

STUDY GUIDE *for*

MEMMLER'S


The Human Body in Health and Disease

12TH EDITION

Barbara Janson Cohen
Kerry L. Hull

 Wolters Kluwer
Health

Lippincott
Williams & Wilkins

 **PASSport**
to **Success**

STUDY GUIDE *for*

MEMMLER'S

The Human Body in Health and Disease

12TH EDITION

Kerry L. Hull

Professor
Department of Biology
Bishop's University
Sherbrooke, Quebec,
Canada

Barbara Janson Cohen



Wolters Kluwer | Lippincott Williams & Wilkins

Health

Philadelphia • Baltimore • New York • London
Buenos Aires • Hong Kong • Sydney • Tokyo

Executive Editor: David Troy
Development Editor: Laura Bonazolli
Senior Product Manager: Eve Malakoff-Klein
Marketing Manager: Allison Noplock
Designer: Terry Mallon
Artist: Christine Vernon/Hearthside and Dragonfly Media Group
Cover Image: Imagineering
Compositor: SPi Global
Printer: C&C Offset Printing

12th Edition

Copyright © 2013, 2009, 2005 Lippincott Williams & Wilkins, a Wolters Kluwer business.

351 West Camden Street Two Commerce Square
Baltimore, MD 21201 2001 Market Street
Philadelphia, PA 19103

Printed in China

All rights reserved. This book is protected by copyright. No part of this book may be reproduced or transmitted in any form or by any means, including as photocopies or scanned-in or other electronic copies, or utilized by any information storage and retrieval system without written permission from the copyright owner, except for brief quotations embodied in critical articles and reviews. Materials appearing in this book prepared by individuals as part of their official duties as U.S. government employees are not covered by the above-mentioned copyright. To request permission, please contact Lippincott Williams & Wilkins at Two Commerce Square, 2001 Market Street, Philadelphia, PA 19103, via e-mail at permissions@lww.com, or via website at lww.com (products and services).

Library of Congress Cataloging-in-Publication Data

ISBN 978-1-6091-3906-3

Care has been taken to confirm the accuracy of the information present and to describe generally accepted practices. However, the authors, editors, and publisher are not responsible for errors or omissions or for any consequences from application of the information in this book and make no warranty, expressed or implied, with respect to the currency, completeness, or accuracy of the contents of the publication. Application of this information in a particular situation remains the professional responsibility of the practitioner; the clinical treatments described and recommended may not be considered absolute and universal recommendations.

The authors, editors, and publisher have exerted every effort to ensure that drug selection and dosage set forth in this text are in accordance with the current recommendations and practice at the time of publication. However, in view of ongoing research, changes in government regulations, and the constant flow of information relating to drug therapy and drug reactions, the reader is urged to check the package insert for each drug for any change in indications and dosage and for added warnings and precautions. This is particularly important when the recommended agent is a new or infrequently employed drug.

Some drugs and medical devices presented in this publication have Food and Drug Administration (FDA) clearance for limited use in restricted research settings. It is the responsibility of the health care providers to ascertain the FDA status of each drug or device planned for use in their clinical practice.

To purchase additional copies of this book, call our customer service department at (800) 638-3030 or fax orders to (301) 223-2320. International customers should call (301) 223-2300.

Visit Lippincott Williams & Wilkins on the Internet: <http://www.lww.com>. Lippincott Williams & Wilkins customer service representatives are available from 8:30 am to 6:00 pm, EST.

9 8 7 6 5 4 3 2 1

The *Study Guide for Memmler's The Human Body in Health and Disease*, 12th edition, helps students learn foundational concepts in anatomy and physiology required for success in allied health occupations. Although it will be more effective when used in conjunction with the 12th edition of *Memmler's The Human Body in Health and Disease*, the *Study Guide* may also be used to supplement other textbooks on basic anatomy and physiology. The questions in this edition reflect revisions and updating of the text. The labeling and coloring exercises are taken from the illustrations designed for the book.

The exercises are designed to facilitate student learning, not merely to test knowledge. Each chapter contains three main components. The first section, "Addressing the Learning Outcomes," can be completed as students read through the chapter. It contains exercises in many formats, including labeling, coloring, matching, and short answer, all designed to foster active learning. The second section, "Making the Connections," asks students to complete a concept map integrating information from multiple learning outcomes. Finally, "Testing Your Knowledge" includes multiple choice, true/false, completion, short answer, and essay questions to identify areas requiring further study. Within this section, "Practical Applications" questions use clinical situations to test students' understanding of a subject. Comparing the normal with the abnormal helps students gain some understanding of disease prevention and health maintenance.

All answers to the *Study Guide* questions are in the *Instructor's Manual* that accompanies the text.

Learning about the Human Body

You already have some ideas about the human body that will influence how you learn the information in this textbook. Many of your theories are correct, and this *Study Guide*, created to accompany the 12th edition of Memmler's *The Human Body in Health and Disease*, will simply add detail and complexity to these ideas. Other theories, however, may be too simplistic. It can be difficult to replace these ingrained beliefs with more accurate information. For instance, many students think that the lungs actively inflate and deflate as we breathe, but it is the diaphragm and the rib-cage muscles that accomplish all of the work. Learning physiology or any other subject therefore involves:

1. **Construction:** Adding to and enhancing your previous store of ideas.
2. **Reconstruction:** Replacing misconceptions (prior views and ideas) with scientifically sound principles.
3. **Self-monitoring.** Construction and reconstruction require that you also monitor your personal understanding of a particular topic and consciously formulate links between what you are learning and what you have previously learned. Rote learning is not an effective way to learn anatomy and physiology (or almost anything else, for that matter). **Metacognition** is monitoring your own understanding. Metacognition is very effective if it takes the form of self-questioning during the lectures. Try to ask yourself questions during lectures, such as “What is the prof trying to show here?” “What do these numbers really mean?” or “How does this stuff relate to the stuff we covered yesterday?” Self-questioning will help you create links between concepts. In other words, try to be an active learner during the lectures. Familiarity with the material is not enough. You have to internalize it and apply it to succeed. You can greatly enhance your ability to be an active learner by reading the appropriate sections of the textbook before the lecture.

Each field in biology has its own language. This language is not designed to make your life difficult; the terms often represent complex concepts. Rote memorization of definitions will not help you learn. Indeed, because biological terms often have different meanings in everyday conversation, you probably hold some definitions that are misleading and must be revised. For example, you may say that someone has a “good metabolism” if they can eat enormous meals and stay slender. However, the term “metabolism” actually refers to all of the chemical reactions that occur in the body, including those that build muscle and fat. We learn a new language not by reading about it but by using it. The *Study Guide* you hold in your hands employs a number of learning techniques in every chapter to help you become comfortable with the language of anatomy, physiology, and disease.

Addressing the Learning Outcomes

The exercises in this section will help you master the material both verbally and visually. Work through the section as you read the textbook chapter—completing the exercises will help you actively learn the material, improving your chances of remembering it at exam time.

The labeling and coloring exercises will be especially useful for mastering anatomy. You can use these exercises in two ways. First, follow the instructions to label and color (when appropriate) the diagram, using your textbook if necessary. Second, use the diagrams for exam preparation by covering up the label names and practicing naming each structure. Coloring exercises are fun and have been shown to enhance learning.

“Making the Connections”: Learning through Concept Maps

This learning activity uses concept mapping to master definitions and concepts. You can think of concept mapping as creating a web of information. Individual terms have a tendency to get lost, but a web of terms is more easily maintained in memory. You can make a concept map by following these steps:

1. Select the concepts to map (6–10 is a good number). Try to use a mixture of nouns, verbs, and processes.
2. If one exists, place the most general, important, or overriding concept at the top or in the center and arrange the other terms around it. Organize the terms so that closely related terms are close together.
3. Draw arrows between concepts that are related. Write a sentence to connect the two concepts that begins with the term at the beginning of the arrow and ends with the term at the end of the arrow.

For instance, consider a simple concept map composed of three terms: student learning, professors, and textbooks. Write the three terms at the three corners of a triangle, separated from each other by 3 to 4 inches. Next is the difficult part: devising connecting phrases that explain the relationship between any two terms. What is the essence of the relationship between student learning and professors? An arrow could be drawn from professors to student learning, with the connecting phrase “*can explain difficult concepts to facilitate*.” The relationship would be “*Professors can explain difficult concepts to facilitate student learning.*” Draw arrows between all other term pairs (*student learning* and *textbooks*, *textbooks* and *professors*) and try to come up with connecting phrases. Make sure that the phrase is read in the direction of the arrow.

There are two concept mapping exercises for most chapters. The first exercise consists of filling in boxes and, in the later maps, connecting phrases. The guided concept maps for Chapters 1 through 7 ask you to think of the appropriate term for each box. The guided concept maps for Chapters 8 through 25 are more traditional concept maps. Pairs of terms are linked together by a connecting phrase. The phrase is read in the direction of the arrow. For instance, an arrow leading from “*genes*” to “*chromosomes*” could result in the phrase “*Genes are found on pieces of DNA called chromosomes.*” The second optional exercise provides a suggested list of terms to use to construct your own map. This second exercise is a powerful learning tool, because you will identify your own links between concepts. The act of creating a concept map is an effective way to understand terms and concepts.

Testing Your Knowledge

These questions should be completed after you have read the textbook and completed the other learning activities in the study guide. Try to answer as many questions as possible without referring to your notes or the text. As in the end-of-chapter questions, there are three different levels of questions. Type I questions (Building Understanding) test simple recall: how well have you learned the material? Type II questions (Understanding Concepts) examine your ability to integrate and apply the information in simple practical situations. Type III questions (Conceptual Thinking) are the most challenging. They ask you to apply your knowledge to new situations and concepts. There is often more than one right answer to Conceptual Thinking questions. The answers to all questions are available from your instructor.

Learning from the World Around You

The best way to learn anatomy and physiology is to immerse yourself in the subject. Tell your friends and family what you are learning. Discover more about recent health advances from television, newspapers, magazines, and the Internet. Our knowledge about the human body is constantly changing. The work you will do using the *Study Guide* can serve as a basis for lifelong learning about the human body in health and disease.

Preface iii
Introduction v

- Unit I The Body as a Whole 1**
- 1. Organization of the Human Body 2
 - 2. Chemistry, Matter, and Life 20
 - 3. Cells and Their Functions 37
 - 4. Tissues, Glands, and Membranes 56
- Unit II Disease and the First Line of Defense 75**
- 5. Disease and Disease-Producing Organisms 76
 - 6. The Integumentary System 96
- Unit III Movement and Support 111**
- 7. The Skeleton: Bones and Joints 112
 - 8. The Muscular System 144
- Unit IV Coordination and Control 167**
- 9. The Nervous System: The Spinal Cord and Spinal Nerves 168
 - 10. The Nervous System: The Brain and Cranial Nerves 187
 - 11. The Sensory System 205
 - 12. The Endocrine System: Glands and Hormones 227
- Unit V Circulation and Body Defense 245**
- 13. The Blood 246
 - 14. The Heart and Heart Disease 265
 - 15. Blood Vessels and Blood Circulation 284
 - 16. The Lymphatic System and Lymphoid Tissue 309
 - 17. Immunity 323
- Unit VI Energy: Supply and Use 337**
- 18. The Respiratory System 338
 - 19. The Digestive System 355
 - 20. Metabolism, Nutrition, and Body Temperature 380
 - 21. Body Fluids 394
 - 22. The Urinary System 405
- Unit VII Perpetuation of Life 429**
- 23. The Male and Female Reproductive Systems 430
 - 24. Development and Birth 452
 - 25. Heredity and Hereditary Diseases 466



UNIT

I

The Body as a Whole

CHAPTER 1 Organization of the Human Body

CHAPTER 2 Chemistry, Matter, and Life

CHAPTER 3 Cells and Their Functions

CHAPTER 4 Tissues, Glands, and
Membranes

CHAPTER

1

Organization of the Human Body

Overview

Anatomy is the study of body structure, whereas **physiology** is the study of how the body functions. Anything that disrupts normal body structure or function is a disease, and the study of disease is called **pathology**.

Living things are organized from simple to complex levels. The simplest living form is the **cell**, the basic unit of life. Specialized cells are grouped into **tissues**, which, in turn, are combined to form **organs**; these organs form **systems**, which work together to maintain the body.

The systems are the

- integumentary system, the body's covering
- skeletal system, the framework of the body
- muscular system, which moves the bones and the skin of the face
- nervous system, the central control system that includes the organs of the sensory system
- endocrine system, which produces regulatory hormones
- cardiovascular system, consisting of the heart and blood vessels, acting to transport vital substances
- lymphatic system, which includes vessels that return tissue fluids to blood and organs that house immune cells
- respiratory system, which adds oxygen to the blood and removes carbon dioxide
- digestive system, which converts raw food materials into products usable by cells
- urinary system, which removes wastes and excess water
- reproductive system, by which new individuals of the species are produced

All the cellular reactions that sustain life together make up **metabolism**, which can be divided into **catabolism** and **anabolism**. In catabolism, complex substances are broken down into simpler molecules. When the nutrients from food are broken down by catabolism, energy is released. This energy is stored in the compound ATP (adenosine triphosphate) for use by the cells. In anabolism, simple compounds are built into substances needed for cell activities.

All the systems work together to maintain a state of balance or **homeostasis**. The main mechanism for maintaining homeostasis is **negative feedback**, by which the state of the body is the signal to keep conditions within set limits.

The human body is composed of large amounts of fluid, the amount and composition of which must be constantly regulated. The **extracellular fluid** consists of the fluid that surrounds the cells as well as the fluid circulating in blood and lymph. The fluid within cells is the **intracellular fluid**.

Study of the body requires knowledge of directional terms to locate parts and to relate various parts to each other. Planes of division represent different directions in which cuts can be made through the body. Separation of the body into areas and regions, together with the use of the special terminology for directions and locations, makes it possible to describe an area within the human body with great accuracy.

The large internal spaces of the body are cavities in which various organs are located. The **dorsal cavity** is subdivided into the **cranial cavity** and the **spinal cavity (canal)**. The **ventral cavity** is subdivided into the **thoracic** and **abdominopelvic cavities**. Imaginary lines are used to divide the abdomen into regions for study and diagnosis.

Addressing the Learning Outcomes

1. DEFINE THE TERMS *ANATOMY, PHYSIOLOGY, AND PATHOLOGY.*

EXERCISE 1-1

Write a definition of each term in the spaces below.

1. Anatomy _____

2. Physiology _____

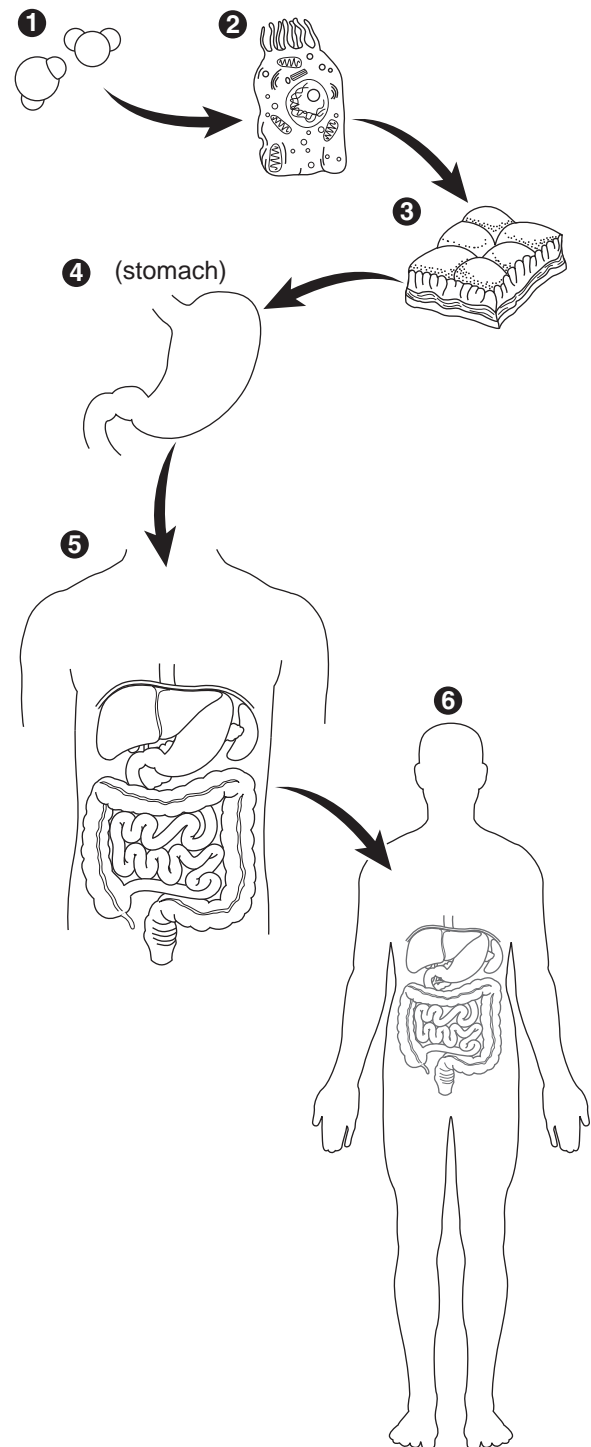
3. Pathology _____

2. DESCRIBE THE ORGANIZATION OF THE BODY FROM CHEMICALS TO THE WHOLE ORGANISM.

EXERCISE 1-2: Levels of Organization (Text Fig. 1-1)

1. Write the name or names of each labeled part on the numbered lines in different colors.
2. Color the different structures on the diagram with the corresponding color. For instance, if you wrote "cell" in blue, color the cell blue.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____



3. LIST 11 BODY SYSTEMS AND GIVE THE GENERAL FUNCTION OF EACH.

EXERCISE 1-3

Write the appropriate term in each blank from the list below.

nervous system

integumentary system

cardiovascular system

respiratory system

skeletal system

urinary system

endocrine system

lymphatic system

digestive system

1. The system that processes sensory information _____
2. The system that delivers nutrients to body tissues _____
3. The system that breaks down and absorbs food _____
4. The system that includes the fingernails _____
5. The system that includes the bladder _____
6. The system that includes the joints _____
7. The system that delivers oxygen to the blood _____
8. The system that includes the tonsils _____

4. DEFINE *METABOLISM* AND NAME THE TWO TYPES OF METABOLIC REACTIONS.

EXERCISE 1-4

Fill in the blanks in the paragraph below using the following terms: ATP, metabolism, catabolism, and anabolism.

The term _____ (1) refers to all life-sustaining reactions that occur within the body. The reactions involved in _____ (2) assemble simple components into more complex ones. The reactions of _____ (3) break down substances into simpler components, generating energy in the form of _____ (4). This energy can be used to fuel cell activities.

5. DEFINE AND GIVE EXAMPLES OF HOMEOSTASIS.

See Exercises 1-5 and 1-6.

6. EXPLAIN HOW NEGATIVE FEEDBACK MAINTAINS HOMEOSTASIS.

EXERCISE 1-5

Fill in the blanks in the paragraph below using the following terms: activates, shuts off, negative feedback, corrects, homeostasis.

The maintenance of a constant internal body state, known as (1) _____, is critical for health. Different body parameters, such as body temperature and blood glucose concentration, are kept constant using (2) _____ _____. For example, when the room temperature decreases, the

thermostat (3) _____ the furnace to increase heat production. The resulting increase in room temperature (4) _____ the initial stimulus, and the thermostat (5) _____ the furnace.

EXERCISE 1-6

Homeostasis involves the regulation of body fluid volume and composition. Fill in the blank after each statement—does it apply to extracellular fluid (EC) or intracellular fluid (IC)?

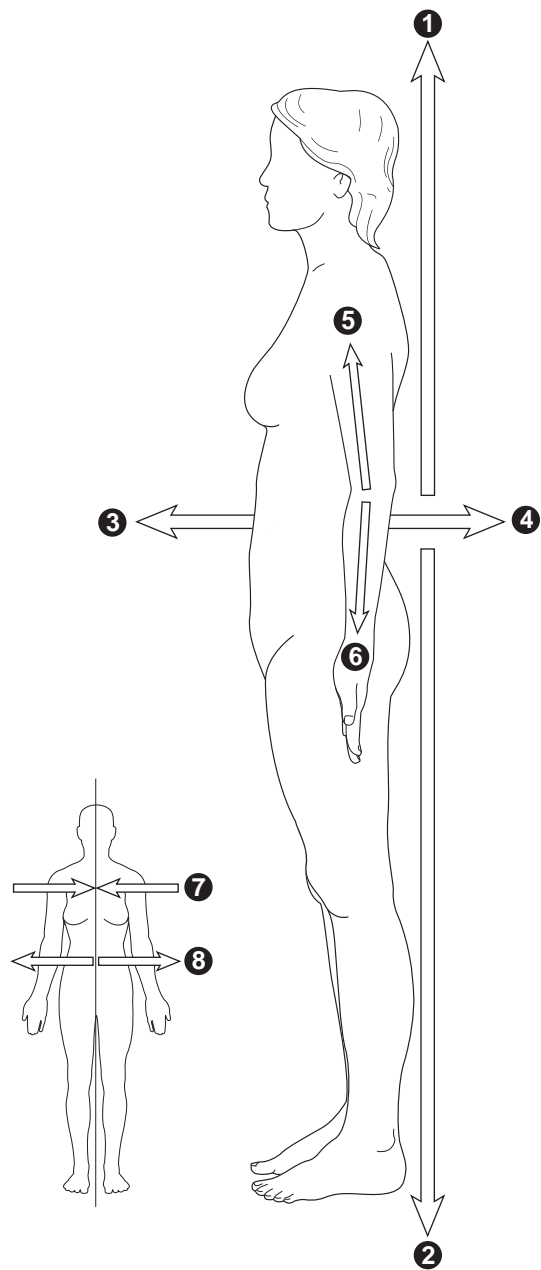
1. Includes lymph and blood _____
2. Refers to fluids inside cells _____
3. Includes fluid between cells _____

7. LIST AND DEFINE THE MAIN DIRECTIONAL TERMS FOR THE BODY.

EXERCISE 1-7: Directional Terms (Text Fig. 1-6)

1. Write the name of each directional term on the numbered lines in different colors.
2. Color the arrow corresponding to each directional term with appropriate color.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____



EXERCISE 1-8

Write the appropriate term in each blank from the list below.

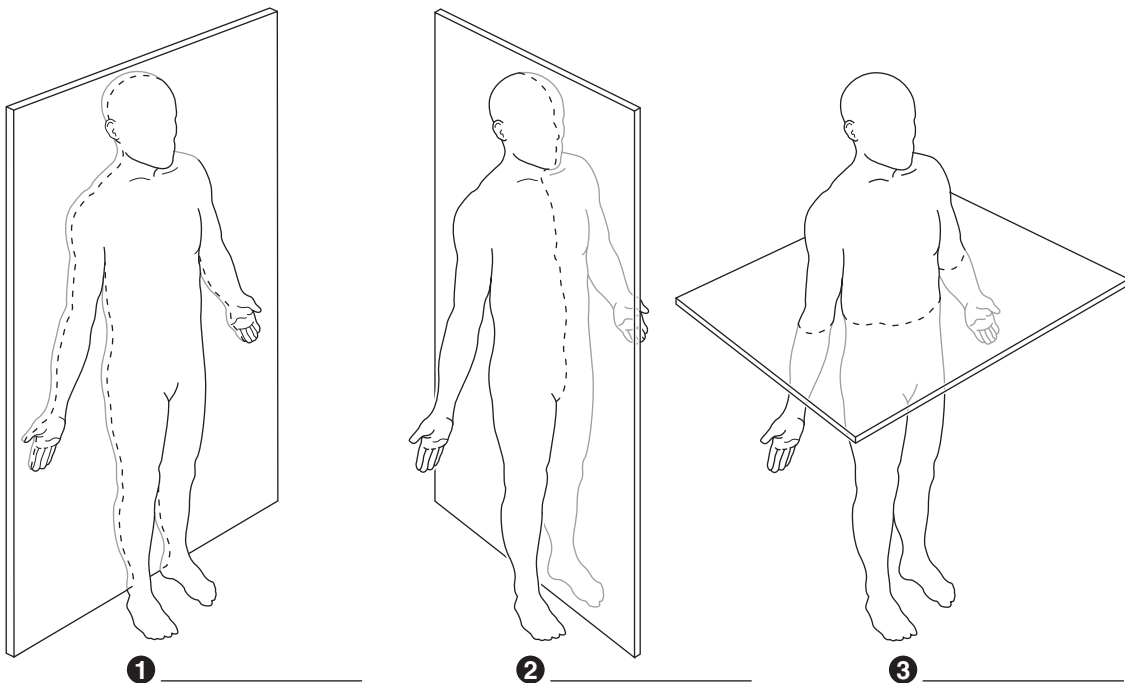
- posterior anterior medial distal
 proximal lateral horizontal

1. A term that indicates a location toward the front _____
2. A term that means farther from the origin of a part _____
3. A directional term that means away from the midline (toward the side) _____
4. A term that describes the position of the ankle in relation to the toes _____
5. A term that describes the position of the shoulder blades in relation to the collar bones _____

8. LIST AND DEFINE THE THREE PLANES OF DIVISION OF THE BODY.

EXERCISE 1-9: Planes of Division (Text Fig. 1-7)

1. Write the names of the three planes of division on the correct numbered lines in different colors.
2. Color each plane in the illustration with its corresponding color.

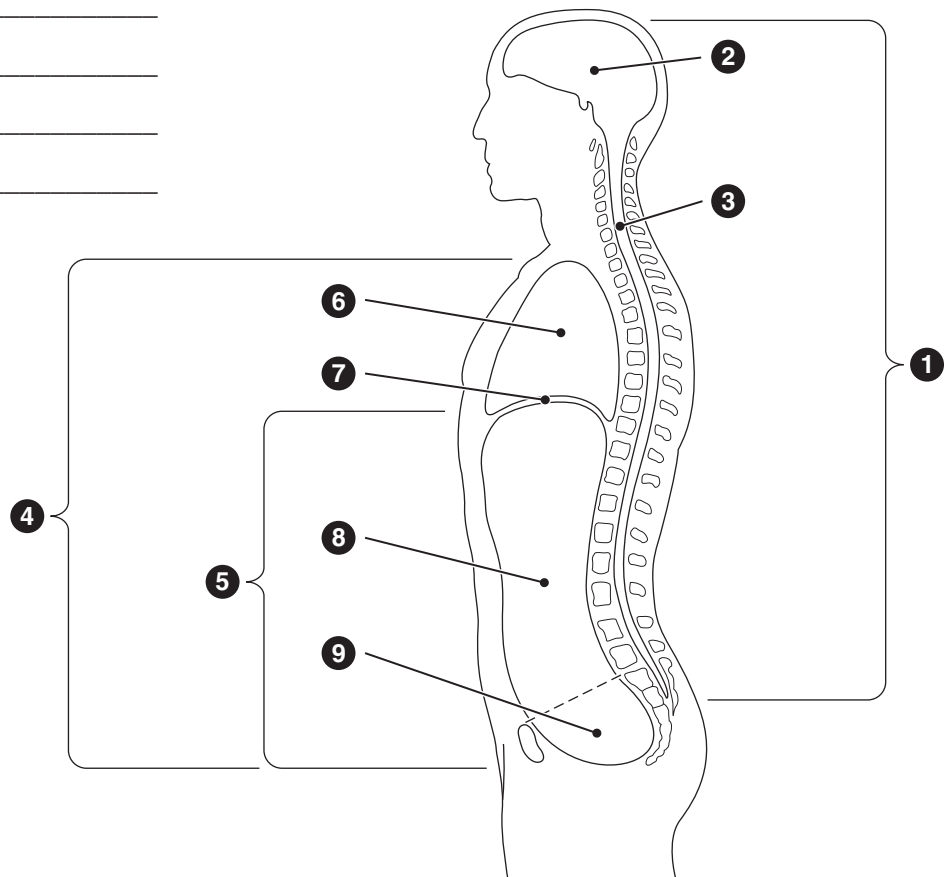


9. NAME THE SUBDIVISIONS OF THE DORSAL AND VENTRAL CAVITIES.

EXERCISE 1-10: Lateral View of Body Cavities (Text Fig. 1-10)

1. Write the names of the different body cavities and other structures in the appropriate spaces in different colors. Try to choose related colors for the dorsal cavity subdivisions and for the ventral cavity subdivisions.
2. Color parts 2, 3, and 6 to 9 with the corresponding color.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

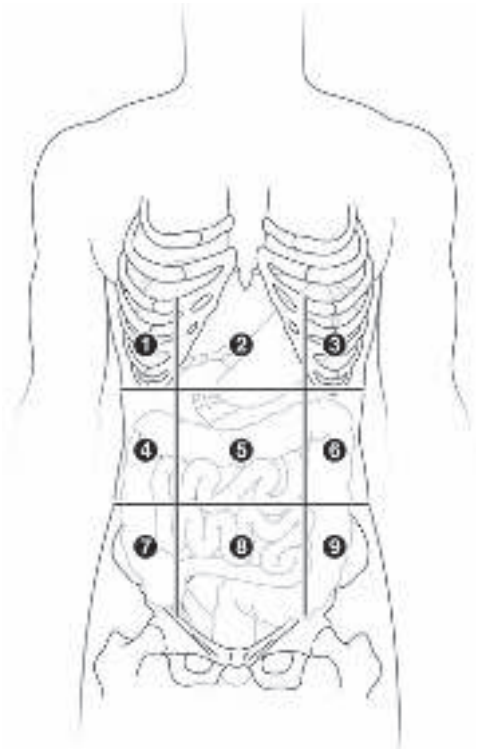


10. NAME AND LOCATE THE SUBDIVISIONS OF THE ABDOMEN.

EXERCISE 1-11: Regions of the Abdomen (Text Fig. 1-12)

1. Write the names of the nine regions of the abdomen on the appropriate numbered lines in different colors.
2. Color the corresponding region with the appropriate color.

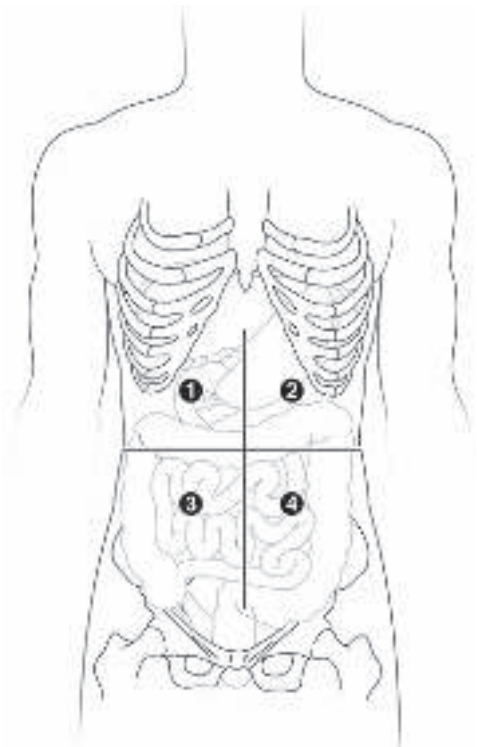
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____



EXERCISE 1-12: Quadrants of the Abdomen (Text Fig. 1-13)

1. Write the names of the four quadrants of the abdomen on the appropriate numbered lines in different colors.
2. Color the corresponding quadrant in the appropriate color.

1. _____
2. _____
3. _____
4. _____



11. CITE SOME ANTERIOR AND POSTERIOR BODY REGIONS ALONG WITH THEIR COMMON NAMES.

EXERCISE 1-13

Complete the following table by writing in the missing terms.

Common Name	Anatomic Adjective
Thigh	
	Antecubital
	Inguinal
Arm	
Forearm	
	Axillary
	Tarsal
Shoulder blade	
	Acromial

12. FIND EXAMPLES OF ANATOMIC AND PHYSIOLOGIC TERMS IN A CASE STUDY.

EXERCISE 1-14

Read through the case study at the beginning of the chapter and the case study discussion at the end of the chapter. Find an example of each type of medical term listed below and write it in the blank.

- a. A term describing one of four abdominal regions _____
- b. A term describing a particular region of the upper limb _____
- c. A term describing a body cavity _____
- d. A term describing one of nine abdominal regions _____
- e. A directional term _____

13. SHOW HOW WORD PARTS ARE USED TO BUILD WORDS RELATED TO THE BODY'S ORGANIZATION.

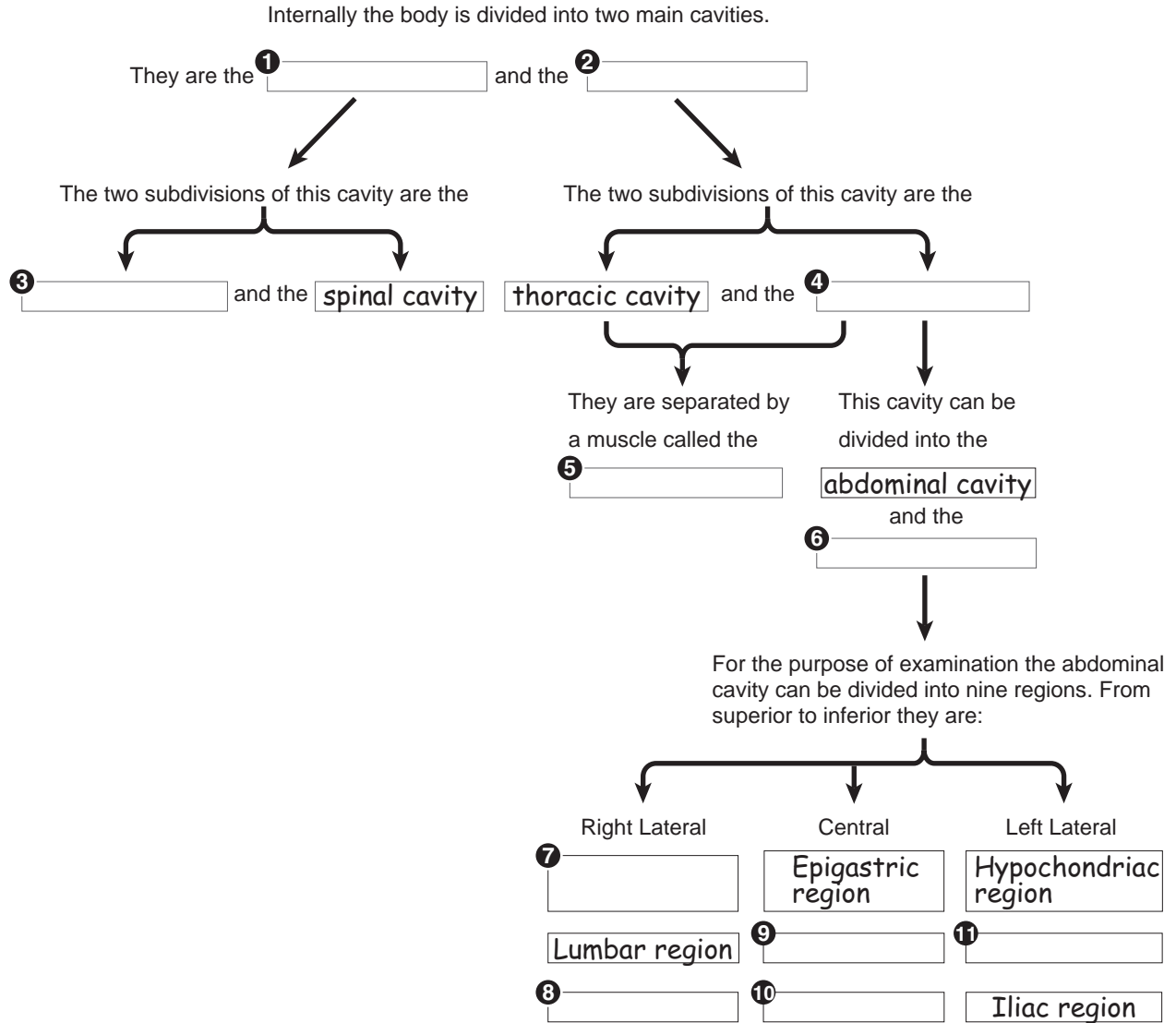
EXERCISE 1-15

Complete the following table by writing the correct word part or meaning in the space provided. Write a word that contains each word part in the "Example" column.

Word Part	Meaning	Example
1. -tomy	_____	_____
2. -stasis	_____	_____
3. _____	nature, physical	_____
4. home/o	_____	_____
5. _____	apart, away from	_____
6. _____	down	_____
7. _____	upward	_____
8. path/o	_____	_____
9. -logy	_____	_____

Making the Connections

The following concept map deals with the body's cavities and their divisions. Complete the concept map by filling in the blanks with the appropriate word or term for the cavity, division, subdivision, or region.



Testing Your Knowledge

BUILDING UNDERSTANDING

I. MULTIPLE CHOICE

Select the best answer and write the letter of your choice in the blank.

1. Which of these phrases describes a wart on the fingertip? 1. _____
 a. phalangeal wart
 b. pedal wart
 c. tarsal wart
 d. axillary wart
2. Which two body cavities are separated by the diaphragm? 2. _____
 a. cranial and the spinal cavities
 b. dorsal and ventral cavities
 c. thoracic and abdominal cavities
 d. abdominal and pelvic cavities
3. What term describes the breakdown of complex molecules into more simple ones? 3. _____
 a. anabolism
 b. synthesis
 c. negative feedback
 d. catabolism
4. Blood plasma is an example of which type of fluid? 4. _____
 a. extracellular
 b. intracellular
 c. superior
 d. extraneous
5. Which body system consists of the skin and accessory organs? 5. _____
 a. circulatory system
 b. nervous system
 c. integumentary system
 d. digestive system
6. Which of these terms describes the right superior region of the abdomen? 6. _____
 a. right lumbar region
 b. right hypochondriac region
 c. right iliac region
 d. right inguinal region
7. Which of these terms describes the study of normal body structure? 7. _____
 a. physiology
 b. pathology
 c. anatomy
 d. chemistry
8. Which of these sections is created when you cut a banana right down the middle, making two identical halves? 8. _____
 a. longitudinal section
 b. horizontal section
 c. cross section
 d. coronal section

II. COMPLETION EXERCISE

► Group A: General Terminology

Write the word or phrase that correctly completes each sentence.

1. In the anatomic position, the body is upright and palms are facing _____.
2. Fluid inside cells is called _____.
3. Catabolism releases energy in the form of _____.
4. Homeostasis is maintained by a form of feedback known as _____.
5. The sum of all catabolic and anabolic reactions in the body is called _____.
6. The abbreviation ATP stands for _____.

► Group B: Body Cavities, Directional Terms, and Planes Of Division

1. The term that means nearer to the point of origin is _____.
2. The term that means farther from the body's midline is _____.
3. The abdomen may be divided into four regions, each of which is called a(n) _____.
4. The cavity that houses the brain is the _____.
5. The plane that divides the body into left and right parts is the _____.
6. The ventral body cavity that contains the stomach, most of the intestine, the liver, and the spleen is the _____.
7. The abdomen may be subdivided into nine regions, including three along the midline. The region closest to the sternum (breastbone) is the _____.
8. The space between the lungs is called the _____.
9. The diaphragm separates the thoracic cavity from the _____.

► Group C: Body Regions

Write the anatomic adjective that corresponds to each body region.

1. Buttock _____
2. Wrist _____
3. Back of knee _____
4. Hip _____
5. Forearm _____

- [A Royal Pain \(Her Royal Spyness, Book 2\) here](#)
- [read **Something Borrowed \(Doctor Who: 50th Anniversary, Sixth Doctor\)**](#)
- [Deadly Companions: How Microbes Shaped Our History pdf, azw \(kindle\)](#)
- [Derrida and Lacan: Another Writing here](#)

- <http://qolorea.com/library/Knitting-Block-by-Block--150-Blocks-for-Sweaters--Scarves--Bags--Toys--Afghans--and-More.pdf>
- <http://thewun.org/?library/Something-Borrowed--Doctor-Who--50th-Anniversary--Sixth-Doctor-.pdf>
- <http://hasanetmekci.com/ebooks/If-This-Isn-t-Nice--What-Is---Advice-for-the-Young.pdf>
- <http://twilightblogs.com/library/Derrida-and-Lacan--Another-Writing.pdf>