

ESSENTIALS OF
Anatomy &
Physiology

Seventh
Edition

Jason LaPres

Beth Kersten

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COURSE GUIDE FOR
ESSENTIALS OF

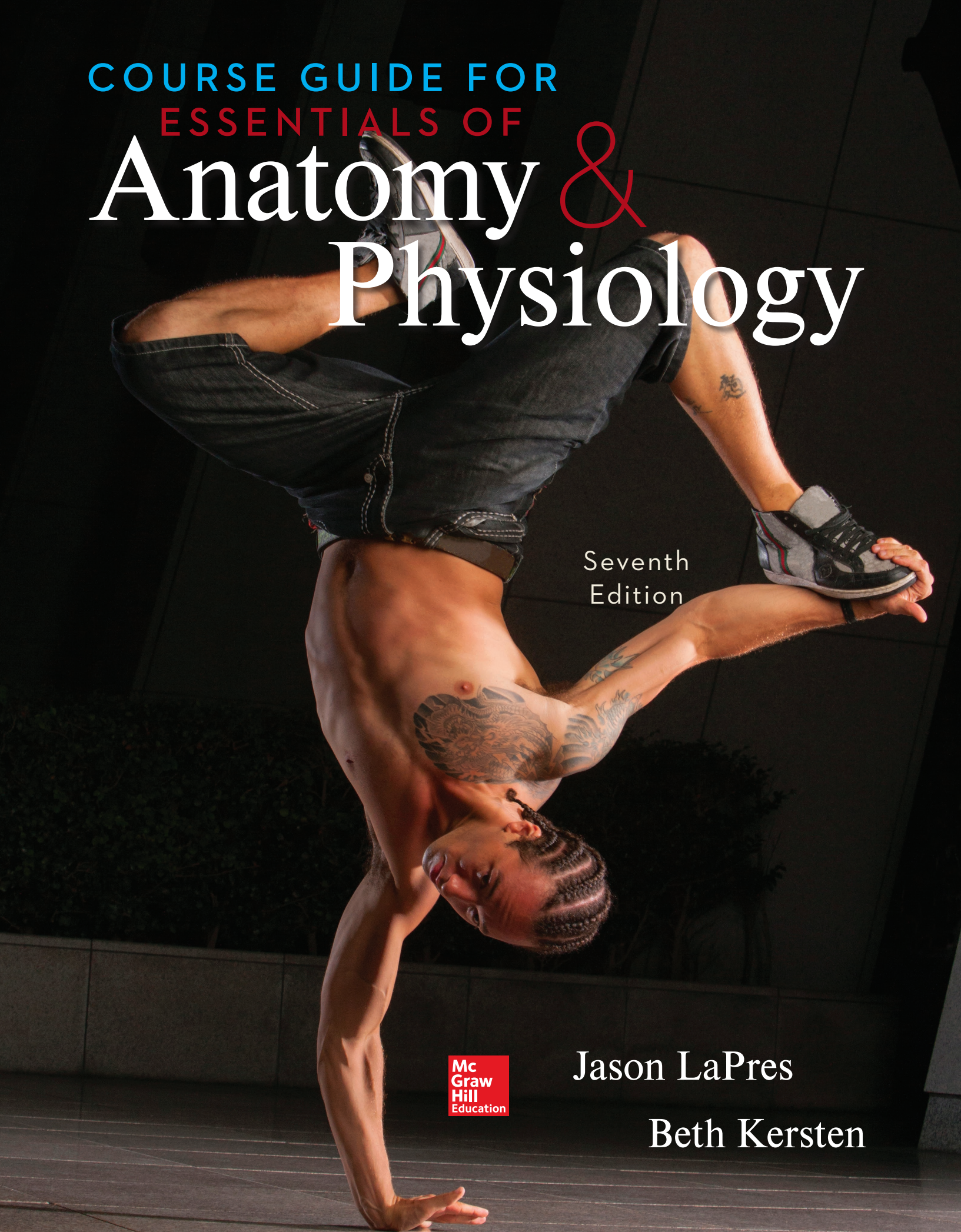
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COURSE GUIDE FOR ESSENTIALS OF ANATOMY & PHYSIOLOGY, SEVENTH EDITION

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This book is printed on acid-free paper.

1 2 3 4 5 6 7 8 9 LMN 21 20 19 18

ISBN 978-1-259-86463-6

MHID 1-259-86463-4

Senior Portfolio Manager: *Michael Ivanov*

Senior Product Developer: *Elizabeth Sievers*

Executive Marketing Manager: *Jim Connely*

Senior Content Project Managers: *Sherry Kane/Danielle Clement*

Senior Buyer: *Sandy Ludovissy*

Lead Design: *David Hash*

Content Licensing Specialist: *Shawntel Schmitt*

Cover Image: ©*DreamPictures/Jensen Walker/Blend Images*

Compositor: *MPS Limited*

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Library of Congress Cataloging-in-Publication Data

LaPres, Jason, author. | Kersten, Beth, author.

Course guide for essentials of anatomy & physiology / Jason LaPres, Beth Kersten.

Course guide for essentials of anatomy and physiology

Seventh edition. | New York, NY : McGraw-Hill Education, [2019]

| "No previous edition for the course guide. It is a part of the main book, "Anatomy & physiology with integrated study guide / Jason LaPres, Beth Kersten, Yong Tang. Sixth edition. 2016" previously."—Publisher. |

Includes bibliographical references and index.

LCCN 2017033641 | ISBN 9781259864636 (alk. paper)

LCSH: Human physiology—Study guides. | Human anatomy—Study

guides.

LCC QP34.5 .L38 2019 | DDC 612.0076—dc23 LC record

available at <https://lcn.loc.gov/2017033641>

The Internet addresses listed in the text were accurate at the time of publication. The inclusion of a website does not indicate an endorsement by the authors or McGraw-Hill Education, and McGraw-Hill Education does not guarantee the accuracy of the information presented at these sites.

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Over the past 15 years, Jason has had the good fortune to be associated with a number of colleagues who have mentored him, helped increase his skills, and trusted him with the responsibility of teaching students who will be caring for others. Jason began his career in Michigan, where from 2001 to 2003 he taught as an adjunct at Henry Ford Community College, Schoolcraft College, and Wayne County Community College, all in the Detroit area. Additionally, at that time he taught high school chemistry and physics at Detroit Charter High School. Jason is currently Dean of Instruction and Professor of Biology at Lone Star College–CyFair in Houston, Texas. He has been with LSC since 2003. In his capacity with LSC he has served as Faculty Senate President for two of the six LSC campuses. His academic background is diverse and, although his primary teaching load is in the Human Anatomy and Physiology program, he has also taught classes in Pathophysiology and mentored several Honor Projects.

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Courtesy of Beth Kersten

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Beth currently lives in North Port, Florida, with her husband John and daughter Melanie. As former Northerners, they greatly enjoy the ability to swim almost year round both in their pool and in the Gulf of Mexico.

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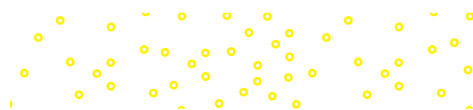
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PREFACE

COURSE GUIDE FOR ESSENTIALS OF ANATOMY & PHYSIOLOGY Seventh Edition is designed for students who are enrolled in a one-semester course in human anatomy and physiology. The scope, organization, writing style, depth of presentation, and pedagogical aspects of the text have been tailored to meet the needs of students preparing for a career in one of the allied health professions, or taking the course as a general education requirement.

Acknowledgments

The development and production of this seventh edition has been a team effort. Our dedicated and creative teammates at McGraw-Hill Education have contributed greatly to the finished product. We gratefully acknowledge and applaud their efforts, and it has been a pleasure to work with these gifted professionals at each step of the process: Elizabeth Sievers (Senior Product Developer), Kate Scheinman (Contract Product Developer), Michael Ivanov (Senior Portfolio Manager), Sherry Kane (Senior Content Project Manager), and James Connely (Executive Marketing Manager).

Student-Centric Revision

Students taking a one-semester course in anatomy and physiology have diverse backgrounds, including limited exposure to biology and chemistry, and this presents a formidable challenge to the instructor. To help meet this challenge, this text is written in a clear and concise manner, which is free from excess jargon and simplifies the complexities of anatomy and physiology in ways that enhance understanding without diluting the essentials of the subject matter.

In preparation for this seventh edition, we surveyed 50 students (in a variety of majors, including allied health professions) and obtained detailed insight into how they would ideally engage with course materials. Stemming from those results, we adjusted the print and digital delivery of the content to align with student preferences.

Also, we are very pleased to incorporate real student data points and input, derived from thousands of our SmartBook™ users, to help guide our revision. SmartBook™ Heat Maps provided a quick visual snapshot of usage of portions of the text and the relative difficulty students experienced in mastering the content. With this

data, we honed not only our text content revision but also the SmartBook™ probes.

Course Guide and Textbook

The previous edition of this title combined two elements: the *Textbook* and the *Study Guide*. For this new seventh edition, the two elements are split into two separate printed products. The *Textbook* content is updated and revised, and the *Study Guide* is expanded and enhanced to serve as a more robust *Course Guide*.

The intention of the *Course Guide* is to be a 1:1 workbook study partner as students read the *Textbook*. Through the student survey, we uncovered their ideal mix of print and digital course materials. With the strong integration of the Connect™ online assessment tools, including SmartBook™, we worked to create an optimal delivery package of the *Course Guide* and Connect™, with the option to purchase a printed version of the *Textbook* through Connect™ at a discounted rate.

Course Guide Organization

The companion *Course Guide* is an efficient mechanism for enhancing learning and reinforcing *Textbook* concepts. The *Course Guide* provides students with a hands-on learning experience that is intended to test their knowledge of course content through the completion of various activities such as figure labeling, fill-in-the-blank, true/false, and short answer questions. Answers to the *Course Guide* are included in the *Instructor Resource* site.

The *Course Guide* follows the organization of the *textbook* and tests students understanding of the text content.

1. A list of Selected Key Terms with definitions and derivations where helpful, is provided at the beginning of the chapter to inform students of some of the key terms to watch for in the chapter.
2. The chapter summary also appears at the start of each chapter, conveniently linked by section, and briefly states the important facts and concepts covered in the chapter.
3. Each chapter concludes with Clinical Insights and Critical Thinking exercises to reinforce student understanding of the content.

Changes in the Seventh Edition

The seventh edition has been substantially enhanced and improved.

- Revised all chapter text to focus on healthy conditions rather than “normal” conditions.
- Approximately 70 figures and tables were revised or are completely new.
- Revised descriptive language to improve the overall readability of the text. Terminology and phrasing more commonly used by students outside the classroom have been added where appropriate. By making the text easier to read, students will have an easier time grasping more complex anatomical and physiological content.
- Added more Check My Understanding sections to better assess student learning throughout the chapters.
- The Critical Thinking sections at the end of the chapters have been moved to the *Course Guide* to consolidate all of the assessment content into one resource, except for the Check My Understanding sections; these remain in the text to offer students opportunities to test their understanding before moving on in the chapter.
- *Course Guide* figures were updated to align with the figures within the lecture text. Figure labeling activities were also redesigned to provide the students with a more hands-on labeling experience.
- Revised each chapter’s Selected Key Terms definitions to better align with the definitions within the chapter text.
- Updated art to create a more vibrant and consistent style.
- Updated terminology to align with the *Terminologia Anatomica*, *Terminologia Histologica*, and *Terminologia Embryologica*.
- Revised figure legends to include a descriptive title and separate legend.

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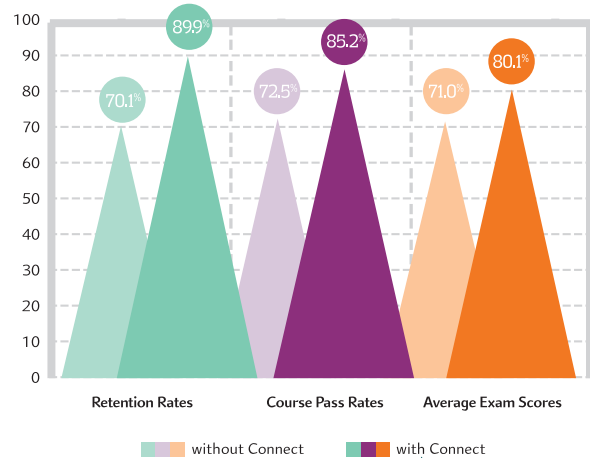
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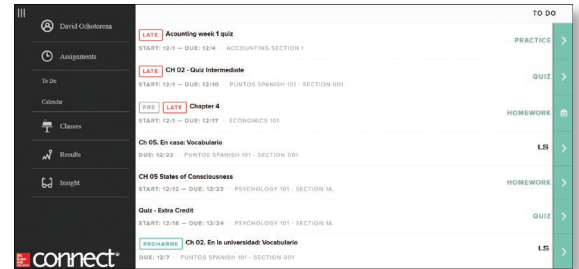


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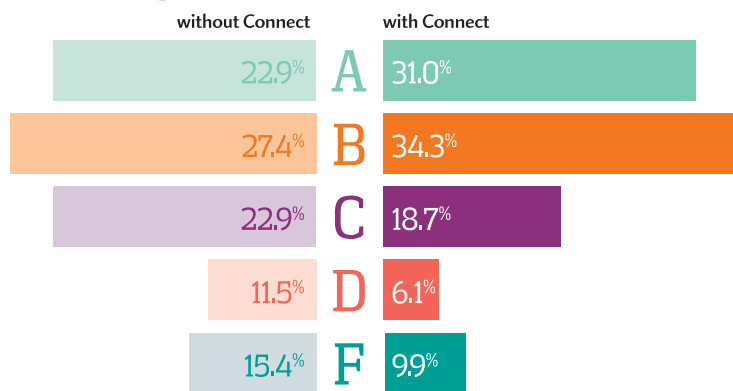
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CHAPTER

1

Introduction to the Human Body



Module 1

Body Orientation

CHAPTER OUTLINE

Selected Key Terms

Chapter Summary

1.1 Anatomy and Physiology

1.2 Levels of Organization

1.3 Directional Terms

1.4 Body Regions

1.5 Body Planes and Sections

1.6 Body Cavities

1.7 Abdominopelvic Subdivisions

1.8 Maintenance of Life

Clinical Insights and Critical Thinking

SELECTED KEY TERMS

Anatomy (ana = apart; tom = to cut) The study of the structure of living organisms.

Appendicular (append = to hang) Pertaining to the upper and lower limbs.

Axial (ax = axis) Pertaining to the longitudinal axis of the body.

Body region (regio = boundary) A portion of the body with a special identifying name.

Directional term (directio = act of guiding) A term that references how the position of a body part relates to the position of another body part.

Effector (efet = result) A structure that functions by performing an action that is directed by an integrating center.

Homeostasis (homeo = same; sta = make stand or stop)

Maintenance of a relatively stable internal environment.

Integrating center (integratus = make whole) A structure that functions to interpret information and coordinate a response.

Metabolism (metabole = change) The sum of the chemical reactions in the body.

Parietal (paries = wall) Pertaining to the wall of a body cavity.

Pericardium (peri = around; cardi = heart) The membrane surrounding the heart.

Peritoneum (ton = to stretch) The membrane lining the abdominal cavity and covering the abdominal organs.

Physiology (physio = nature; logy = study of) The study of the function of living organisms.

Plane (planum = flat surface) Imaginary two-dimensional flat surface that marks the direction of a cut through a structure.

Pleura (pleura = rib) The membrane lining the thoracic cavity and covering the lungs.

Receptor (recipere = receive) A structure that functions to collect information.

Section (sectio = cutting) A flat surface of the body produced by a cut through a plane of the body.

Serous membrane (serum = watery fluid; membrana = thin layer of tissue) A two-layered membrane that lines body cavities and covers the internal organs.

Visceral (viscus = internal organ) Pertaining to organs in a body cavity.

Chapter Summary

1.1 Anatomy and Physiology

- Human anatomy is the study of body structure and organization.
- Human physiology is the study of body functions.

1.2 Levels of Organization

- The body consists of several levels of organization of increasing complexity.
- From simple to complex, the organizational levels are chemical, cellular, tissue, organ, organ system, and organismal.
- The organs of the body are arranged in coordinated groups called organ systems.
- The 11 organ systems of the body are

| | |
|---------------|----------------|
| integumentary | cardiovascular |
| skeletal | lymphoid |
| muscular | respiratory |
| nervous | urinary |
| endocrine | reproductive |
| digestive | |

1.3 Directional Terms

- Directional terms are used to describe the relative positions of body parts.
- Directional terms occur in pairs, with the members of a pair having opposite meanings.

| | |
|--------------------|-------------------|
| anterior–posterior | proximal–distal |
| superior–inferior | external–internal |
| medial–lateral | parietal–visceral |
| central–peripheral | |

1.4 Body Regions

- The body is divided into two major portions: the axial portion and the appendicular portion.
- The axial portion is subdivided into the head, neck, and trunk.
- The head and neck contain cervical, cranial, and facial regions. The cranial and facial regions combine to form the cephalic region.
- The facial region consists of orbital, nasal, oral, and buccal regions.
- The trunk consists of anterior, posterior, lateral, and inferior regions.
- Anterior trunk regions include the abdominal, inguinal, pectoral, pubic, sternal, and umbilical regions.
- Posterior trunk regions include the dorsal, gluteal, lumbar, sacral, scapular, and vertebral regions.
- Lateral trunk regions are the axillary and coxal regions.
- Inferior trunk regions are the genital and perineal regions.

- The appendicular portion of the body consists of the upper and lower limbs.
- The upper limb is attached to the trunk at the shoulder. Regions of the upper limb are the antebrachial, brachial, carpal, cubital, deltoid, digital, and palmar regions.
- The lower limb is attached to the trunk at the hip. Regions of the lower limb are the crural, digital, femoral, patellar, pedal, plantar, popliteal, sural, and tarsal regions.

1.5 Body Planes and Sections

- Well-defined planes are used to guide sectioning of the body or organs.
- The common planes are transverse, sagittal, and frontal.
- The common planes produce longitudinal sections and cross sections of the body.

1.6 Body Cavities

- The cranial cavity is located within the skull, and the vertebral canal is located within the vertebral column.
- The thoracic cavity lies above the diaphragm. It consists of two lateral pleural cavities and the mediastinum, which contains the pericardial cavity.
- The abdominopelvic cavity lies below the diaphragm. It consists of a superior abdominal cavity and an inferior pelvic cavity.
- The body cavities are lined with protective and supportive membranes.
- The meninges consist of three membranes that line the cranial cavity and vertebral canal and that enclose the brain and spinal cord.
- The parietal pleurae line the walls of the thoracic cage, while the visceral pleurae cover the surfaces of the lungs.
- The pleural cavity is the space between the parietal and visceral pleurae.
- The parietal pericardium is a saclike membrane in the mediastinum that surrounds the heart. The visceral pericardium is attached to the surface of the heart.
- The pericardial cavity is the space between the parietal and visceral pericardia.
- The parietal peritoneum lines the walls of the abdominal cavity but does not extend into the pelvic cavity. The visceral peritoneum covers the surface of abdominal organs.
- The peritoneal cavity is the space between the parietal and visceral peritoneum.
- The mesenteries are double-layered folds of the visceral peritoneum that support internal organs.
- Kidneys, pancreas, and parts of the intestines are located behind the parietal peritoneum in the retroperitoneal space.

1.7 Abdominopelvic Subdivisions

- The abdominopelvic cavity is subdivided into either four quadrants or nine regions as an aid in locating organs.
- The four quadrants are

| | |
|-------------|------------|
| right upper | left upper |
| right lower | left lower |
- The nine regions are

| | |
|---------------------|---------------------|
| epigastric | right flank |
| left hypochondriac | hypogastric (pubic) |
| right hypochondriac | left inguinal |
| umbilical | right inguinal |
| left flank | |

1.8 Maintenance of Life

- Metabolism is the sum of all of the body's chemical reactions. It consists of anabolism, the synthesis of body chemicals, and catabolism, the breakdown of body chemicals.
- The basic needs of the body are food, water, oxygen, body temperature, and atmospheric pressure.
- Homeostasis is the maintenance of a relatively stable internal environment.
- Homeostasis is regulated by negative-feedback mechanisms.
- Negative-feedback mechanisms consist of three components: receptors, integrating center, and effectors.
- Positive-feedback mechanisms promote an ever-increasing change from the norm.

1.1 Anatomy and Physiology

Learning Objective

1. Define anatomy and physiology.

1. Write the terms that match the phrases in the spaces at the right.

a) The study of tissues _____

b) The study of body organization and structure _____

c) The study of body functions _____

1.2 Levels of Organization

Learning Objectives

2. Describe the levels of organization in the human body.

3. List the major organs and functions for each organ system.

1. List the levels of organization from the most complex to the simplest.

a) _____

d) _____

b) _____

e) _____

c) _____

f) _____

2. Write the terms that match the phrases in the spaces at the right.

a) A coordinated group of organs. _____

b) Structural and functional units of the body. _____

c) An aggregation of similar cells. _____

3. Match the names of the organ systems with the phrases.

| | | |
|---------------------|-------------------|-------------|
| Cardiovascular | Integumentary | Nervous |
| Digestive | Lymphoid | Respiratory |
| Endocrine | Male Reproductive | Skeletal |
| Female Reproductive | Muscular | Urinary |

- a) Stomach, liver, intestines. _____
- b) Brain, spinal cord, nerves. _____
- c) Secretes hormones. _____
- d) Skin, hair, nails. _____
- e) Returns lymph to blood; provides immunity. _____
- f) Bones, ligaments, cartilages. _____
- g) Contraction enables movement. _____
- h) Transports materials to and from cells. _____
- i) Kidneys, ureters, urinary bladder. _____
- j) Testes, penis, prostate. _____
- k) Ovaries, uterine tubes, uterus, vagina. _____
- l) Blood, heart, arteries, veins. _____
- m) Supports the body. _____
- n) Secretes hormones that regulate functions. _____
- o) Regulates volume of body fluids. _____
- p) Protects underlying tissues. _____
- q) Rapid coordination of body functions. _____
- r) Digests food and absorbs nutrients. _____
- s) Gas exchange between air and blood. _____
- t) Larynx, trachea, bronchi, and lungs. _____

1.3 Directional Terms

Learning Objective

4. Use directional terms to describe the locations of body parts.

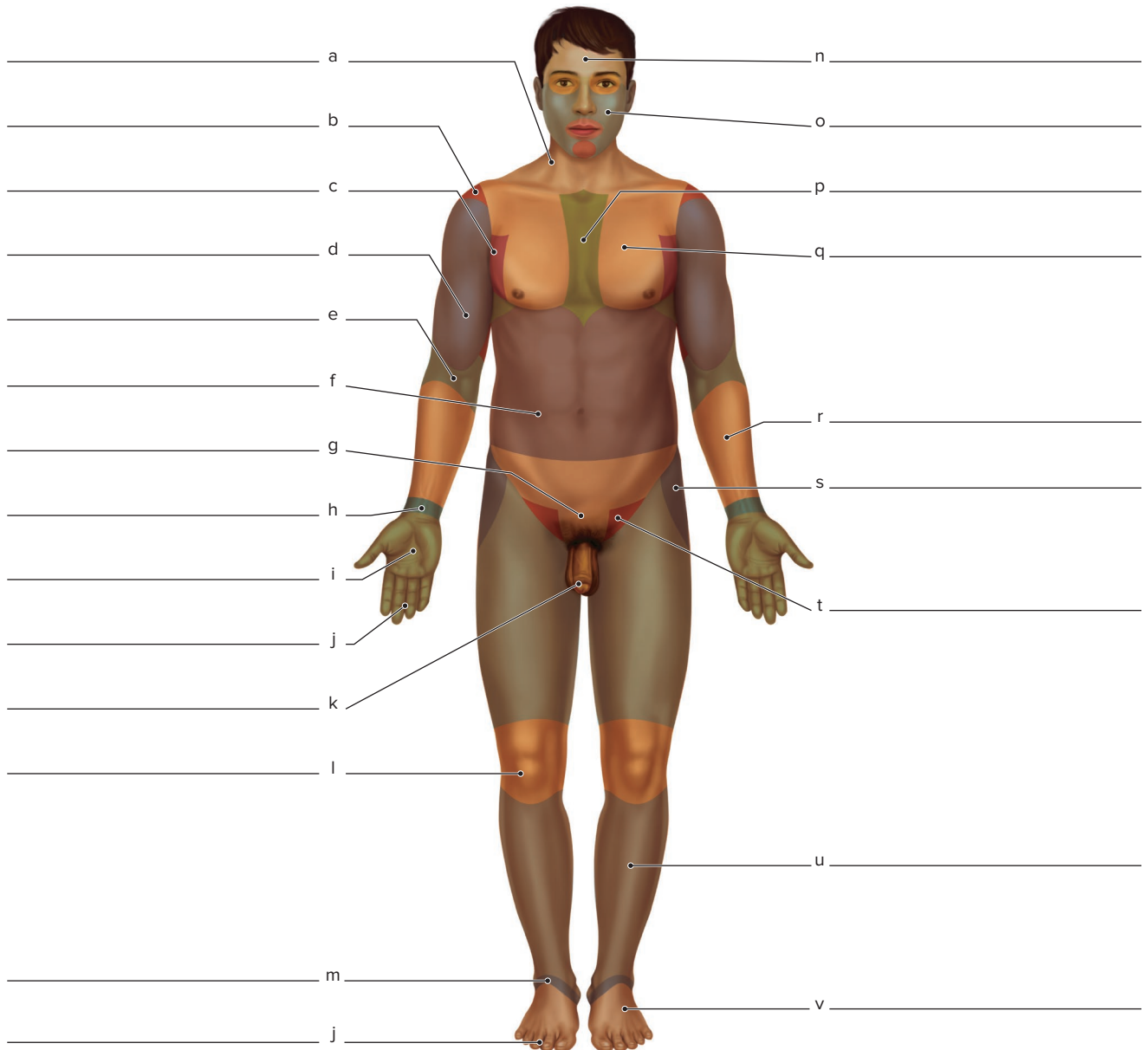
- 1. Provide the term that correctly completes each statement.
 - a) The head is _____ to the neck. _____
 - b) The hand is _____ to the wrist. _____
 - c) The skin is _____ to the muscles. _____
 - d) The mouth is _____ to the nose. _____
 - e) The elbow is _____ to the wrist. _____
 - f) The ear is on the _____ surface of the head. _____
 - g) The umbilicus is on the _____ body surface. _____
 - h) The hip is on the _____ body surface. _____
 - i) The buttocks are on the _____ body surface. _____

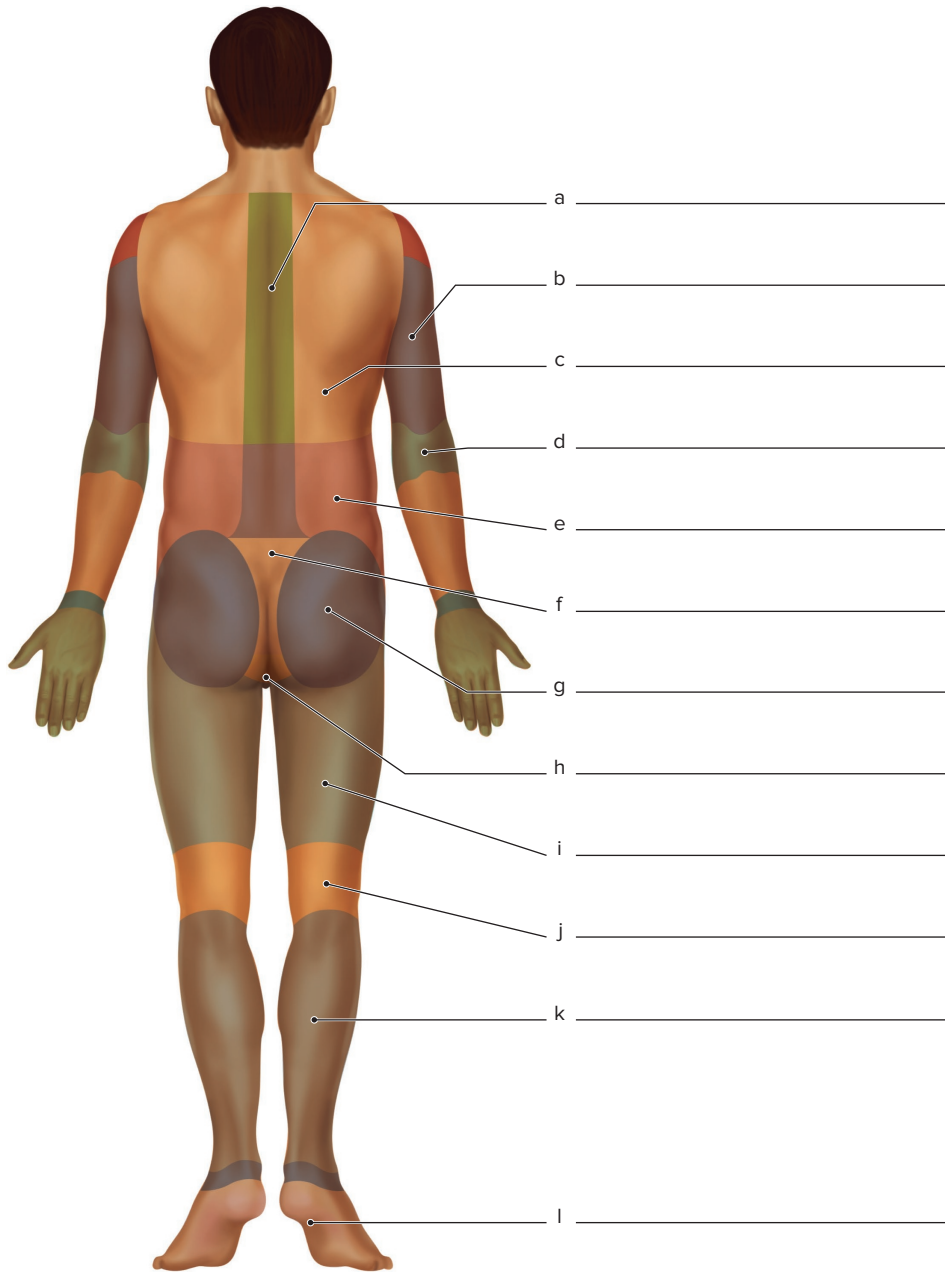
1.4 Body Regions

Learning Objective

5. Locate the major body regions on a diagram or anatomical model.

1. Label the body regions by placing the correct term in the space by the correct label. (See text figure 1.4 Major Regions of the Body.) **AP|R**





1.5 Body Planes and Sections

Learning Objective

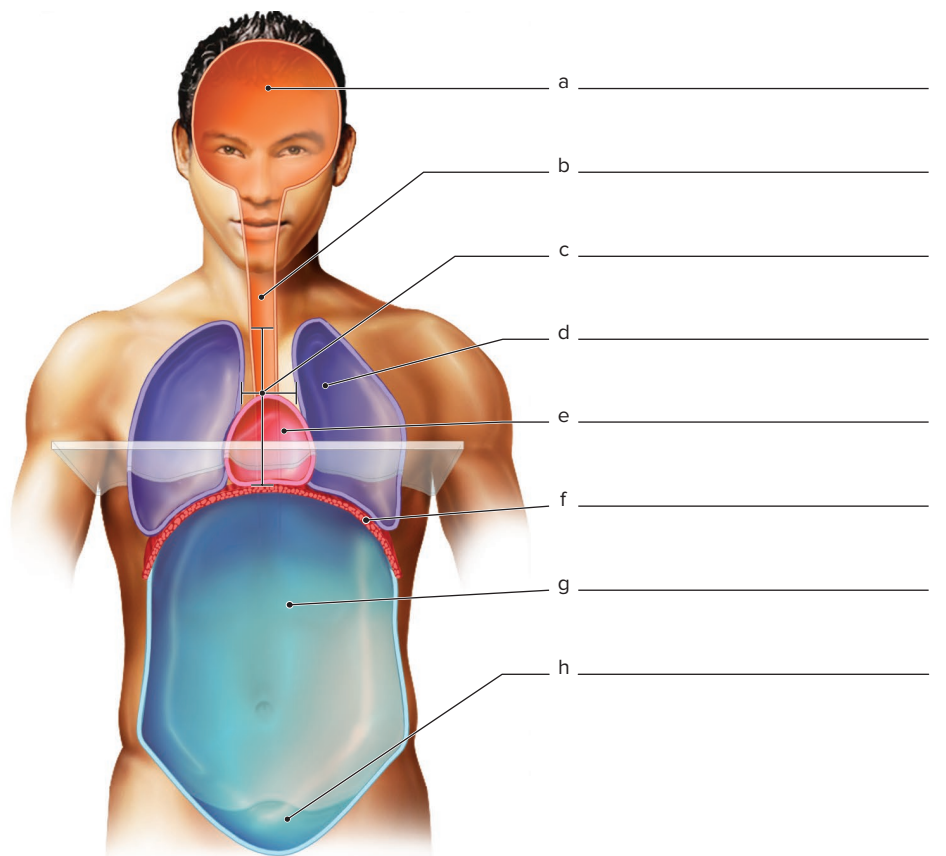
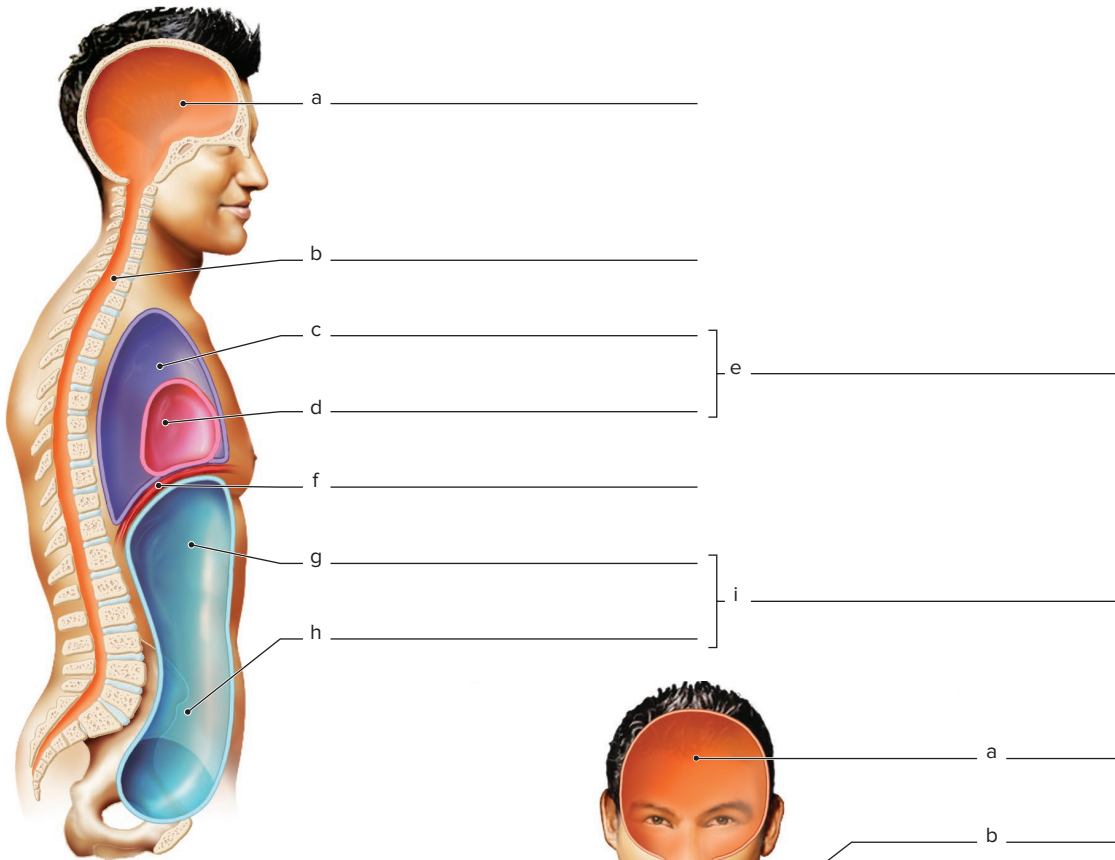
6. Describe the three planes used in making sections of the body or body parts.

1. Name the planes that match the statements.
 - a) Divides the body into equal left and right halves.
 - b) Divides the body into superior and inferior portions.
 - c) Divides the body into left and right portions.
 - d) Divides the body into anterior and posterior portions.
 - e) Any cut along the longitudinal axis of a structure.
 - f) Any cut at a 90° angle to the longitudinal axis of a structure.
 - g) A cut between the longitudinal axis and a 90° angle of a structure.

1.6 Body Cavities

Learning Objectives

7. Locate the body cavities and their subdivisions and membranes on a diagram.
 8. Name the organs located in each body cavity.
1. Label the body cavities and related structures by placing the correct term in the space by the correct label.
 (See text figure 1.6 Body Cavities and Their Subdivisions.) **AP|R**



2. Place the letter of the cavity where the organ is located in the blank beside the organ name. Answers may be used more than once.

- | | | |
|---------------------|-----------------------|-----------------------|
| a) Abdominal cavity | c) Mediastinum | e) Pleural cavity |
| b) Cranial cavity | d) Pelvic cavity | f) Vertebral canal |
| _____ Brain | _____ Lungs | _____ Stomach |
| _____ Gallbladder | _____ Rectum | _____ Thymus |
| _____ Heart | _____ Small intestine | _____ Urinary bladder |
| _____ Liver | _____ Spinal cord | |

3. Write the names of the membranes that match the statements in the spaces at the right.

- | | |
|--|-------|
| a) Covers the surface of the heart. | _____ |
| b) Covers the surface of the stomach. | _____ |
| c) Lines the abdominal cavity. | _____ |
| d) Surrounds the brain. | _____ |
| e) Lines the thoracic cavity. | _____ |
| f) Lines the vertebral canal. | _____ |
| g) Covers the surface of the lungs. | _____ |
| h) Forms double-membrane sac around heart. | _____ |
| i) Double-layered membranes supporting abdominal organs. | _____ |

1.7 Abdominopelvic Subdivisions

Learning Objectives

9. Name the abdominopelvic quadrants and regions.
 10. Locate the abdominopelvic quadrants and regions on a diagram.

1. Select the abdominopelvic quadrant and abdominopelvic region in which the following structures are located.

Quadrants

- a) Right upper
- b) Left upper
- c) Right lower
- d) Left lower

- _____ Gallbladder
- _____ Spleen
- _____ Rectum
- _____ Right kidney
- _____ Appendix

Regions

- e) Epigastric
- f) Hypogastric
- g) Left hypochondriac
- h) Left inguinal
- i) Left flank
- j) Right hypochondriac
- k) Right inguinal
- l) Right flank
- m) Umbilical

- _____ Stomach
- _____ Ascending colon
- _____ Urinary bladder
- _____ Left kidney
- _____ Pancreas

2. Label the abdominopelvic quadrants and abdominopelvic regions by writing the correct terms in the spaces within the diagram. (See text figure 1.9 Abdominopelvic Subdivisions.) **AP|R**

