STUDENT STUDY GUIDE

HOLE'S

HUMAN ANATOMY & PHYSIOLOGY

DAVID SHIER

JACKIE BUTLER

RICKI LEWIS

NANCY A. SICKLES CORBETT

McGraw Hill WCB McGraw-Hill

SEVENTH EDITION

STUDENT STUDY GUIDE

HOLE'S

HUMAN ANATOMY & PHYSIOLOGY

DAVID SHIER

JACKIE BUTLER

RICKI LEWIS

NANCY A. SICKLES CORBETT

SCHOOL OF NURSING, MEDICAL COLLEGE OF PENNSYLVANIA AND HAHNEMANN UNIVERSITY

WCB McGraw-Hill

Boston, Massachusetts Burr Ridge, Illinios Dubuque, Iowa
Madison, Wisconsin New York, New York San Francisco, California St. Louis, Missouri

SEVENTH EDITION

WCB/McGraw-Hill

A Division of The ***McGraw-Hill*** *Companies*

Book Team

Editor *Colin H. Wheatley*
Developmental Editor *Kristine Noel*
Production Editor *Sue Dillon*
Designer *Barbara Hodgson*
Art Editor *Brenda A. Ernzen*
Photo Editor *Janice Hancock*
Permissions Coordinator *Mavis M. Oeth*

President and Chief Executive Officer *Beverly Kolz*
Vice President, Publisher *Kevin Kane*
Vice President, Director of Sales and Marketing *Virginia S. Moffat*
Vice President, Director of Production *Colleen A. Yonda*
National Sales Manager *Douglas J. DiNardo*
Marketing Manager *Craig S. Marty*
Advertising Manager *Janelle Keeffer*
Production Editorial Manager *Renée Menne*
Publishing Services Manager *Karen J. Slaght*
Royalty/Permissions Manager *Connie Allendorf*

Cover photo © Mark Lewis/Tony Stone Images

The credits section for this book begins on page 277 and is considered an extension of the copyright page.

ISBN 0-697-20963-6

Printed in the United States of America

10 9 8 7 6 5 4 3

TO THE STUDENT

A study guide attempts to do as the term implies; that is, to guide your study so that your learning efforts are most efficient.

This study guide is based on several beliefs: (1) Learning occurs best when the learner is active rather than passive; (2) learning is easiest when the material is organized in simple units; and (3) the learner can best evaluate what he or she knows well, is unsure of, or does not know.

The study guide chapters correspond to the chapters in the text, *Human Anatomy and Physiology,* seventh edition, by John W. Hole, Jr., Wm. C. Brown Publishers, 1995. The elements of the study guide chapters and their purposes are described below.

1. *Overview.* The learning objectives at the beginning of each chapter in the text are arranged in groups according to broad, general concepts presented in the chapter. The overview also contains a purpose statement that offers a rationale for studying the chapter.
2. *Chapter Objectives.* The chapter objectives from the text are listed.
3. *Focus Question.* The focus question helps you focus your study of each chapter.
4. *Mastery Test.* The mastery test, taken before reading the chapter, is designed to help you identify the following:
   a. The concepts you already know.
   b. Those concepts you need to clarify.
   c. Those concepts you do not know.

   If you are using a study guide for the first time, you may be unfamiliar with this type of testing. It is important for you to realize that this test is *for your information.* Its purpose is to help you learn where to concentrate your learning efforts; therefore, it is best not to guess at any answers.
5. *Study Activities.* A variety of study activities helps facilitate the study of the principal ideas of each chapter.

The study activities should be done after you have read the chapter carefully, concentrating on those areas that the mastery test indicates you do not know.

The first activity in each chapter is a vocabulary exercise, concentrating on words or word parts appropriate to each chapter. You are asked to define these as you understand them and then compare your definitions with those in the chapter. You may find it helpful to define terms orally and in writing. If you have a tape recorder, you may use it as a study device.

After the vocabulary exercise, you may be asked to describe a process, label a diagram, fill in a chart, or observe the function of a body part in yourself or in a partner. (This partner may be a classmate or a cooperative family member.) These are written activities, but you may also find it helpful to repeat them orally.

After you complete the study activities, retake the mastery test. A comparison of the two scores will indicate the progress you have made. You may also wish to set a learning goal for yourself, such as a score of 70%, 80%, or 90%, on the mastery test after completing your study of a chapter. If you have not attained your goal, the mastery test results can show where you need additional study.

The answers to the mastery test are at the end of the study guide. You can compare your responses to the review activities by referring to the appropriate page numbers in the text. Each major section in the study guide is identified by a Roman numeral and the title of the corresponding section in the text. The activities in the study guide are lettered, and the corresponding pages in the text are noted after the activity.

You are responsible for your own learning. No teacher can assume that responsibility. A study guide can help you direct your study more efficiently, but only you can control how well and how completely you use the guide.

CONTENTS

CHAPTER 1

INTRODUCTION TO HUMAN ANATOMY AND PHYSIOLOGY

OVERVIEW

This chapter begins the study of anatomy and physiology by defining the disciplines (objective 1), and explaining the characteristics and needs that are common to all living things (objectives 2 and 3). It introduces a basic mechanism necessary to maintain life (objectives 4 and 5), as well as the relationship of increasingly complex levels of organization in humans (objective 6). The study of levels of organization continues with the identification of body cavities and the organs found within each cavity (objectives 7 and 8). The membranes associated with the abdominopelvic and thoracic cavities are described (objective 9). The functions of the various organ systems as well as the organs associated with each system are described (objectives 10 and 11). Finally, the language used to describe relative positions of body parts, body sections, and body regions is presented (objective 12).

This chapter defines the characteristics and needs common to all living things and the manner in which the human body is organized to accomplish life processes. The language peculiar to anatomy and physiology is also introduced.

CHAPTER OBJECTIVES

After you have studied this chapter, you should be able to:

1. Define *anatomy* and *physiology*, and explain how they are related.
2. List and describe the major characteristics of life.
3. List and describe the major needs of organisms.
4. Define *homeostasis* and explain its importance to survival.
5. Describe a homeostatic mechanism.
6. Explain what is meant by *levels of organization*.
7. Describe the location of the major body cavities.
8. List the organs located in each of the body cavities.
9. Name the membranes associated with the thoracic and abdominopelvic cavities.
10. Name the major organ systems of the body and list the organs associated with each system.
11. Describe the general functions of each organ system.
12. Properly use the terms that describe relative positions, body sections, and body regions.

FOCUS QUESTION

How is the human body organized to accomplish those tasks that are essential to maintain life?

MASTERY TEST

Now take the mastery test. Do not guess. As soon as you complete the test, correct it. Note your successes and failures so that you can read the chapter to meet your learning needs.

Questions 1–4 Match the structures listed in the first column with the functions listed in the second column.

Structure	Function
_____ 1. atoms, molecules, macromolecules	a. components of more complex living units
_____ 2. cells	b. provide various substances required for life
_____ 3. tissues, organs, organ systems	c. allow life to continue despite changing environments and reproduce to continue their species (ex., humans)
_____ 4. organisms	d. simplest living units

5. Study of the human body began with earliest humans because
   a. our early ancestors were curious about the world around them.
   b. they were as interested in their body parts and their functions as we are today.
   c. of their concern with illness and injury.

6. Which of the following factors set the stage for the development of modern science?
   a. a belief that spirits or gods controlled sickness and health
   b. the growing experience of medicine men as they treated the sick with herbs and potions
   c. the belief that natural processes were caused by forces that could be understood
   d. the ability to ask questions and record the answers

7. What two languages form the basis for the language of anatomy and physiology?

8. The branch of science that studies the structure morphology of body parts is _____ .

9. The branch of science that studies what body parts do and how they do it is _____ .

10. The function of a part is (always/sometimes/never) related to its structure.

11. List those characteristics that are common to all living organisms.
    a.
    b.
    c.
    d.
    e.
    f.
    g.
    h.
    i.
    j.

12. The physical and chemical changes or reactions that occur in the body are called _____ .

13. The vital signs include
    a. temperature.
    b. heart rate.
    c. respiratory rate.
    d. reflex activity.

14. The most abundant chemical substance in the human body is _____ .

15. Food is used as an _____ source, to build new _____ _____ , and to participate in chemical reactions.

16. Oxygen is used to release _____ .

17. An increase in temperature (increases/decreases) the rate of chemical reactions.

18. Atmospheric pressure plays a part in _____ .

19. Homeostasis means
    a. maintenance of a stable internal environment.
    b. integrating the functions of the various organ systems.
    c. preventing any change in the organism.

20. Blood sugar (is/is not) maintained by a negative feedback mechanism.

21. Positive feedback mechanisms lead to (health/illness).

22. The smallest particle in the human body is the
    a. molecule.
    b. atom.
    c. cell.

23. List the five levels of organization of the body in order of increasing complexity, beginning with the cell.

24. The portion of the body that contains the head, neck, and trunk is called the _____ portion.

25. The arms and legs are called the _____ portion.

26. The two major cavities of the axial portion of the body are the _____ cavity and the _____ cavity.

27. The inferior boundary of the thoracic cavity is the _____ .

28. The heart, esophagus, trachea, and thymus gland are located in the _____ of the thoracic cavity.

29. The pelvic cavity is
    a. the lower one-third of the abdominopelvic cavity.
    b. the portion of the abdomen that contains the reproductive organs.
    c. the portion of the abdomen surrounded by the bones of the pelvis.

30. The visceral and parietal pleural membranes secrete a serous fluid into a potential space called the _____ _____ .

31. The heart is covered by the _____ membranes.

32. The peritoneal membranes are located in the _____ cavity.

33. Match the systems listed in the first column with the functions listed in the second column.

_____ 1. nervous system	a. reproduction
_____ 2. muscular system	b. processing and transporting
_____ 3. circulatory system	c. integration and coordination
_____ 4. respiratory system	d. support and movement
_____ 5. skeletal system	
_____ 6. digestive system	
_____ 7. lymphatic system	
_____ 8. endocrine system	
_____ 9. urinary system	
_____ 10. reproductive system	

34. Which of the following positions of body parts is/are in *anatomic* position?
    a. palms of hands turned toward sides of body
    b. standing erect
    c. arms at side
    d. face toward left shoulder

35. Terms of relative position are used to describe
    a. the relationship of siblings within a family.
    b. the importance of the various functions of organ systems in maintaining life.
    c. the location of one body part with respect to another.

36. A sagittal section divides the body into
    a. superior and inferior portions.
    b. right and left portions.
    c. anterior and posterior portions.

37. The terms *epigastric*, *hypochondriac*, and *iliac* are examples of _____ _____ .

38. Ultrasonography involves the use of _____ ; MRI creates an image of body parts using a _____ field.

39. Which of the following body parts will be well visualized using ultrasonography?
    a. lungs
    b. heart
    c. bone
    d. uterus

40. MRI (is/is not) a good technique to use to study soft tissues such as the brain.

Study Activities

I. Aids to Understanding Words (Please refer to Appendix D and the inside front and back covers.)
Define the following word parts.

append-

cardi-

cran-

dors-

homeo-

-logy

meta-

nas-

orb-

pariet-

pelv-

peri-

pleur-

-stasis

-tomy

II. Introduction (p. 3)
Why did the study of the human body begin with attempts to understand illness and injury rather than with attempts to understand the human body?

III. Anatomy and Physiology (pp. 3–4)
Explain how the structure of the following parts is related to the function given.
fingers: grasping

heart: pumping

blood vessels: moving blood in the proper direction

IV. Characteristics of Life (pp. 4–5)

A. Describe the following characteristics of life.

movement

responsiveness

reproduction

growth

respiration

ingestion

digestion

absorption

assimilation

circulation

excretion

B. What is metabolism?

C. Why are observations of the vital signs important to nurses and physicians?

V. Maintenance of Life (pp. 5–8)

A. Match the terms in the first column with the statements in the second column that define their role in the maintenance of life.

_____ 1. water
_____ 2. food
_____ 3. oxygen
_____ 4. heat
_____ 5. pressure

a. essential for metabolic processes
b. governs the rate of chemical reactions
c. creates a pressing or compressing action
d. necessary for release of energy
e. provides chemicals for building new living matter

B. Homeostasis

1. Define *homeostasis.*

2. How is body temperature maintained at 37° C (98.6° F)?

3. Describe negative and positive feedback mechanisms. Give examples of each.

VI. Levels of Organization (pp. 8–9)

Arrange the following structures in increasing levels of complexity: atoms, organ systems, organelles, organism, organs, macromolecules, cells, tissue, molecules.

VII. Body Cavities (pp. 9–13)

A. The dorsal cavity is subdivided into the _____ cavity and the _____ cavity.

B. Answer the following concerning the ventral cavity.

1. The ventral cavity is subdivided into the _____ cavity and the _____ cavity.
2. The _____ divides the ventral cavity.
3. List the viscera found in each portion of the ventral cavity.

C. List the four smaller cavities of the body.

VIII. Thoracic and Abdominopelvic Membranes (pp. 13–14)

A. Fill in the blanks.

1. The walls of the thoracic cavity are lined with a _____ membrane called the _____ _____ .
2. The lungs are covered by the _____ _____ .
3. Why is the pleural cavity called a potential space?

B. Name and describe the membranes covering the heart.

C. The linings of the abdominopelvic cavity are the _____ _____ and the _____ _____ .

IX. Organ Systems (pp. 14–18)

Fill in the following chart.

Structure and function of organ systems

Function	Organ system	Organs in system
Support and movement	1.	1.
	2.	2.
Integration and coordination	1.	1.
	2.	2.
Processing and transporting	1.	1.
	2.	2.
	3.	3.
	4.	4.
	5.	5.
Reproduction: female	1.	1.
Reproduction: male	2.	2.

X. Anatomical Terminology (pp. 18–23)

A. Use this illustration to specify the terms that describe the relationship of one point on the body to another.

1. Point (*a*) in relation to point (*d*).

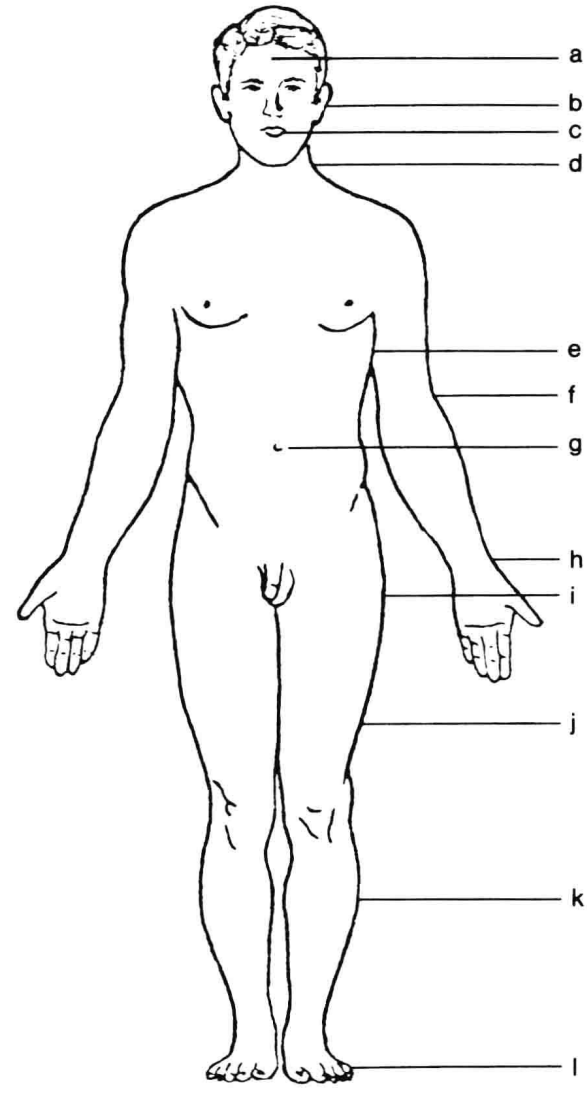
2. Point (*f*) in relation to point (*h*).

3. Point (*g*) in relation to point (*i*).

4. Point (*l*) in relation to point (*j*).

5. Point (*i*) in relation to point (*g*).

6. Point (*c*) in relation to point (*a*).



B. Use this illustration to perform the following exercises.

1. Draw a line through the drawing to indicate a midsagittal section. How is this different from a frontal section?
2. Draw a line through the drawing to indicate a transverse section.
3. Define cross section, longitudinal section, and oblique section.

4. Locate and label the following body regions: epigastric, umbilical, hypogastric, hypochondriac, lumbar, and iliac. Locate these regions on yourself or on a partner.
5. Use lines *a–l* to locate and label the following body parts on the diagram: antebrachium, antecubital, axillary, brachial, buccal, cervical, groin, inguinal, mammary, ophthalmic, palmar, pectoral.

XI. Ultrasonography and Magnetic Resonance Imaging (p. 10)

A. Describe ultrasonography.

B. Describe magnetic resonance imaging.

XII. Clinical Focus Question

List the ways that health professionals use their knowledge of anatomy and physiology to assess and evaluate their clients' health.

When you have completed the study activities to your satisfaction, retake the mastery test and compare your performance with your initial attempt. If there are still areas you do not understand, repeat the appropriate study activities.

CHAPTER 2

CHEMICAL BASIS OF LIFE

OVERVIEW

This chapter introduces some basic concepts of chemistry, a science that studies the composition of substances and the changes that occur as basic elements combine. It explains how substances combine to make up matter (objectives 1–5), how substances are classified as acid or base (objective 6), and the organic and inorganic substances that make up the living cell (objectives 7 and 8).

Knowledge of basic chemical concepts enhances understanding of the functions of cells and of the human body.

CHAPTER OBJECTIVES

After you have studied this chapter, you should be able to:

1. Explain how the study of living material is dependent on the study of chemistry.
2. Describe the relationships among matter, atoms, and molecules.
3. Discuss how atomic structure is related to the ways in which atoms interact.
4. Explain how molecular and structural formulas are used to symbolize the composition of compounds.
5. Describe three types of chemical reactions.
6. Discuss the concept of pH.
7. List the major groups of inorganic substances that are common in cells.
8. Describe the general roles played in cells by various types of organic substances.

FOCUS QUESTION

How is chemistry related to the structure and function of living things and their parts?

MASTERY TEST

Now take the mastery test. Do not guess. As soon as you complete the test, correct it. Note your successes and failures so that you can read the chapter to meet your learning needs.

Questions 1–5 Match the structures listed in the first column with the functions listed in the second column.

Structure

_____ 1. atom

_____ 2. molecule

_____ 3. electrolyte

_____ 4. carbohydrates, lipids, protein

_____ 5. nucleic acids

Function

a. molecular building blocks and energy sources for living cells
b. the operating instructions for living cells—the genes
c. smallest complete unit of an element
d. two or more atoms joined together
e. molecule that gives rise to ions (charged particles) in the internal environment

6. The symptoms of Wilson's disease are due to
   a. an excess of iron.
   b. an excess of copper.
   c. an excess of fatty insulation.
   d. an excess of vitamin C.

7. A missing or defective enzyme is the cause of disorders known as _____ _____ of metabolism.

8. The discipline that deals with the chemistry of living things is called _____ .

9. What is matter? In what forms can it be found?

10. The basic units of matter are _____ .

11. Which of the following substances is *not* an element?
    a. iron
    b. bronze
    c. oxygen
    d. hydrogen

12. Carbon, hydrogen, oxygen, and nitrogen are examples of _____ elements.

13. Many trace elements are important parts of _____ .

14. What elements are most plentiful in the composition of the human body?

15. An atom is made up of
    a. a nucleus.
    b. protons.
    c. neutrons.
    d. electrons.
    e. All of the above.

16. Match the following.

    _____ 1. neutron
    _____ 2. proton
    _____ 3. electron

    a. positive electrical charge
    b. negative electrical charge
    c. no electrical charge

17. The atomic number of an element is determined by the number of _____ .

18. The atomic weight of an element is determined by adding the number of _____ and the number of _____ .

19. An isotope has the same atomic _____ but different atomic _____ .

20. The atoms of the same element have the same number of _____ , but may vary in the number of _____ .

21. When an isotope decomposes and gives off energy, it is
    a. unstable.
    b. radioactive.
    c. explosive.

22. The interaction of atoms is determined primarily by the number of _____ they possess.

23. Atomic radiation that travels the most rapidly and is the most penetrating is
    a. alpha.
    b. beta.
    c. gamma.

24. The time it takes for one-half of the amount of an isotope to decay to a nonradioactive form is its _____ .

25. An element is chemically inactive if
    a. it has a high atomic weight.
    b. its outer electron shell is filled.
    c. it has an odd number of protons.