the Learning Objective(s) listed in the chapter opener outline.

Do You Know the Basics?

Exercise 5.1: Identification and Classification of Epithelial Tissue

1. The epithelial type that protects against abrasion is _____. 1
2. Endothelium is a _____ epithelium that lines the walls of blood vessels and the heart. 2
3. Match the function listed in column A with the surface modifications and specialized cells found in epithelial tissues listed in column B. 3 5

Column A	*Column B*
____ 1. provide lubrication	a. cilia
____ 2. increase surface area for enhanced absorption	b. goblet cells
____ 3. aid in movement of substances in one direction	c. keratinization
____ 4. imparts strength and protection	d. microvilli

4. When observing a cross section of a tube that is lined with epithelial tissue (e.g., the gut tube), the epithelial surface that faces the lumen of the tube is the _____ (apical/basal) surface. 4

Exercise 5.2: Identification of Embryonic Connective Tissue

5. Embryonic connective tissue is called _____. 6

Exercise 5.3: Identification and Classification of Connective Tissue Proper

6. The extracellular matrix of connective tissue is composed of cells and fibers. _____ (True/False) 7–8
7. For each category of connective tissue listed in the following table, write in the major cell types, the fiber types, and the characteristics of the ground substance of the tissue. Refer to the textbook for assistance. 7–11

	Connective Tissue Proper	Cartilage	Bone	Fluid Connective Tissue
Cells				
Fibers				
Ground Substance				

- **Labeling Activities** In the gross anatomy exercises of this manual, images of things such as cranial bones, muscles of the body, and so on are *not* presented as labeled photos because the students *already have* labeled photos in their main textbook. Instead, each image is presented as a labeling activity with a checklist of structures. The checklists serve two purposes: (1) they guide students to what items they need to be able to identify on classroom models, fresh specimens, or cadavers (if the laboratory uses human cadavers), and (2) they double as a list of terms students can use to complete the labeling activities. Answers to the labeling activities are provided in the appendix. Thus, if a student does not know what a leader line is pointing to, or cannot remember the correct term, he or she can consult the appendix to locate the correct answer. This is a bit more challenging to students than having a pre-labeled image in the lab manual. However, that is precisely the goal: challenge the students!
- **Learning Strategy** Handy "Learning Strategy" boxes coach students through the more problematic areas of study. They offer tips such as points of clarification and things to be aware of, and/or careful of when making certain observations.

(continued from previous page)

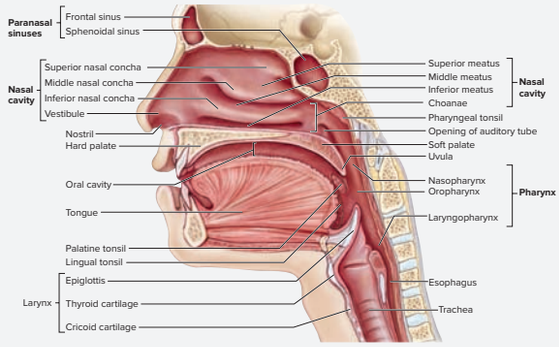


Figure 20.6 The Upper Respiratory Tract. Respiratory system structures visible in a midsagittal view of the head and neck.

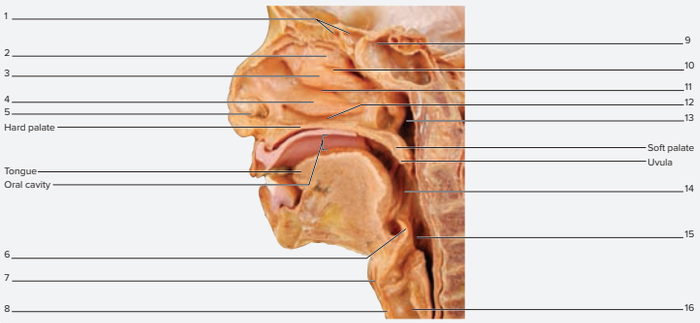


Figure 20.7 The Upper Respiratory Tract: Midsagittal View. Use the terms listed to fill in the numbered labels in the figure.

- ☐ cricoid cartilage
- ☐ epiglottis
- ☐ ethmoidal sinuses
- ☐ inferior meatus
- ☐ inferior nasal concha
- ☐ laryngopharynx
- ☐ lumen of larynx
- ☐ middle meatus
- ☐ middle nasal concha
- ☐ nasopharynx
- ☐ oropharynx
- ☐ sphenoidal sinus
- ☐ superior meatus
- ☐ superior nasal concha
- ☐ thyroid cartilage
- ☐ vestibule

Learning Strategy

When learning the processes, projections, foramina (holes), and other markings of the bones, view each structure, study it closely, and contemplate its function. The process may be an attachment point for a ligament, a tendon, or a muscle. The opening or hole may serve as a passageway for a nerve, artery, or vein. The smooth surface may be where the bone articulates with another bone. For each structure, relate form to function.

- **What Do You Think? Questions** Placed at key points within exercises, these critical thinking questions challenge students to think beyond the "what" of the structures they are observing and start to think about the "why." Answers are provided in the appendix.

WHAT DO YOU THINK?

1. Why do you think the fontanels persist until well after the birth of the infant?

- **Tables** Each chapter contains numerous tables, which concisely summarize necessary details. As stated previously, the goal of this manual was expressly not to repeat textual material. However, students still need the information as reference while in the laboratory classroom. Thus, critical information and key structures are covered in table format. A concerted effort has been made to include a column that provides word origins for each structure listed within the table. These word origins are intended to give students continual exposure to the origins of the language of anatomy, which is critical for learning.
- ***Anatomy & Physiology*** **| REVEALED® Correlations**  Where pertinent, optional activities indicated by the logo above direct students to where they can find related content on Anatomy & Physiology Revealed.

Instructor Resources

Assignable Questions

Pre- and Post-Laboratory questions, along with labeling questions, are available for use in online assignments via McGraw-Hill's Connect.

Textbook Images

Image files for use in presentations and teaching materials are provided under the Instructor Resources tab within Connect.

Instructor's Manual

A helpful manual containing materials lists, presentation ideas, and answer keys for the Pre- and Post-Laboratory Worksheets is available to instructors who use this laboratory manual.

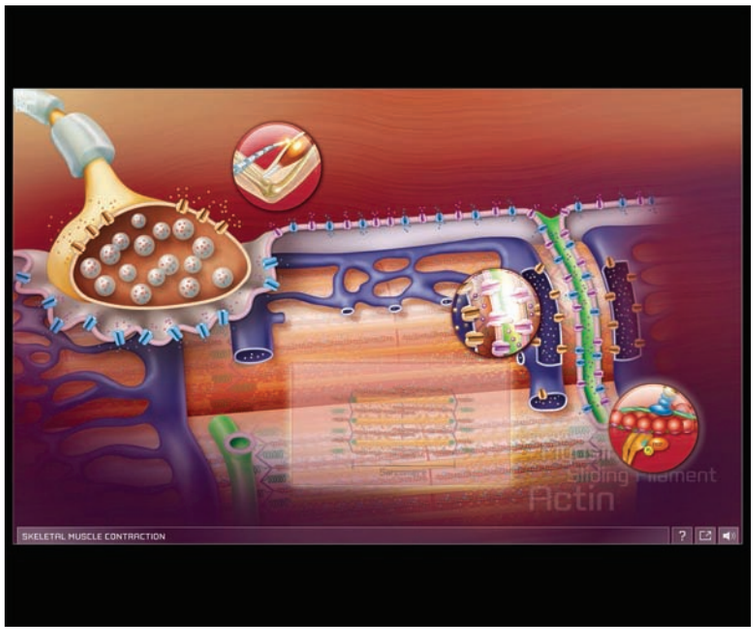
An Interactive Cadaver Dissection Experience

Anatomy & Physiology|Revealed 3.2®
www.aprevealed.com

An **interactive cadaver dissection tool** to enhance lecture and lab. Make use of the custom structure list to focus learning! Now, mobile—get the experience anywhere, anytime!

Anatomy & Physiology REVEALED 3.2 | Cat and **Anatomy & Physiology REVEALED 3.2 | Fetal Pig** are online interactive cat dissection and fetal pig dissection experiences that use cat photos or fetal pig photos, combined with a layering technique that allows you to peel away layers to reveal structures beneath the surface.

Both **Anatomy & Physiology REVEALED 3.2 | Cat** and **Anatomy & Physiology REVEALED 3.2 | Fetal Pig** offer animations, histologic and radiologic imaging, audio pronunciations, and comprehensive quizzing.



Concept Overview Interactives

Located within Anatomy & Physiology REVEALED 3.2, **Concept Overview Interactives** combine multiple concepts into one big-picture summary. These striking, visually dynamic presentations offer a review of previously covered material in a creatively designed environment to emphasize how individual parts fit together in the understanding of a larger mechanism or concept.

Concept Overview Interactive modules have assessable, auto-graded learning activities in Connect®, can be used as a self-study tool for students, and are also provided separately to instructors as classroom presentation tools.

Roots, Combining Forms, Prefixes, and Suffixes

Many terms used in the biological sciences are compound words; that is, words made up of one or more word roots and appropriate prefixes and/or suffixes. Less than 400 roots, prefixes, and suffixes make up more than 90% of the medical vocabulary. These combining forms are most often derived from the ancient Latin or Greek. Prefixes are placed before the root term and suffixes are added after. The following list includes the most common forms used in anatomy and medicine and an example for each. This list, and the word origin information found throughout the text, is intended to facilitate learning an often unnecessarily complex-sounding vocabulary. Exclusively a learning tool, the entries are by intention brief. If you learn them, you will find your progress in your anatomy course swift, steady, and strong (the three "s'es" of success).

a-	without, lack of	asymptomatic (absence of symptoms)
ab-	away from	abstinence (to hold back from)
acou-	hearing	acoustics (science of sound)
-ac, -al	pertaining to	cardiac (the heart), myocardial (heart muscle)
ad-	to, toward, near to	adduction (move toward midline)
aden-, adeno-	gland	adenoma (tumor of a gland)
af-	toward	afferent (moving toward)
albi-	white	albinuria (passing of pale or white urine)
-algia	painful condition	myalgia (muscle pain)
an-	without, lack of	anesthesia (absence of pain)
andro-	male	androgens (male hormones)
angi-, angio-	vessel	angiopathy (disease of blood vessels)
ante-	before	antepartum (before birth)
anti-	against	anticoagulant (prevents blood clotting)
apo-	separated from, off	apodia (congenital absence of feet)
arthr-, arthro-	joint	arthritis (inflammation of a joint)
-ary	associated with	urinary (associated with urine)
-asis, -asia	condition or state of	homeostasis (state of metabolic balance)
audio-	hearing	auditory (belonging to the hearing sense)
auri-	ear	auricle (ear-shaped structure)
auto-	self	autolysis (self breakdown)
baro-	weight, pressure	baroreceptor (receptor for pressure changes)
bi-	twice, double	bicuspid (two cusps)
-blast	germ, bud	chondroblast (cartilage-producing cell)
brachi-	arm	brachial (of the arm)
brady-	slow	bradycardia (slow heart rate)
bucc-	cheek	buccal cavity (inside cheek region)
callo-	thick	callosity (thickening of keratinized layer of epidermis)
carcin-	cancer	carcinogenic (causing cancer)
cardio-	heart	cardiogram (register of heart activity)
caud-	tail	caudal (by the tail)
cephal-	head	cephalic (by the head)
cerebro-	brain	cerebrospinal (of the brain and spinal cord)
chondro-	cartilage, gristle	chondrocyte (cartilage cell)
-cide	kill	spermicide (agent that kills sperm)
circum-	around	circumduction (movement forming a circle)
-clast	break	osteoclast (cell that breaks down bone)
co-, com-	with, together	cooperate, gray commissure (connects right/left horns)
contra-	against, opposite	contralateral (opposite side)
cost-	rib	intercostals (between the ribs)
crani-	skull	cranial cavity (where the brain is)
cune-	wedge	cuneiform (wedge shaped)
cuti-	skin	subcutaneous (under the skin)
cyan-	blue color	cyanosis (bluish discoloration of skin)
cysti-, cysto-	sac, bladder	cystoscope (instrument for examining inside of bladder)
-cyte, ctyo-	cell	erythrocyte (red blood cell), cytology (study of cells)
demi-	half	costal demifacet (half-moon facet on vertebra for rib articulation)
derm-	skin	dermatology (study of skin)
di-, diplo-	two	diploid (two sets of chromosomes)
duct-, -duct	lead, draw	ovarian duct, adduct (to lead away from)
dur-	hard	dura mater (tough menix of CNS)
dys-	painful, difficult, bad	dysuria (painful urination)
e-, ec-, ef-, ex-	out, from	efferent (carries away from), excretion (eliminate from)
ecto-	outside, outer	ectocardia (displacement of heart)
-ectomy	to cut out	appendectomy (removal of appendix)
ede-, -edem	swelling	myoedema (muscle swelling)
-el, -elle	small	organelle (tiny structure that performs specific cellular functions)
endo-	within	endocardium (lining within heart chambers)
entero-	intestine	enteritis (inflammation of intestines)
epi-	upon, on	epicardium (membrane covering heart)
ex-, exo-	outside	exhale (breathe out); exocrine (gland that secretes to outside)
extra-	outside	extracellular (outside the cell)
-ferent	carry	afferent (carries toward)
-form	resembling, shape of	fusiform (spindle-shaped)
gastr-, gastro-	stomach	gastric ulcer (stomach ulcer)
-genesis, -genic	produce, origin	gluconeogenesis (glucose from another molecule), carcinogenic (causes cancer)
gloss-, glosso-	tongue	hypoglossal (under the tongue)
glyco-	sugar, sweet	glycolysis (breakdown of glucose)
gyn-	female, woman	gynecology (treatment of female reproductive organs)
hapto-	single	haploid (single set of chromosomes)
hem-, hemato-	blood	hematology (study of blood)
hepato-	liver	hepatitis (inflammation of the liver)
hetero-	different	heterosexual (involving different sexes)
hist-, histo-	tissue	histology (study of tissues)
holo-	whole, entire	hologynic (manifests only in females), holocrania (absence of all bones of skull vault)
homo-, homeo-	same	homeostasis (constancy of body parameters)
hydro-	water	hydroadipsia (absence of thirst for water)

— Continued on inside back cover

— Continued from inside front cover

hyper-	over, above	hypertrophy (overgrowth of cells or part)
hypo-	below, under	hypoglycemia (low blood sugar)
idio-	self, distinct	idiopathic (disease of unknown cause)
infra-	below	infraspinatus (below the spine of scapula)
inter-	between	interosseous (between two bones)
intra-	within	intracellular (within the cell)
-issimus	greatest	latissimus (widest)
iso-	equal, same	isotonic (same concentration)
-itis	inflammation	neuritis (inflammation of nerve)
juxta-	near	juxtaglomerular (near the glomerulus)
labi-	lip	labia major (thickened folds of skin and connective tissue in female external genitalia)
lacto-	milk	lactose (milk sugar)
leuko-	white	leukocyte (white blood cell)
lip-	fat	lipid (an operational term denoting solubility characteristics; “fat soluble”)
-logy	study	urology (study of urinary system)
-lysis	breaking up, dissolve	hemolysis (breaking up erythrocytes)
macro-	large	macrophage (certain large leukocytes)
mamm-, mast-	breast	mammary glands, mastectomy (breast removal)
medi-	middle	medial (toward the midline)
melano-	black	melanocyte (dark pigment-producing cell)
-mers, -meres	parts	polymers (larger molecules made of monomers)
meta-	after, beyond	metastasis (beyond the original position)
micro-	small	microorganism (very small organism)
mono	one, single	monomer (a single part); monosaccharide (a simple or single sugar)
morph-	form, shape	morphology (study of shape)
myo-	muscle	myometrium (muscular wall of uterus)
necro-	dead	necrotic (being of dead tissue)
neo-	new	neonatal (newborn)
nephro-	kidney	nephrology (study of kidneys)
neuro-	nerve	neurilemma (nerve cell membrane)
oculo-, ophthalm	eye	oculomotor (movement of the eye), ophthalmology (study of the eye)
odonto-	tooth	odontoid (shaped like a tooth)
-ole	little	arteriole (small artery-like vessel)
oligo-	few, little, deficient	oliguria (little urine output)
-oma	tumor	carcinoma (cancerous tumor), osteoma (benign bone tumor)
oo-	egg	oocyte (egg cell)
-osis	condition of	osteoporosis (having bones that are porous)
osse-, osteo-	bone	osteoblast (bone-forming cell)
oto-	ear	otogenic (originating within the ear)
para-	near, beside	paranasal (by the nose)
-pathy	disease	neuropathy (nerve disease)
pelv-	basin	renal pelvis (collection area in kidney)
-penia	deficiency	leucopenia (deficiency of leukocytes)
peri-	around	periosteum (membrane covering bones)
phag-	eat	phagocytosis (cellular eating)
phil-	have an affinity for	lipophilic (associates with fat)
-plegia	paralyze, stroke	paraplegia (paralysis of lower extremities)
pneumo-	air, gas, lungs	pneumothorax (air in the pleural cavity)
-poie, -poiesis	make, formation of	erythropoietin (hormone that stimulates erythrocyte production)
poly-	many	polycythemia (excess erythrocytes)
post-	after	postnatal (after birth)
pre-	before in time, place	prenatal (before birth)
pro-	before in time, place	prosect (to cut for demonstration)
pseudo-	false	pseudostratified (not true layered)
quad-	fourfold	quadriceps femoris (4-headed muscle of anterior thigh)
rami-	branch	ramus (primary division of a nerve)
rect-	straight	rectus abdominis (straight muscle of abdomen)
reno-	kidney	renal (of the kidney)
retro-	backward, behind	retroperitoneal (posterior to the peritoneum)
sclero-	hard	arteriosclerosis (hardening of the arteries)
semi-	half	semilunar (half-moon shaped)
serrate-	saw-edged	serratus anterior (muscle of thorax)
somato-	body	somatotropin (growth hormone)
steno-	narrow	stenosis (narrowing of opening)
sterno-	breast, chest	sternum (bone over heart and medial to ribs)
stria-	stripe	striated (showing stripes or lines)
sub-	under	subcutaneous (under the skin)
super-, supra-	above, upper	supercilia (upper brows), suprarenal (superior to the kidney)
sym-, syn-	together, with	symphysis (growing together), synapse (where neurons, or neuron and muscle fiber, meet)
tachy-	fast	tachycardia (rapid heart rate)
therm-	heat	thermometer (tool to measure temperature)
thorac-	chest	thoracic cavity (body cavity containing heart, lungs)
thrombo-	blood clot	thrombocyte (platelet)
-tomy	cut, incise	appendectomy (removal of appendix)
topo-	place, position	ectopic (being out of position)
trans-	across	transdermal (across the skin)
tri-	three	triceps brachii (three-headed muscle)
-tropic	influencing	gonadotropic (effecting the gonads)
tunica-	layer, coat	tunica interna (inner part of blood vessel)
ultra-	beyond, excess	ultradian (more than every 24 hours)
uni-	one	unicellular (single cell)
-uria	urine	polyuria (excess urine)
vas-	vessel	vasodilation (widening of lumen of blood vessel)
vertebro-	spine	vertebrae (bones of the spine)
villo-	hair	microvilli (minute projections of cell membrane)
viscer-	internal organ	visceral (of the internal organs)
zyg-	yoked, paired, union	azygos (unpaired anatomical structure)

The Laboratory Environment

1

OUTLINE AND LEARNING OBJECTIVES

INTRODUCTION

Welcome to the human anatomy laboratory! Most students experience both excitement and anxiety about this course. The human body is a fascinating subject, and the study of human anatomy is an experience that is typically not forgotten.

This laboratory manual is designed for an integrated, systems-based course that combines both human gross anatomy and histology and gross anatomy. **Histology** is the study of tissues and requires the use of a microscope. **Gross anatomy** is the study of structures that can be seen with the naked eye. This includes any structure that can be seen without the use of a microscope. The hope is that upon completion of this course, students will have developed an understanding of and appreciation for how tissue structure relates to gross structure, and vice versa. That said, in the laboratory classroom itself, the two levels of structure are often studied somewhat separately. That is, laboratory studies in histology will likely involve observing histology slides with a microscope or using some sort of virtual microscopy system; laboratory studies in gross anatomy will likely involve observing classroom models, dissecting animal specimens, or making observations of human bones and/or human cadavers. To assist students in these endeavors, the exercises in this manual are divided into two types of activities: histology exercises and gross

anatomy exercises. Where applicable, each chapter will begin with a section on histology and end with a section on gross anatomy. Although the two activities may be performed somewhat separately, the goal is to integrate the study of histology and gross anatomy, and to associate structure with function at all levels. "Concept Connection" boxes and questions within exercises in each chapter will assist students with this task.

The purpose of this introductory chapter is to familiarize students with common equipment, chemicals, and dissection instruments encountered in the laboratory. Additional topics include the proper use of protective equipment, the proper disposal of waste materials, and common dissection techniques.

List of Reference Tables

Clinical View | Use of Human Cadavers in the Anatomy Laboratory

Where did that body lying on a table in the human anatomy laboratory come from? Typically, the body was donated by a person who made special arrangements before the time of death to donate his or her body to a body donor program so it could be used for education or research. Individuals who donate their bodies for these purposes make a conscious decision to do so. Such individuals have provided an incredible gift—the opportunity to learn human anatomy from an actual human body. It is important to remember that what that person has given is, indeed, a gift. The cadaver deserves the utmost of respect at all times. Making jokes about any part of the cadaver or intentionally damaging or "poking" at parts of the cadaver is unacceptable behavior.

The thought of learning anatomy by observing structures on what was, at one time, a living, breathing human being makes many individuals feel uncomfortable at first. It is quite normal to have an emotional response to the cadaver upon first inspection. It takes time and experience to become comfortable around the cadaver. Even if you think you will be just fine around the cadaver, it is important to be aware of your response and the responses of fellow classmates. If at any time you feel faint or light-headed, sit down immediately. Fainting, though rare, is a possibility, and can lead to injuries if a fainting person falls unexpectedly. Be aware of fellow students: if they appear to lose facial color or start to look sick—they may need assistance.

Typically the part of the body that evokes the most emotional response is the face, because it is most indicative of the person that the cadaver once was. Because of this, the face of the cadaver should remain covered most of the time. This does not necessarily mean that viewing the face is not allowed. However, before uncovering the face, make sure that other students in the room know that it will be uncovered. If you have a particularly strong emotional response to the cadaver, take a break and come back to it later when you are feeling better.

Individuals with a great deal of experience around cadavers had a similar emotional response the first time as well. In time one learns to disconnect emotions from the experience. Certainly at one time the body that is the cadaver in the laboratory was the home of a living human being. However, now it is just a body. Eventually students do become comfortable using the cadaver and find that it is an invaluable learning tool that is far more useful than any model or picture could ever be. There is nothing quite like the real thing to help students truly understand the structure of the human body. Make the most of this unique opportunity—and give thanks to those who selflessly donated their bodies to provide students with the ultimate learning experience in anatomy.

Students who are curious about the uses of cadavers in science and research are encouraged to check out the following book from the library: Mary Roach, *Stiff: The Curious Lives of Human Cadavers* (New York: W.W. Norton, 2003).

Chapter 1: The Laboratory Environment

Name: _____

Date: _____ Section: _____

PRE-LABORATORY WORKSHEET

These Pre-laboratory Worksheet questions may be assigned by instructors through their connect course.

1. Histology is the study of intracellular organelles. _____ (True/False)

2. Human cadaver tissue is disposed of in a biohazard waste bag. _____ (True/False)

3. List the pieces of equipment used for protection against the hazards associated with embalming chemicals.

a. _____

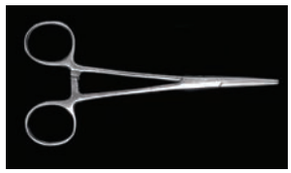
b. _____

c. _____

d. _____

e. _____

4. The dissection instrument shown here is a pair of: _____ .



© Christine Eckel

5. After dissecting a preserved cow eye, what receptacle should be used to dispose of the tissue?

_____

6. Which of the following chemicals are commonly used as *preservatives*? (Check all that apply.)

_____ a. ethanol

_____ b. formalin

_____ c. distilled water

_____ d. phenol

_____ e. glycerine

7. Which of the following chemicals require the use of personal protective equipment when handling them? (Check all that apply.)

_____ a. ethanol

_____ b. formalin

_____ c. distilled water

_____ d. phenol

_____ e. glycerine

8. When removing a scalpel blade, point the blade away from you and others. _____ (True/False)

9. Which one of the following dissecting tools is the most beneficial for attempting to loosen the hold between a specimen's skin and the underlying fascia? (Circle one.)

a. dissecting probe

b. finger

c. scalpel

d. scissors

10. Blunt dissection technique is most useful for separating tissues without damaging delicate structures. _____ (True/False)

Laboratory Equipment

The typical human anatomy classroom consists of laboratory tables or benches that provide ample room for use of microscopes, classroom models, and dissection materials. If human cadavers are used in the classroom, there will also be a space dedicated to the tables where the cadavers are stored. When entering the classroom for the first time, look around and become familiar with the environment. Pay particular attention to the location of sinks, eyewash stations, and safety equipment such as first-aid kits and fire extinguishers. The instructor will most likely provide a detailed introduction specific to the laboratory classroom, safety procedures, and accepted protocol. The main purpose of the exercises in this chapter is to introduce common safety devices and dissection equipment. *Do not* use the information in this chapter as the sole source of information on laboratory safety. The exercises in this chapter are not intended to serve as a safety manual for the laboratory.

EXERCISE 1.1 Identification of Common Dissection Instruments

Several dissection instruments are commonly found in the human anatomy laboratory classroom. **Table 1.1** describes each of these instruments and their uses.

1. Obtain a dissection kit from the laboratory instructor, or use your own dissection kit if you were required to bring your own to class.
2. Identify the instruments listed in **figure 1.1,** using table 1.1 as a guide. Then label figure 1.1.

Table 1.1 Common Dissection Instruments

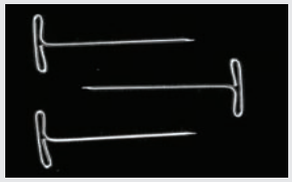
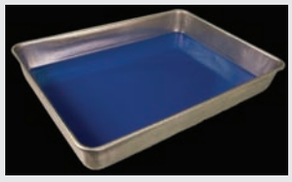
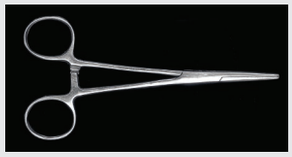
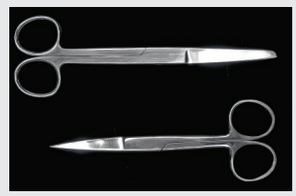
Tool	Description and Use	Photo	Word Origin
Blunt probe	An instrument with a blunt (not sharp) end on it. This instrument is used to pry and poke at tissues without causing damage. Some probes come with a sharper point on the opposite end that can be used for "picking" at tissues.	 © Christine Eckel	*proba,* examination
Dissecting needles	Long, thick needles that have a handle made of wood, plastic, or metal. These needles are used to pick at tissues and to pry small pieces of tissue apart.	 © Christine Eckel	*dissectus,* to cut up
Dissecting pins	"T" shaped pins that are used to pin tissues to the wax or plastic pad within a dissecting tray. Pinning other structures away from the area of interest allows greater visibility within the dissection field and prevents unwanted damage to adjacent tissues.	 © Christine Eckel	*dissectus,* to cut up
Dissecting tray	Metal or plastic tray used to hold a specimen. The tray is filled with wax or plastic. The wax and/or plastic is soft enough to pin tissues to it.	 © Christine Eckel	*dissectus,* to cut up
Forceps	Resemble tweezers and are used for holding objects. Some are large and have tongs on the ends that assist with grabbing tough tissues. Some are small and fine (needle-nose) for picking up small objects. Forceps may also be straight-tipped or curve-tipped.	 © Christine Eckel	*formus,* form + *ceps,* taker
Hemostat	In surgery these are used to compress blood vessels and stop bleeding (hence the name). For dissection they are useful as "grabbing" tools. The handle locks in place, which allows the user to pull on tissues without causing hand and forearm muscles to fatigue.	 © Christine Eckel	*haimo-,* blood + *statikos,* causing to stop

Table 1.1 Common Dissection Instruments *(continued)*

Tool	Description and Use	Photo	Word Origin
Scalpel	A sharp cutting tool. Generally the blade and the blade handle will be separate, unless using a disposable scalpel. Refer to specific directions in the text regarding proper use of a scalpel, as this instrument can be dangerous!	 © Christine Eckel	*scalpere,* to scratch
Scalpel blade	Both the cutting part and the disposable part of a scalpel. The number of the blade indicates blade size, and must be matched with an appropriately numbered blade handle. When a blade becomes dull, it may be removed and replaced with a new blade. Used blades must be disposed of in a sharps container.	 © Christine Eckel	*scalpere,* to scratch
Scalpel blade handle	The nondisposable part of a scalpel that is used to hold the blade. The number on the handle indicates the size of the handle and is used to match it with a particular blade size. A scalpel blade handle can be a useful tool for blunt dissection when used *without* a blade attached.	 © Christine Eckel	*scalpere,* to scratch
Scissors	Some scissors come with pointed blades and some have one curved (blunt) and one pointed blade. Scissors with the curved/blunt edge are used when extra care is needed to prevent damage to structures. To use, direct the curved blade toward the structures that could be damaged. Pointed-blade scissors are particularly helpful for using "open scissors" technique (see text).	 © Christine Eckel	*scindere,* to cut

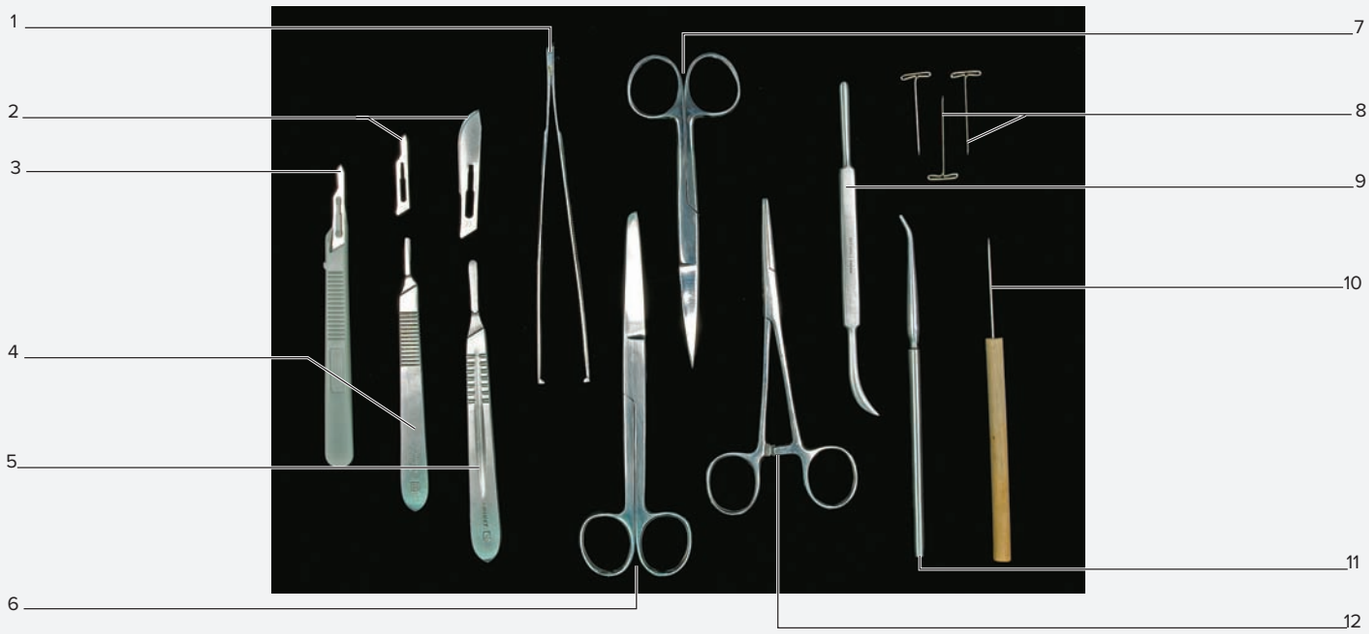


Figure 1.1 **Identification of Common Dissection Instruments.** Use the terms listed to fill in the numbered labels in the figure. Answers may be used more than once.

- ☐ blunt probe
- ☐ dissecting needle
- ☐ dissecting pins
- ☐ forceps
- ☐ hemostat
- ☐ scalpel (disposable)
- ☐ scalpel blade handle (#4)
- ☐ scalpel blade handle (#3)
- ☐ scalpel blades
- ☐ scissors (curved)
- ☐ scissors (pointed)

© Christine Eckel

Protective Equipment

The human anatomy laboratory poses few risks, although it is important to be aware of what these risks are. The main risks are damage to skin or eyes from exposure to laboratory chemicals (covered in the next section) or cuts from dissection tools. As a general precaution, wear protective gloves when working with fresh or preserved specimens (animal or human) to keep any potentially infectious or caustic agents from contacting the skin. If there is a risk of squirting fluid, then also wear protective eyewear (safety glasses or safety goggles). When wearing gloves, be sure to wear the correct size for your hands. If the gloves are too small, they may tear easily. If they are too big, they may make handling instruments and tissues difficult. When the gloves become dirty, remove them and put on a new pair. When removing a glove, start at the wrist and pull toward the fingers, turning the glove inside-out as it is removed. This will prevent any potentially damaging fluids from contacting the skin during removal of the gloves.

There is always a risk of cutting yourself or others when using sharp dissecting tools. To prevent injury from dissection instruments pay attention to the following rules. First and foremost—*never* wear open-toed shoes to the laboratory. Dissecting tools are often dropped and can cut feet if they are not covered by protective footwear. When using sharp tools such as scalpels, always be aware of the direction the sharp blades of those instruments are pointing. The sharp end should always point away from the user *and* away from others in the laboratory. When dissecting, be aware of where others are standing or sitting, and consider the risk posed to yourself and others if a hand were to slip. *Never* place hands in the dissecting field when anyone is actively dissecting. If another person asks for assistance holding tissues during a dissection, use forceps or some other device to hold the tissue to ensure that your hands are not within reach of the scalpel blade. Always be aware of the physical location of the scalpel, particularly when not using it. Individuals can be accidentally cut by reaching into a dissecting tray or table and unexpectedly discovering a sharp scalpel in the dissection field. If using dissecting pins to hold back tissues, always remove them from the specimen before closing up for the day. This prevents unsuspecting individuals from getting jabbed by the pins when dissection continues at a later date.

Hazardous Chemicals

Relatively few chemicals are used in the human anatomy laboratory. Most of these chemicals are used to preserve, or "embalm," animal specimens or human cadavers. Generally these chemicals are not stored in the laboratory at full strength. Rather, most are diluted to about 10% of full strength. These chemicals will be encountered most commonly when using specimens or tissues that were previously injected with solutions containing the chemicals. Thus, safety measures in the laboratory are designed to protect users from the forms of these chemicals that are most likely to be encountered. The most common chemicals used for embalming purposes are formalin, ethanol, phenol, and glycerol.

Table 1.2 summarizes the uses and hazards of these chemicals. The majority of these chemicals are used to fix tissues and prevent the growth of harmful microorganisms, such as bacteria, viruses, and fungi. "Fixation" refers to the ability of the chemical to solidify proteins, thus preventing breakdown. **Preservatives** both fix tissues and inhibit the growth of harmful microorganisms. Because most preservatives also dehydrate tissues, "humectants" are added to embalming solutions. **Humectants,** such as glycerol, attract water. When humectants act alongside preservatives, they help keep tissues moist. Other chemicals that may be added to embalming solutions are pigments, which make the tissues look more natural, or chemicals that mask the odors of the preservative chemicals. **Formalin** and **phenol** are the most toxic and odorous preservative chemicals. Luckily, exposure to them in the anatomy laboratory is very low. It may smell as if the concentrations of these chemicals are high, as the odor is often misleading because these chemicals can be detected by odor in extremely small quantities.

Table 1.2 Preservative Chemicals Encountered in the Human Anatomy Laboratory

Chemical	Description	Use	Hazard	Preventing Exposure	Disposal
Ethanol	Inhibits growth of bacteria and fungi.	Preservative	Flammable, so requires storage in a fire-safe cabinet. Generally safe in small quantities.	Gloves and eye protection. Rinse tissues immediately if exposed, particularly eyes. Seek medical attention if irritation persists.	Small amounts may be flushed down the sink along with plenty of water to dilute the solution.
Formalin	Fixes tissues by causing proteins to cross-link (solidify). Destroys autolytic enzymes, which initiate tissue decomposition. Inhibits growth of bacteria, yeast, and mold.	Preservative	Flammable, so requires storage in a fire-safe cabinet. Toxic at full strength. Penetrates skin. Corrosive. Burns skin. Damages lungs if inhaled. May be carcinogenic.	Gloves and eye protection. Rinse tissues immediately if exposed, particularly eyes. Seek medical attention if irritation persists.	Do not pour into sinks.
Glycerine (glycerol)	Helps control moisture balance in tissues. When used with formalin, it counteracts the dehydrating effects of formalin.	Humectant	Flammable, so requires storage in a fire-safe cabinet. Generally safe. Can pose a slipping hazard if spilled on the floor.	Gloves and eye protection. Rinse tissues immediately if exposed, particularly eyes. Seek medical attention if irritation persists.	Small amounts may be flushed down the sink along with plenty of water to dilute the solution.
Phenol	Assists formalin in fixing tissues through protein solidification. Inhibits growth of bacteria, yeast, and mold.	Preservative	Flammable, so requires storage in a fire-safe cabinet. Extremely toxic at full strength. Rapidly penetrates the skin. Corrosive. Burns skin. Damages lungs if inhaled. NOTE: when used as embalming preservative concentration (and thus toxicity) is extremely low.	Gloves and eye protection. Rinse tissues immediately if exposed. Use an eyewash station if solution gets in the eyes. Seek medical attention if irritation persists.	Do not pour into sinks.

Although the concentrations of formalin and phenol users are exposed to are very low, if these chemicals have been used to preserve specimens, protective clothing must be worn to prevent the chemicals from contacting the skin or eyes. Use gloves whenever handling specimens, and use protective eyewear whenever there is a risk of chemicals getting into the eyes. If skin is exposed, rinse it immediately. If eyes are exposed, use the eyewash station in the laboratory to rinse the eyes thoroughly. If skin or eyes continue to be irritated after rinsing, consult a medical doctor.

Proper Disposal of Laboratory Waste

There are several types of waste that must be disposed of in the human anatomy laboratory. Much of this waste is "normal" waste, such as tissues, paper towels, rubber gloves, and the like. Such waste should be disposed of in the regular classroom garbage/waste container. However, at times the waste materials may potentially be classified as **hazardous waste.** Hazardous waste must be disposed of in a special container. The general rule for determining if something is potentially hazardous or not is this: if the possibility exists that someone may be injured in any way from handling this waste, it is hazardous. Follow this rule, and be sure to ask the instructor how to properly dispose of something any time there is a question as to whether it is hazardous or not. It is always better to err on the side of caution.

What is hazardous waste?

- Any sort of fresh tissue and/or blood is potentially hazardous
- Laboratory chemicals
- Broken glass, scalpel blades, or any other sharp item that may cut an individual who handles the waste

Sharps Containers

Sharps containers (figure 1.2) are plastic containers (often red or orange) that are used to dispose of anything "sharp," such as needles, scalpel blades, broken glass, pins, or anything else that has the potential to cut or puncture a person who handles it. Such items should NEVER go in the garbage, because they may injure anyone who handles the garbage thereafter. When in doubt, put it in the sharps container.

Biohazard Bags

Special **biohazard bags** may be available in the laboratory. These are used for biological materials such as blood or other fresh animal tissue that requires special disposal. When it comes to human blood, an item containing a small amount of blood (such as a band-aid) can be disposed of in a normal wastebasket. However, a blood-soaked towel or other item must be disposed of in a biohazard bag. A biohazard bag is usually red or clear with the symbol shown in **figure 1.3** on it. When dealing with tissues that must be disposed of in a biohazard bag, the instructor will generally inform students of this. Again, when in doubt, always ask before disposing of something potentially hazardous. Important note: human cadaveric tissues do *not* go into biohazard bags. They must be kept with the cadaver. Any piece of human tissue removed from a cadaver must eventually be returned to the cadaver to be cremated with the entire body.

Figure 1.2 Sharps Containers. Samples of two different models of sharps containers. Such containers allow one to place sharp objects into the container, but they cannot be removed once placed inside. Note the biohazard warning symbol on the containers.

Figure 1.3 Biohazard Waste Symbol.

Dissection Techniques

The word *dissect* literally means to cut something up. Most individuals have been led to think that the first thing a surgeon or anatomist does when planning to dissect is to pick up a scalpel and cut. However, skilled dissection does not always involve actually cutting tissues. In fact, the dissector's best friend is a technique called "blunt dissection." Blunt dissection specifically involves separation of tissues *without* using sharp instruments (hence the term *blunt*). When dissecting tissues, always try using blunt dissection before picking up sharp instruments such as scissors and scalpels. Sharp instruments are very handy—as they are good at cutting things. However, often students will end up cutting many things they do not wish to cut, purely by accident. Thus, being sparse and prudent in the use of sharp tools is one of the most important tips for performing a good dissection.

For this exercise, the demonstration of techniques will be shown using a fresh chicken purchased from a grocery store. However, the instructor may choose another specimen to practice on. For now, the goal is to separate the skin from the underlying tissues such as bones and muscle (the "meat") of the specimen.

Sharp Dissection Techniques

"Sharp dissection" techniques are the techniques most familiar to individuals. These techniques involve the use of sharp instruments such as scissors and scalpels. They are "cutting" techniques. They are advantageous in that they can be used to separate tough tissues from each other, or to remove pieces of tissue from a dissection specimen. The danger of using sharp dissection techniques is that novice and experienced dissectors alike will often end up cutting things they do not wish to cut, such as blood vessels and nerves. Therefore, sharp dissection techniques should be used with care.

EXERCISE 1.2 Proper Disposal of Laboratory Waste

1. Circle the letter (a, b, or c) of the correct waste receptacle (shown in **figure 1.4**) for each item listed here.

1.	broken scissors	a	b	c	5.	paper towel	a	b	c
2.	cotton swab	a	b	c	6.	rubber glove	a	b	c
3.	dissecting pins	a	b	c	7.	scalpel blades	a	b	c
4.	glass slide	a	b	c					

(a) (b) (c)

Figure 1.4 Common Laboratory Waste Receptacles. (a) Sharps container. (b) Waste basket. (c) Hazardous waste bag.

EXERCISE 1.3 Placing a Scalpel Blade on a Scalpel Blade Handle

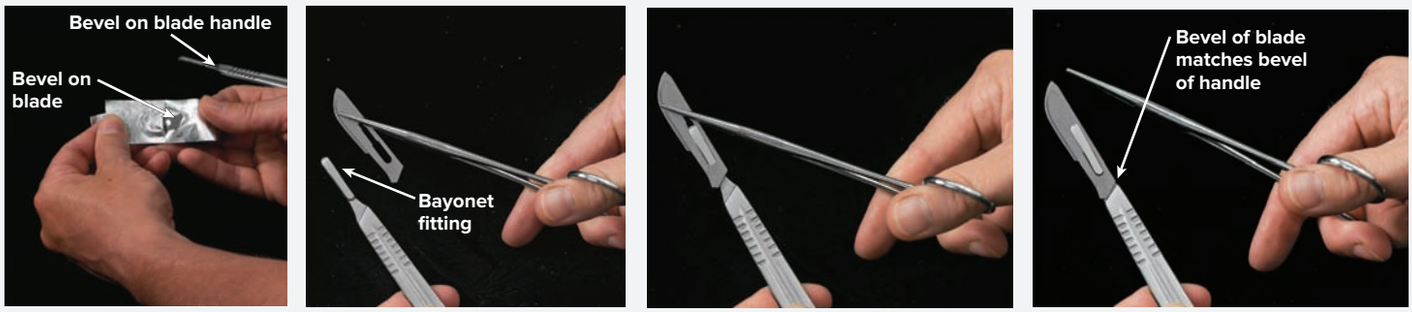
Scalpels come in many forms. Some are of the disposable type, which typically means that the handle and blade come as one unit and the handle is made out of plastic **(figure 1.5).** Often the blades and handles are separate items. This allows replacement of the blade when it becomes dull from use. This exercise covers how to properly place a scalpel blade on a scalpel blade handle, and how to properly remove the blade once finished.

1. Obtain a **scalpel blade** and **scalpel blade handle** from the instructor. Scalpel blades and handles come in various sizes, and it is important to match the size of the blade to the size of the blade handle. Observe the scalpel handle and look for a number stamped on it, which will be a 3 or a 4 **(figure 1.6*a*).** Next, observe the blade packet and note the number on it (figure 1.6*b*). A number 3 handle is used to fit number 10, 10A, 11, 12, 12D, and 15 blades. A number 4 handle is used to fit number 18, 20, 21, 22, 23, 24, 24D, or 25 blades. Larger handles and blades are generally used for making bigger, deeper cuts whereas the smaller handles and blades are generally used for finer dissection. A commonly used combination in anatomy laboratories is the number 4 handle matched with a number 22 blade.

2. Once the scalpel handle and blade size are properly paired, carefully open the scalpel blade packet halfway **(figure 1.7*a*-1).** Note the bevel on the blade. This bevel matches the bevel on the blade handle, so that there is only one way to properly place the scalpel blade on the handle. The blade handle has a

Figure 1.5 Disposable Scalpel. The scalpel blade and scalpel blade handle are both disposable. The entire unit must be disposed of in a sharps container.

Figure 1.6 **Scalpel Blade Handles and Blades.** (a) The number on the scalpel blade handle indicates what size blades will fit on the handle. (b) The number on the blade wrapper indicates the size of the blade. See text for how to fit proper blade size to blade handle.



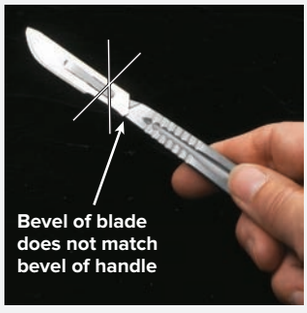


Figure 1.7 **Scalpel Blade Placement.** (a) Correct procedure. (b) Incorrect placement of a blade on a blade handle. Notice that the bevel on the blade does not match up with the bevel on the blade handle. If placed in this fashion, the blade will not be secure on the handle and may slip off the handle and injure someone.

bayonet fitting that is matched to the opening on the scalpel blade (figure 1.7*a*-2), which will lock the blade in place on the handle. The safest way to place the blade on the handle is to first grasp the end of the blade using **hemostats** (figure 1.7*a*-3; table 1.1). Then, while matching the bevel on the blade to the bevel on the handle, slide the blade onto the handle until it clicks, indicating it is locked in place (figure 1.7*a*-4). If it does not go on easily, check to make sure that the blade has not been placed on the handle incorrectly, as in figure 1.7*b*. Now it is ready for use!

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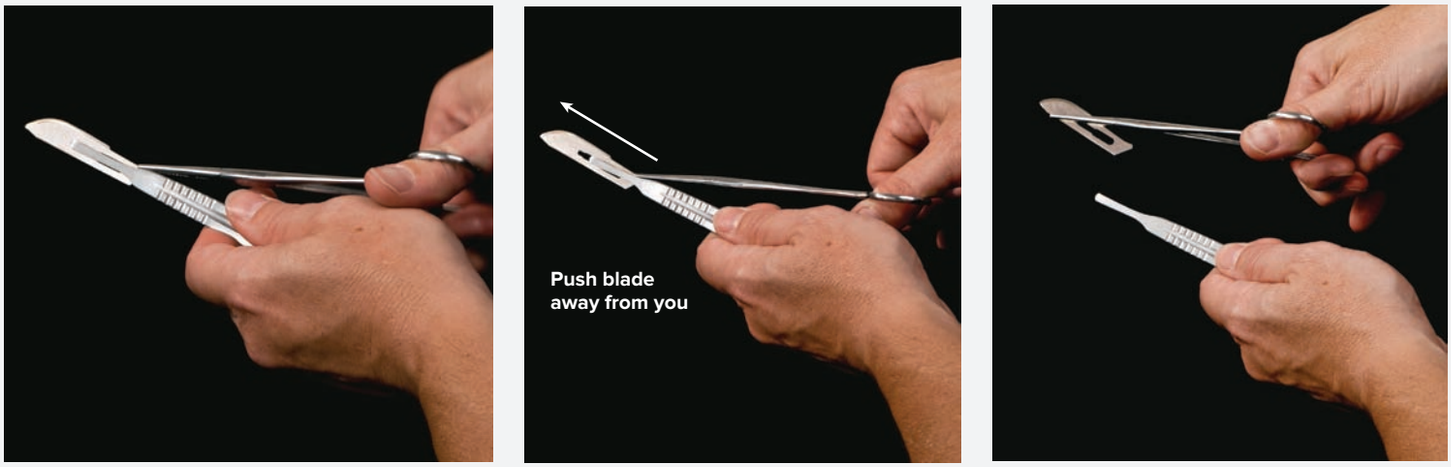
(1) Orient the blade and blade handle with sharp edge of the blade pointed to the right, as shown on the front of the device.

(2) Push the blade into the slot on the device until you hear and feel a distinct "click."

(3) While holding the removal device firmly with your free hand, pull the blade handle out of the device.

Figure 1.8 **Removal of a Scalpel Blade from Handle Using All-in-One Blade Remover/Sharps Container.**

3. The safest way to remove a blade from a handle is to use a device that is both a **blade remover** and a sharps container all in one (an example is shown in **figure 1.8).**
4. If a blade remover is not available, obtain a pair of hemostats to remove the blade. Pointing the blade *away* from you (but not toward someone else), clamp the part of the blade nearest the handle with the hemostats **(figure 1.9-1).** Grip the blade firmly with the hemostats, then slide the blade over the bayonet on the handle while keeping the tip of the blade pointing away from you until the blade comes off of the handle (figure 1.9-2). Keeping the blade clamped with the hemostats, transport the blade to a sharps container and dispose of it in the sharps container (figure 1.9-3).



(1) With the blade pointed away from you and the bayonet surface of the handle also directed away from you, grasp the base of the blade with hemostats and lock the hemostats firmly to the blade.

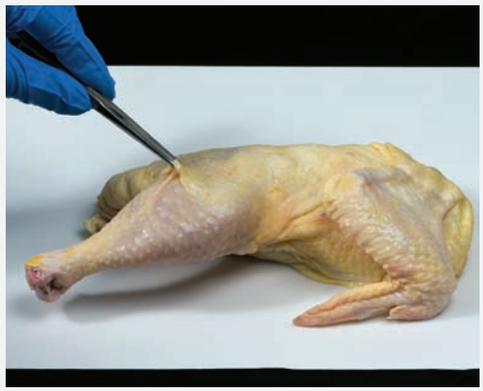
(2) Slide the blade off of the bayonet on the blade handle. Again, push it away from you (and away from others in your vicinity as well).

(3) Once the blade has been removed from the handle, continue to grasp it firmly with the hemostats.

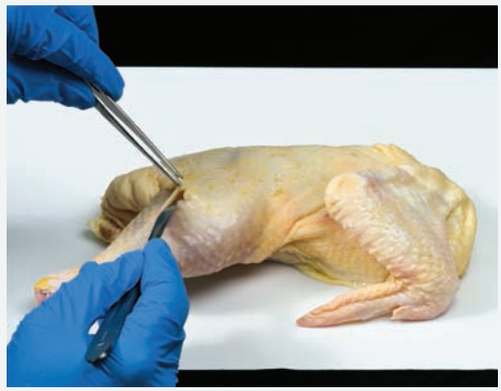
Figure 1.9 **Removal of a Scalpel Blade from Handle Using Hemostats.**

EXERCISE 1.4 Dissecting with a Scalpel

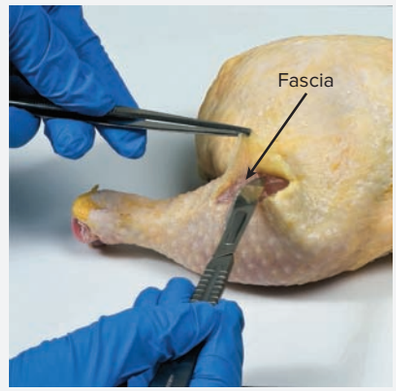
1. Obtain a dissection specimen and place it on a dissecting tray.
2. Obtain a scalpel with a blade (see exercise 1.3) and some **tissue forceps** (table 1.1). If the tissue is difficult to grasp, use **hemostats** instead of forceps. Hemostats "lock" on to the tissue so the tissue is not dropped when the user's grip on the handle is released.
3. Using the forceps or hemostats, pull the skin away from the muscle on the dissection specimen **(figure 1.10-1).** Carefully cut into the skin using the tip of the scalpel blade (figure 1.10-2). Note how easily a new blade cuts into the tissue. When cutting with a scalpel, take care not to cut too deep, or too aggressively, or underlying tissues will be damaged. Once a small slit has been created in the skin, observe the stringy tissue that lies between the skin and the muscle. This tissue is a loose connective tissue called fascia (figure 1.10-3), which is discussed in detail in chapter 5. Because the goal is to separate the skin from the muscle, it is necessary to loosen the "grip" of the fascia that holds the skin and muscle together. One way to do this is to cut into the fascia using the scalpel.
4. Next, *without* holding the skin away from the muscle with forceps, cut into the skin using a considerable amount of pressure. Note how easy it is to cut through the skin directly into the muscle. This is not desirable. To avoid damaging the underlying tissues, push a blunt probe or scalpel handle (*without* blade attached!) into the space between the skin and muscle, thus protecting the underlying tissues. Then cut with the scalpel superficial to the probe **(figure 1.11).**



(1) Pull the skin away from the underlying tissues using tissue forceps.

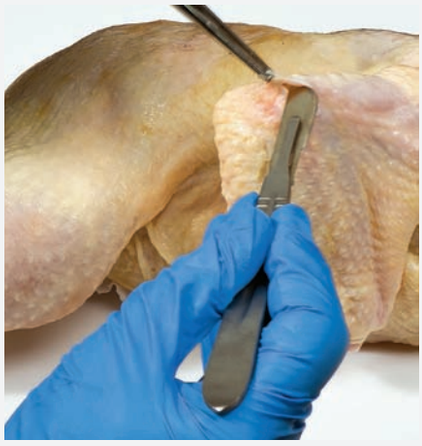


(2) Begin cutting the skin with the scalpel, taking care not to cut delicate tissues deep to the skin.

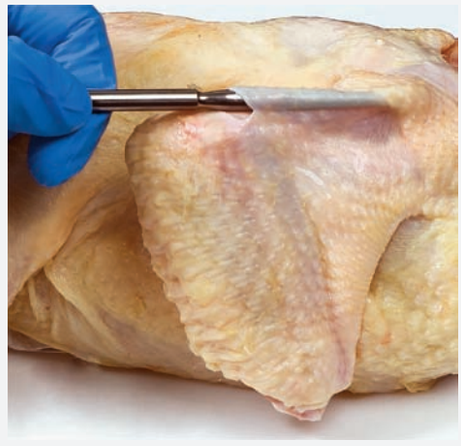


(3) To assist with removal of the skin, use the scalpel to gently cut away the fascia that loosely holds the skin to the muscle. Maintain as much tension on the skin as possible and always keep the sharp end of the blade pointed toward the skin, not the underlying tissues.

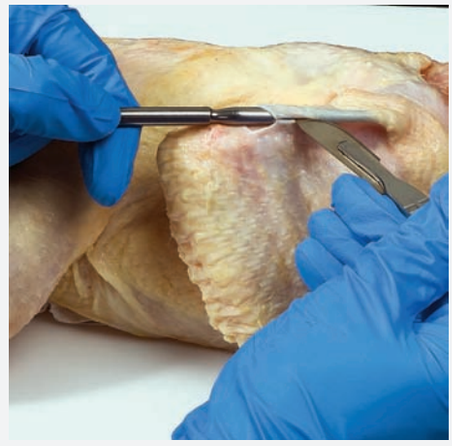
Figure 1.10 **Dissecting with a Scalpel.**



(1) Pull the skin away from the underlying tissues using tissue forceps and cut a small slit in the skin with the scalpel, taking care not to cut delicate tissues deep to the skin.



(2) Push the probe under the skin along the line where the cut will be made.



(3) Cut the skin superficial to the probe with the scalpel. Notice how the blunt probe limits the depth at which the scalpel can cut, thus protecting underlying tissues.

Figure 1.11 **Protecting Underlying Tissues with a Probe when Dissecting with a Scalpel.**

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The probe limits the depth at which the scalpel blade can cut, thus protecting the underlying tissues.

5. Once enough skin has been pulled back for it to be easily grasped with forceps or hemostats, put as much tension on the skin as possible, thus stretching out the fibers in the fascia **(figure 1.12).** Once the fascia is stretched, you can use the scalpel to cut the fascia and remove the skin from the specimen. When you cut with the scalpel, always point the sharp end of the blade toward the skin, not toward the underlying tissues, so as to protect those underlying tissues.
6. Practice using the forceps, hemostats, blunt probe, and scalpel to remove the skin from part of the specimen. Note areas where this is more difficult than others. As you are practicing, consider carefully whether or not the scalpel is the best instrument for the job, or if using it is causing damage to tissues.

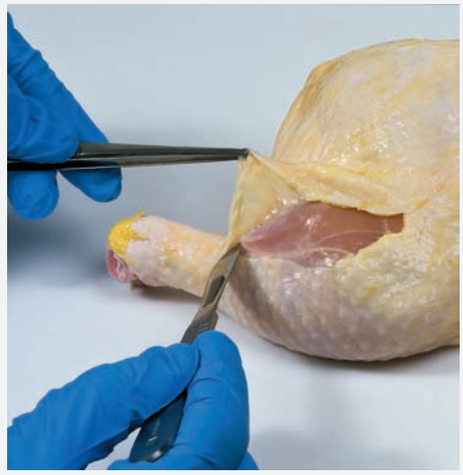
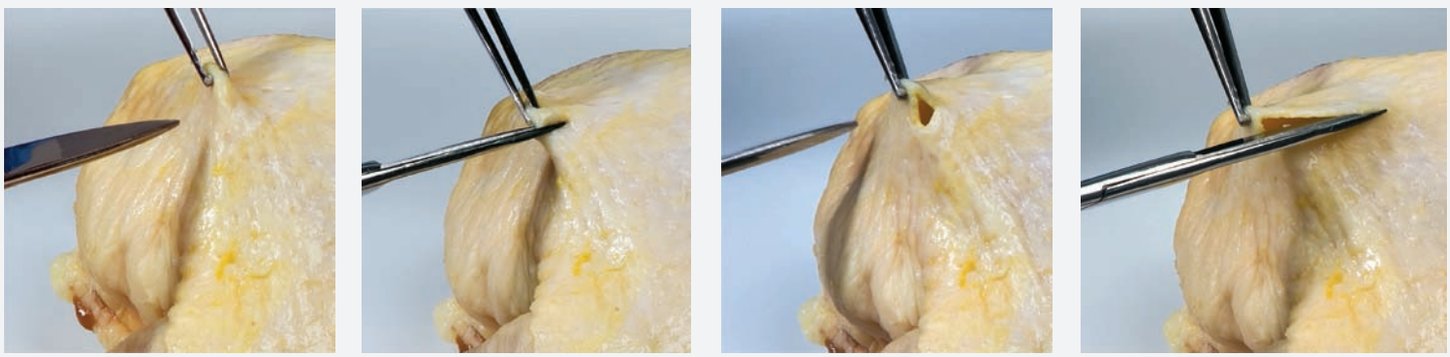


Figure 1.12 Removing the Rest of the Skin with the Scalpel. Use the forceps to pull the skin away from the underlying tissues. Keep as much tension as possible on the fascia. Cut the fascia with the scalpel, always keeping the sharp part of the scalpel blade directed toward the skin. This way, if the blade slips accidentally, it will cut the skin, not the underlying tissues.

EXERCISE 1.5 Dissecting with Scissors

1. Using the same dissection specimen as in exercise 1.4, practice using scissors to cut tissues.
2. Obtain a pair of **pointed scissors** and **forceps** (table 1.1). Using the forceps, grasp part of the skin covering part of the specimen that has not already been dissected **(figure 1.13-1).** Pull the skin away from the muscle. Next, cut a slit into the skin large enough for the fascia beneath it to become visible (figure 1.13-2, 3). Continue to lengthen the cut until it is about 2 inches long (figure 1.13-4).
3. **Open scissors technique:** There are many tissues within the fascia that may need to be preserved, such as nerves and blood vessels. When using "sharp dissection" techniques, these structures may accidentally get cut. For this reason, the "blunt dissection" technique is preferred, to preserve important structures. One blunt dissection technique is called an "open scissors" technique, so named because the dissecting action of the scissors is performed by starting with the scissors closed and then actively opening them. This is exactly the opposite of how most scissors are used.



① Use tissue forceps to pull the skin away from underlying tissues.

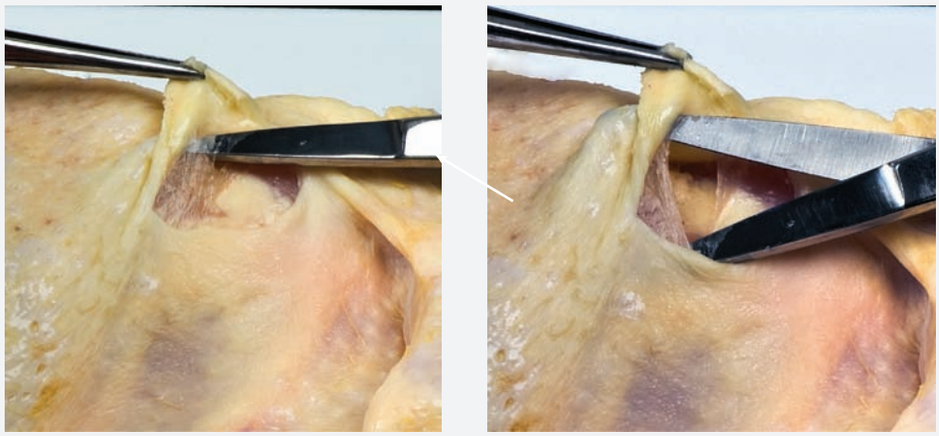
② Make a small cut in the skin with the scissors.

③ A small hole has now been created in the skin. Insert the tip of the scissors into this hole and begin cutting directionally along the skin.

④ Continue the cut along the skin. Use the tissue forceps to pull the skin away from underlying tissues before making each cut to avoid damaging underlying structures.

Figure 1.13 Dissecting with Scissors.

4. With the scissors closed, push the tip of the scissors into the space between the skin and the muscle so that it pierces the fascia **(figure 1.14-1).** Once the tip of the scissors is within the fascia, open the scissors (figure 1.14-2). Notice how this action causes the fibers within the fascia to separate from each other and loosens the hold between the skin and the fascia. When using the open scissors technique, keep the scissors open within the specimen. Remove the scissors completely prior to closing the scissors to prevent causing damage to surrounding tissues and structures while the scissors are still in the fascia.
5. Continue to loosen the fascia using the open scissors technique. While doing this, observe small structures such as blood vessels and nerves running in the space between the skin and the underlying tissues. Notice how the fibers in the fascia easily separate from each other without damaging the vessels and nerves when using the open scissors technique. At times, the hold of the fascia is too tight, and "open scissors" technique will no longer work effectively. At those times, switch to "normal" scissors technique to cut away the tough tissue.
6. Practice using both open and normal scissors techniques to continue to remove skin from underlying tissues.



(1) Make a small cut in the skin. Using forceps, pull the skin away from the underlying fascia. Push the tip of the *closed* scissors into the fascia that lies deep to the skin.

(2) Open the scissors, thus separating the fibers of the fascia and loosening the skin from the underlying tissues.

Figure 1.14 Open Scissors Technique.

Blunt Dissection Techniques

As we began to see in exercise 1.3, there are times when sharp dissection technique is undesirable, because tissues might be damaged if we use sharp instruments. At these times it is best to switch to blunt dissection techniques. Blunt dissection is designed to separate tissues without damaging delicate structures.

EXERCISE 1.6 Blunt Dissection Techniques

1. Practice using blunt dissection techniques using the same dissection specimen as in exercises 1.4 and 1.5.
2. Obtain a pair of **pointed scissors** and **forceps** (table 1.1). Using the forceps, grasp part of the skin of the specimen not previously dissected and pull it away from the muscle. Next, make a small cut into the skin until the fascia beneath it is visible **(figure 1.15).** This is the "sharp dissection" technique previously described.
3. When attempting to preserve structures such as nerves and blood vessels, "sharp dissection" techniques may damage these structures. For this reason, use "blunt dissection" techniques whenever possible to prevent damage to important structures. "Open scissors," described in exercise 1.4, is one blunt dissection technique. Use the open scissors technique to loosen the hold between the skin and the fascia on the specimen.
4. Once the space between the skin and muscle is large enough for a finger to be pushed in, set the scissors down. Proceed to separate the skin from the muscle using only your fingers (figure 1.15-2). Because sharp instruments are not used to perform this, it is also referred to as a "blunt dissection" technique.

(continued on next page)

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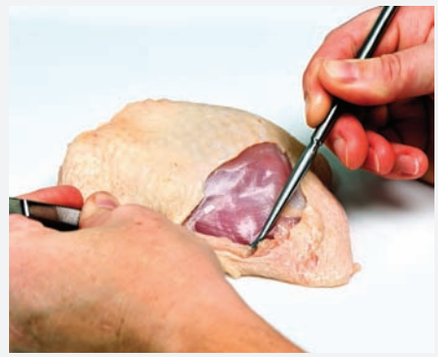
1 Using tissue forceps and scissors, pull the skin away from the underlying tissues and make a cut in the skin. Use open scissors technique to loosen the fascia and to create a space where a blunt probe or your fingers may be pushed in.

2 Using your fingers, pull the skin away from the underlying tissues. When necessary, use a sharp instrument to cut any fascia that is very tough and won't separate using blunt techniques.



3 A blunt probe can be moved around under the skin to gently separate the connective tissue without damaging underlying structures.

Figure 1.15 **Blunt Dissection.** Blunt dissection techniques involve separating tissues with fingers or blunt instruments such as a probe. When handling fresh tissue such as this chicken thigh, either use gloves or make sure to wash your hands thoroughly when the dissection is complete.

5. Obtain a blunt probe (table 1.1). A blunt probe can be used in place of fingers to separate structures when fingers are too large (figure 1.15-3). Because the probe does not cut the tissue, this is also a "blunt dissection" technique.
6. Other items that can be used for blunt dissection are scalpel blade handles (*without* the blades on them!), or the rounded ends of forceps. Practice using these tools to separate skin from muscle in different regions of the dissection specimen. The general rule of thumb is to start with sharp dissection techniques to cut slits in the skin, but then transition to blunt dissection techniques whenever possible to prevent accidental damage to underlying tissues.

WHAT DO YOU THINK?

1. **One of the dissection instruments that may be used is a hemostat. The word "hemostat" comes from the Greek words *haemo-*, which means "blood," and *-statos*, which means "stationary." Given the name of the tool, and considering its function in dissection, what do you think these tools were originally designed for?**

Chapter 1: The Laboratory Environment

Name: _____

Date: _____ Section: _____

POST-LABORATORY WORKSHEET

The 1 corresponds to the Learning Objective listed in the chapter opener outline.

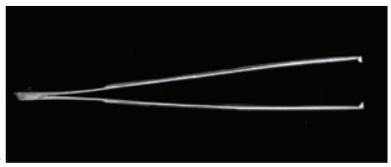
Do You Know the Basics?

Exercise 1.1: Identification of Common Dissection Instruments

1. An instrument that resembles tweezers and is used to grasp objects is a _____. (Circle one.) 1
   a. blunt probe
   b. forceps
   c. hemostat
   d. scalpel
   e. scissors

2. Write the name of each dissection instrument in the space provided. 1

a. _____



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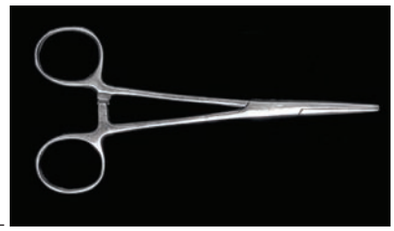
b. _____



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c. _____

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d. _____

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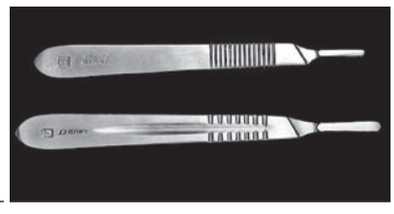

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