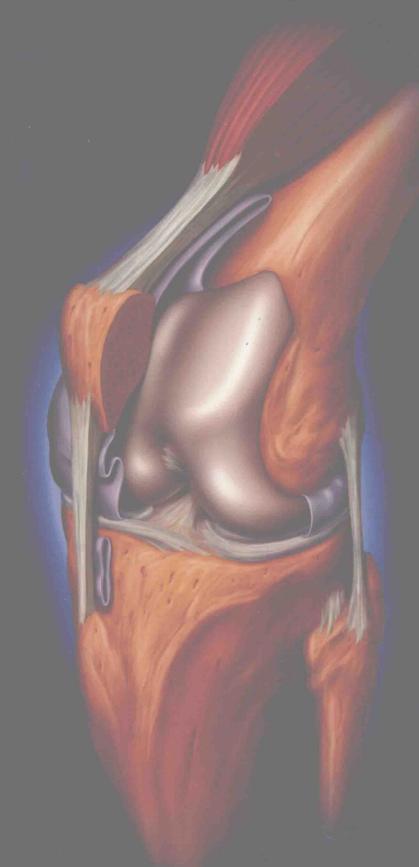
# STANLEY E. GUNSTREAM



# ANATOMY

# PHYSIOLOGY

with Integrated Study Guide

# STANLEY E. GUNSTREAM Pasadena City College

# ANATOMY PHYSIOLOGY

with Integrated Study Guide



# McGraw-Hill Higher Education 💥

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#### ANATOMY & PHYSIOLOGY WITH INTEGRATED STUDY GUIDE, SECOND EDITION

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#### Anatomy and Physiology Laboratory Textbooks

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Some of the laboratory experiments included in this text may be hazardous if materials are handled improperly or if procedures are conducted incorrectly. Safety precautions are necessary when you are working with chemicals, glass test tubes, hot water baths, sharp instruments, and the like, or for any procedures that generally require caution. Your school may have set regulations regarding safety procedures that your instructor will explain to you. Should you have any problems with materials or procedures, please ask your instructor for help.

# PREFACE



natomy and Physiology with Integrated Study Guide, second edition, is designed for students who are enrolled in a onesemester 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.

These students usually 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 clear, concise English and simplifies the complexities of anatomy and physiology in ways that enhance understanding without diluting the essential subject matter.

#### **Themes**

There are two unifying themes in this presentation of normal human anatomy and physiology: (1) the relationships between structure and function of body parts and (2) the mechanisms of homeostasis. In addition, interrelationships of the organ systems are noted where appropriate and useful.

# **Organization**

The sequence of chapters progresses from simple to complex. The simple-to-complex progression also is used within each chapter. Chapters covering an organ system begin with anatomy to ensure that students are well prepared to understand the physiology that follows. Each chapter concludes with a brief consideration of common disorders that the student may encounter in the clinical setting. An integrated study guide, unique among anatomy and physiology texts, is located between the text proper and the appendices.

# **Study Guide**

The *Study Guide* is a proven mechanism for enhancing learning by students and now features full-color line art. There is a study guide of four to eight pages for each chapter. Students demonstrate their understanding of the chapter by labeling diagrams and answering

completion, matching, and true/false questions. The completion questions "force" students to write and spell correctly the technical terms that they must know. Each chapter study guide concludes with a few critical-thinking, short-answer essay questions where students apply their knowledge to clinical situations.

Answers to the *Study Guide* are included in the *Instructor's Manual* to allow the instructor flexibility: (1) answers may be posted so students can check their own responses, or (2) they may be graded to assess student progress. Either way, prompt feedback to students is most effective in maximizing learning.

# Other Learning Aids

A variety of additional learning aids are incorporated to facilitate the learning process and to stimulate interest in the subject.

# Chapter Preview and Learning Objectives

Each chapter begins with a list of major topics discussed in the chapter, and under each topic the learning objectives are noted. This informs students of the major topics to be covered and their minimal learning responsibilities.

## **Key Terms**

Several features have been incorporated to assist students in learning the necessary technical terms that often are troublesome for beginning students.

- A list of Selected Key Terms with definitions, and including 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. Throughout the text, key terms are in bold or italic type for easy recognition, and they are defined at the time of first usage. A *phonetic pronunciation* follows where students need help in pronouncing the term. Experience has shown that students learn only terms that they can pronounce.

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- 3. Keys to Medical Terminology in appendix A explains how technical terms are structured and provides a list of prefixes, suffixes, and root words to further aid an understanding of medical terminology.
- 4. At the end of each chapter, a section titled Building Your Vocabulary provides a list of Selected New Terms that allows students to review their understanding of the new terms. Also, a few Related Clinical Terms are defined with phonetic pronunciations to help students to start building a clinical vocabulary.

#### **Figures and Tables**

Over 300 new, high quality, full-color illustrations are coordinated with the text to help students visualize anatomical features and physiological concepts. Tables are used throughout to summarize information in a way that is more easily learned by students.

#### **Clinical Boxes**

Numerous boxes containing related clinical information are strategically placed throughout the text. They serve to provide interesting and useful information related to the topic at hand. The clinical boxes are identified by a *stethoscope icon* for easy recognition.

#### **In-Text Review Questions**

Review questions at the end of major sections challenge students to assess their understanding before proceeding.

## **Chapter Summary**

Each chapter summary consists of a numerical listing of key concepts for each major heading of the chapter. The summary provides a quick review of each chapter for the student.

## **Study Activities**

In this section, students are directed to complete the chapter study guide and the chapter learning objectives. Both activities aid and reinforce learning and allow students to recognize those topics that they need to study further.

## **Check Your Understanding**

Each chapter concludes with a brief quiz, composed of completion questions, that allows students to

evaluate their understanding of chapter topics. Answers are provided in appendix B for immediate feedback.

# Changes in the Second Edition

Every chapter has been improved to make this edition even more suitable for allied health students.

- Most chapters have been substantially rewritten to update the subject matter and to simplify the narrative.
- 2. Nearly all figures are new, and they present the subject matter with even greater clarity.
- Many new tables have been added that summarize information in ways that enhance student learning.
- In-text review questions have been inserted at the end of major sections to challenge students to assess their understanding before proceeding.
- Tables of normal values for common blood and urine tests and a list of common medical abbreviations have been added to the appendices.

# **Multimedia Correlations**

This second edition introduces the Dynamic Human, Version 2.0, 3-D Visual Guide to Anatomy and Physiology CD-ROM, which interactively illustrates the complex relationships between anatomical structures and their functions in the human body. The program covers each body system, demonstrating clinical concepts, histology, and physiology. The Dynamic Human icon 7 appears in appropriate figure legends to alert the reader to the corresponding information. A list of correlating figures to specific sections of The Dynamic Human, Version 2.0, follows this preface.

A set of five videotapes contains nearly 53 animations of physiological processes integral to the study of human anatomy and physiology. Entitled "WCB's Life Science Animation (LSA) Videotape Series," these videotapes cover such topics as cell division, genetics, and reproduction. The LSA 3-D Videotape with 42 key biological processes is included in these correlations. Videotape icons appear in appropriate figure legends to alert the reader to these animations. A list of the figures that relate to the animations follows this preface.

## Ancillaries Instructor's Manual

This helpful manual provides the following for each chapter:

- 1. lecture outline;
- 2. instructional suggestions;
- 3. list of related films and videos;
- 4. answers to the Study Guide;
- 5. a test-item file of 40 to 50 multiple-choice questions with answers.

# **Laboratory Manual**

Anatomy and Physiology Laboratory Textbook, Essentials Version by Stanley E. Gunstream, Harold J. Benson, Arthur Talaro, and Kathleen P. Talaro, all of Pasadena City College. This excellent lab text presents the fundamentals of human anatomy and physiology in an easy-to-read manner that is appropriate for students in allied health programs. It is designed especially for the one-semester course; it features a simple, concise writing style, 37 self-directing exercises, full-color photomicrographs in the Histology Atlas, and numerous illustrations in each exercise. The lab text is accompanied by an Instructor's Handbook and Slides.

# Also Available from McGraw-Hill . . . .

- The Dynamic Human CD-ROM, Version 2.0 (0-697-38935-9) consists of 3-D and other visualizations of relationships between human structure and function.
- The Dynamic Human Videodisc (0-697-38937-5) contains all of the CD-ROM animations, with a bar code directory.
- Virtual Physiology Lab CD-ROM (0-697-37994-9)
  has 10 simulations of animal-based experiments
  common in the physiology component of a laboratory course; allows students to repeat experiments for improved mastery.
- WCB Anatomy and Physiology Videodisc (0-697-27716-X) has more than 30 physiological animations, line art, and photomicrographs, with a bar code directory.
- WCB's Life Science Animations (LSA) contains 53 animations on VHS videocassettes; Chemistry, The Cell, and Energetics (0-697-

- 25068-7); Cell Division, Heredity, Genetics, Reproduction, and Development (0-697-25069-5); Animal Biology No. 1 (0-697-25070-9); Animal Biology No. 2 (0-697-25071-7); and Plant Biology, Evolution, and Ecology (0-697-26600-1). Another available videotape is Physiological Concepts of Life Science (0-697-21512-1). A new 3-D videotape (0-07-290652-9) is also available with 42 key biological processes all narrated and animated in vibrant color with dynamic three-dimensional graphics.
- WCB Anatomy and Physiology Videotape Series consists of four videotapes, free to qualified adopters, including Blood Cell Counting, Identification and Grouping (0-697-11629-8); Introduction to the Human Cadaver and Prosection (0-697-11177-6); Introduction to Cat Dissection: Cat Musculature (0-697-11630-1); and Internal Organs and Circulatory System of the Cat (0-697-13922-0).
- Human Anatomy and Physiology Study Cards, third edition (00697-26447-5) by Kent Van De Graaff, Ward Rhees, and Christopher Creek is a boxed set of 300 illustrated cards (3 × 5 in.), each of which concisely summarizes a concept of structure or function, defines a term, and provides a concise table of related information.
- Coloring Guide to Anatomy and Physiology (0-697-17109-4) by Robert and Judith Stone consists of outline drawings and text that emphasize learning through color association. Students retain information through a meditative exercise in color-coding structures and correlated labels. This can be an especially effective aid for students who more easily remember visual concepts than verbal ones.
- An Atlas to Human Anatomy (0-697-38793-3) by Dennis Strete and Christopher Creek is a new full-color atlas that contains over 200 fullcolor photographs and over 150 black-andwhite illustrations that accompany and portray the necessary detail of human anatomy.
- Atlas of the Skeletal Muscles, third edition (0-07-290332-5) by Robert and Judith Stone illustrates each skeletal muscle in a diagram that the student can color, and provides a concise table of the origin, insertion, action, and innervation of each muscle.
- Laboratory Atlas of Anatomy and Physiology, second edition (0-697-39480-8) by Douglas Eder et al. is a full-color atlas containing histology, human skeletal anatomy, human muscular anatomy, dissections, and reference tables.

# Acknowledgments

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S.E.G.

## LIFE SCIENCE 3D ANIMATIONS CORRELATION GUIDE

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# LIFE SCIENCE ANIMATIONS CORRELATION GUIDE

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# NOTE TO STUDENTS

ou are starting a fascinating and challenging study of human anatomy and physiology. The course will be rigorous, but you can improve your chances of success by taking advantage of the learning aids found in this text. The suggestions noted below have been helpful to many students. Consider incorporating them into your study habits.

- 1. You can best profit from your instructor's lecture if you have prepared for it by studying the reading assignment before you attend the lecture. If you do this, you will know the new terms that will be encountered and at least the general aspects of the subject matter. This will enable you to better understand the lecture and take better lecture notes. It will save you study time later on.
- 2. Before you read a chapter, you need to do two things. First, examine the *Chapter Preview and Learning Objectives*. This will inform you of the sequence of major topics to be covered and your minimal learning responsibilities. Second, study the list of *Selected Key Terms* to learn their meanings. After you have done these two things, you will be prepared to learn effectively as you read the chapter
- 3. As you read a chapter, watch for new terms and be sure to learn their pronunciation and meaning before going on. Use the *Glossary* and *Keys to Medical Terminology* as necessary to assist you. Key terms are in bold or italic print so that you can easily recognize them. Where pronunciation help is needed, a *phonentic pronunciation* immediately follows in parentheses to help you pronounce the term correctly. Say the term out loud a few times to be sure that you know the correct pronunciation. This will help you remember the term.

The phonetic pronunciation breaks terms into syllables and includes marks denoting long vowel sounds and major accents. Vowels marked with a line above the letter are pronounced with a long sound—the same sound as when saying the letter. Some examples follow:

- ā as in take
- i as in time
- ē as in be
- ō as in hole

Vowels without these marks are pronounced with short sounds as in the following examples:

- · a as in above
- · o as in pot
- · e as in pet
- u as in mud
- i as in hip

The accent mark indicates the major accent in the term, such as in terminology (ter-min-ol'-ō-jē) and anatomy (a-nat'-ō-mē).

You can best learn new terms and their meanings by preparing *flash cards* from  $3 \times 5$  index cards. Place the term on one side and the definition on the other. *Place only one term on each card*.

- 4. Use a highlighter pen liberally to mark the key statements in each paragraph as you read. This will help you identify the key points to study later on. You may want to make flash cards to help you learn these key points.
- Review questions are strategically located in the text to allow you to check your understanding of each major section. It is important to be able to answer these questions correctly before proceeding.
- 6. After reading the chapter, review the *Chapter Summary* to be sure that you understood the key points of the chapter. This section will give you a quick review of the chapter later on as well.
- 7. Learning new terms is one of the more difficult aspects of a course in anatomy and physiology. After reading a chapter, use *Building Your Vocabulary* to help you master the terminology. Review the list of *Selected New Terms* to be sure that you know their meanings. If not, look them up in the chapter or in the glossary. Then learn the *Related Clinical Terms* to start building your clinical vocabulary.
- 8. After you think that you understand the topics pretty well, complete the *Study Activities* to reinforce your understanding and bring to your attention those topics that you need to study a bit more.
  - Complete the Study Guide for the chapter you are studying. It covers the major points of the chapter, and it includes a few critical thinking questions that apply your knowledge to clinical situations. You may find it easier to remove the chapter study guide from the text before completing it. You can keep the study guides in a loose-leaf notebook. Your instructor has the answer key so you can check your responses.
  - Complete the Learning Objectives listed on the first page of each chapter. If you can explain the concepts and mechanisms correctly in your own words, you know the topics well.
- 9. Finally, complete the *Check Your Understanding* self-test. The answers to the questions are located in appendix B for immediate feedback. If you have thoughtfully completed all of these study aides and have answered the questions correctly, you may be confident of your understanding.

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# Chapter Preview & Learning Objectives

# R Introduction to the Human Body

#### **Anatomy and Physiology**

Contrast anatomy and physiology.

#### Levels of Organization

- · List and describe the levels of organization in the human body.
- List the major organs and functions for each organ system.

#### **Directional Terms**

· Use directional terms to describe the location of body parts.

#### **Body Regions**

· Locate the major body regions on a chart or manikin.

#### **Body Planes and Sections**

· Name and describe the four planes used in making sections of the body or body parts.

#### **Body Cavities**

- Name the two major body cavities, their subdivisions and membranes, and locate them on a chart or manikin.
- · Name the organs located in each body cavity.

#### **Abdominopelvic Subdivisions**

· Name the abdominopelvic quadrants and nine regions, locate them on a chart or manikin, and list the major internal organs found in each.

#### Maintenance of Life

- · Describe the general nature of metabolism.
- · List the five basic needs essential for human life.
- · Define homeostasis and explain its relationship to both normal body functions and disorders.

**Chapter Summary Building Your Vocabulary Study Activities Check Your Understanding** 

# SELECTED KEY TERMS

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

**Anterior** (ante = before, in front of) The abdominal or ventral side of the body.

**Appendicular** (append = to hang) Pertaining to the extremities (arms and legs).

Axial (ax = axis) Pertaining to the longitudinal axis of the body. Cephalic (cephal = head) Pertaining to the head. Cervical (cervic = neck) Pertaining to the neck. Homeostasis (homeo = same; sta = make stand or stop) Maintenance of a relatively stable internal environment.

**Meninges** (mening = membrane) Membranes covering the brain and spinal cord.

**Metabolism** (metabole = change) The sum of the chemical reactions (changes) 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** (peri = around; ton = to stretch) The membrane lining the abdominal cavity and covering the abdominal organs.

**Physiology** (physio = nature; logy = study of) The study of the functioning of living organisms. **Pleura** (pleura = rib) The membrane lining the thoracic cavity. **Posterior** (post = after, behind)

The dorsal or backside of the body.

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

Y

ou are beginning a fascinating and challenging study—the study of the human body. As you progress through this text, you will begin to understand the com-

plexity of organization and function found in the human organism. Keep in mind that the goals of your study are to learn (1) how the body is structured and organized and (2) how the body functions.

This first chapter provides an overview of the human body to build a foundation of knowledge that is necessary for your continued study. Like the chapters that follow, this chapter introduces a number of new terms that must be learned. It is important that you start to build a vocabulary of technical terms and continue to develop it throughout your study.

# **Anatomy and Physiology**

Knowledge of the human organism is obtained primarily from two scientific disciplines—anatomy and physiology—and each consists of a number of subdisciplines.

Human **anatomy** (ah-nat'-ō-mē) is the study of the structure and organization of the body and its parts. There are two subdivisions of anatomy. *Gross anatomy* involves the dissection and examination of various parts of the body without magnifying lenses. *Microanatomy* consists of the microscopic examination of tissues and cells.

Human **physiology** (fiz-ē-ol'-ō-jē) is the study of the function of the body and its parts. Physiology involves observation and experimentation, and it usually requires the use of specialized equipment and materials. In your study of the human body, you will see that there is always a definite relationship between the anatomy and physiology of the body and body parts.

# **Levels of Organization**

The human body is complex, so it is not surprising that there are several levels of structural organization, as shown in figure 1.1.

#### **Chemical Level**

At the simplest level, the body is composed of chemical substances that are formed of atoms and molecules. *Atoms* are the fundamental building blocks of chemicals, and atoms combine in specific ways to form *molecules*. Some molecules are very small, such as water molecules, but others may be very large, such as the macromolecules of proteins.

#### Cellular Level

Various combinations of chemical substances form the trillions of cells composing the body. **Cells** are the basic structural and functional units of the body because all of the processes of life occur within cells. The body is composed of many different types of cells. Muscle cells, blood cells, and nerve cells are examples.

Cells contain subunits called *organelles* that carry out specific functions within the cells. Organelles are formed of both small and large molecules.