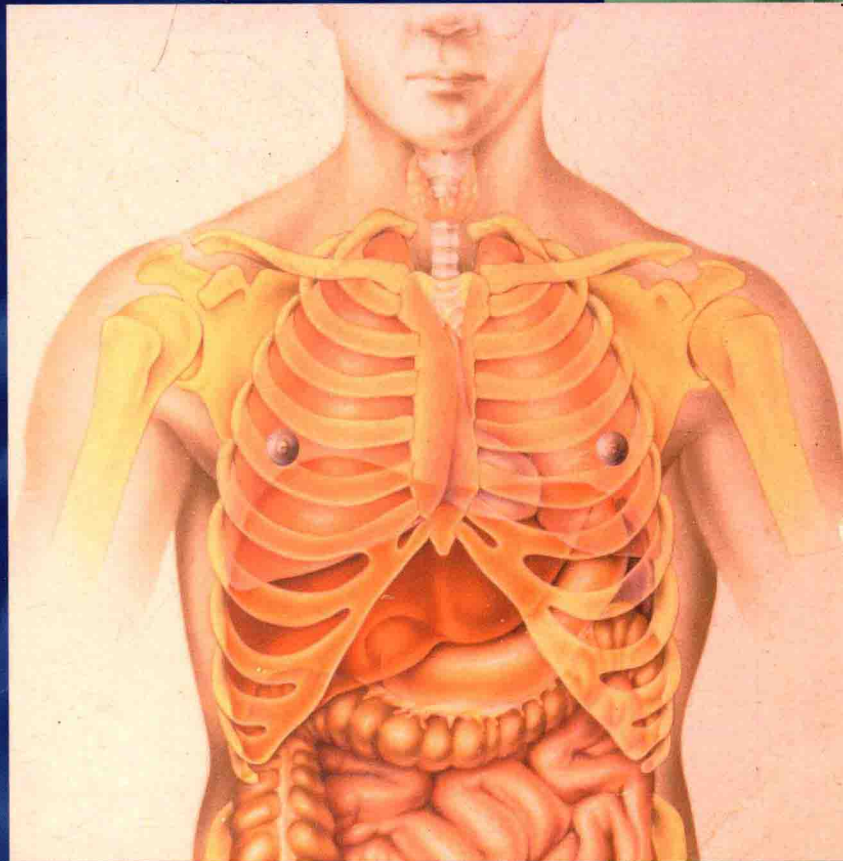


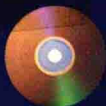
LEARNING HUMAN ANATOMY

A Laboratory Text & Workbook

THIRD EDITION



JULIA F. GUY



CD-ROM Included

learning HUMAN ANATOMY

A Laboratory Text & Workbook

Third Edition

Julia F. Guy, MS, PhD
Assistant Professor
The Ohio State University
College of Medicine and Public Health
Division of Anatomy
Columbus, Ohio

With Illustrations by
Pamela Blackshere Lewis
Susan J. Myers
Gina Lapurga



Upper Saddle River, New Jersey 07458

NOTICE

The author[s] and the publisher of this volume have taken care that the information and technical recommendations contained herein are based on research and expert consultation, and are accurate and compatible with the standards generally accepted at the time of publication. Nevertheless, as new information becomes available, changes in clinical and technical practices become necessary. The reader is advised to carefully consult manufacturers' instructions and information material for all supplies and equipment before use, and to consult with a healthcare professional as necessary. This advice is especially important when using new supplies or equipment for clinical purposes. The author[s] and publisher disclaim all responsibility for any liability, loss, injury, or damage incurred as a consequence, directly or indirectly, of the use and application of any of the contents of this volume.

Publisher: *Julie Levin Alexander*
Publisher's Assistant: *Regina Bruno*
Senior Acquisitions Editor: *Mark Cohen*
Associate Editor: *Melissa Kerian*
Editorial Assistant: *Jaquay Felix*
Director of Manufacturing and Production: *Bruce Johnson*
Managing Editor for Production: *Patrick Walsh*
Production Liaison: *Cathy O'Connell*
Production Editor: *Bruce Hobart/Pine Tree Composition, Inc.*
Manufacturing Manager: *Ilene Sanford*
Manufacturing Buyer: *Pat Brown*
Creative Director: *Cheryl Asherman*
Senior Design Coordinator: *Christopher Weigand*
Cover Designer: *Kevin Kall*
Director of Marketing/Marketing Manager: *Karen Allman*
Channel Marketing Manager: *Rachele Strober*
Marketing Coordinator: *Janet Ryerson*
Media Editor: *John Jordan*
Media Production Manager: *Amy Peltier*
Media Project Manager: *Stephen Hartner*
Composition: *Pine Tree Composition*
Printer/Binder: *The Banta Company, VA*
Cover Printer: *Phoenix Color Corp.*

Copyright © 2005 by Pearson Education, Inc., Upper Saddle River, New Jersey 07458

Pearson Prentice Hall. All rights reserved. Printed in the United States of America. This publication is protected by Copyright and permission should be obtained from the publisher prior to any prohibited reproduction, storage in a retrieval system, or transmission in any form or by any means, electronic, mechanical, photocopying, recording, or likewise. For information regarding permission(s), write to: Rights and Permissions Department.

Pearson Prentice Hall™ is a trademark of Pearson Education, Inc.
Pearson® is a registered trademark of Pearson plc
Prentice Hall® is a registered trademark of Pearson Education, Inc.

Pearson Education LTD.
Pearson Education Singapore, Pte. Ltd
Pearson Education, Canada, Ltd
Pearson Education-Japan
Pearson Education Australia PTY, Limited

Pearson Education North Asia Ltd
Pearson Education de Mexico, S.A. de C.V.
Pearson Education Malaysia, Pte. Ltd
Pearson Education, Upper Saddle River, New Jersey



10 9 8 7 6 5 4 3 2
ISBN 0-13-143320-2

Preface

The third edition of *Learning Human Anatomy: A Laboratory Text and Workbook* continues to be a unique resource for introductory human anatomy courses/labs that use human cadavers and human organs (or models) as demonstration tools. The book has been written in an outline format and is designed to help students organize the anatomical material and find information quickly. Much of the text is included within the illustration keys, so the visual image of the *structure*, its *name*, and its *purpose* in an anatomical position can be related. The illustrations continue to emphasize the anatomy that is vital for a one-term, introductory course, or for general review. A reference text will still be required by students who need great amounts of detailed information.

The idea for this book was conceived from a need for a gross anatomy guide for undergraduates; therefore, its treatment of embryology and histology is minimal. Some basic understanding of biology (cell organization and function) is assumed, but not necessary.

Because anatomy is a visual science, the lab experience is vital in understanding three-dimensional relationships. For this reason, the more time spent looking at the structures, relating them to the living body, and forming mental images, the more easily the student will learn the material. Further, it aids the student in understanding the *relationships* and *organization* of the *major structures* within a given *body region*.

To further the understanding of relationships within body regions, this book presents a combined regional and systemic approach to human anatomy. Regionally, the body is divided into four units, as is the book:

- Lower Limb
- Upper Limb
- Head & Neck
- Abdominopelvis & Thorax

Activities and exercises are designed to reinforce each lesson and help students form the mental images and the understanding of positions on their own bodies, which will help in remembering the information. The illustrations are designed to be actively integrated into the student's study and instructions are noted to direct students to make their own colored illustrations. *Clinical comments* make selected information more clinically relevant. In this *third edition* there are several new illustrations as well as additional clinical comments, more functional anatomy, and a few more exercises. When the course is completed and this book is used as designed, the student will own a customized review book, created in part, by the student.

SUPPLEMENTAL LABORATORY CD-ROM SAMPLE INCLUDED

In the back of this book you will find a sample CD that includes one lesson from each of the four units of the book. The lessons were chosen to give an overview of the manner in which different material is presented. The ANATLAB (Anatomy Lab) program parallels the information in the book

and provides real cadaver views of the major structures of the body. It is an interactive multimedia tutorial that helps the student visualize the body three-dimensionally. It is unique in its use of narrated cadaver demonstrations that make the information in the lab text come alive. Many of the illustrations that have been so well received by students who used the first and second editions of the book are included within the computer program. These illustrations are often compared to real cadaver images, bones, or x-rays. The computer program supplements the book by providing a cadaver orientation to all the anatomical structures, and by helping with the pronunciation of words. It is a tutorial, so answering the questions within the lesson helps the student really understand the anatomy. Quizzes at the end of each of the 28 lessons and unit quizzes following each of the four units check for mastery of the subject. *The Anatomy Lab* runs on both Windows and Macintosh formats. To purchase, see the order form at the back of this book.

Acknowledgments

I would like to thank my friend and colleague, Susan Turner, PhD, for her ongoing review, counsel, and encouragement. I also wish to express my appreciation for the positive comments and suggestions of the many students who have used this book.

Reviewers

Fredric Bassett, MS
Professor
Health Sciences Division
Rose State College
Midwest City, Oklahoma

Edward W. Carroll, Ph.D.
Clinical Assistant Professor
Department of Biomedical Sciences
Marquette University
Milwaukee, Wisconsin

Suzanne M. Cooke Schreiber
Instructor
University of New Hampshire
Durham, New Hampshire

Marie L. Hornyik, Ph.D., ATC
Assistant Professor
Department of Health and Kinesiology
Purdue University
West Lafayette, Indiana

Jonathan K. Kalmey, Ph.D.
Assistant Professor of Anatomy
College of Medical Sciences
Nova Southeastern University
Fort Lauderdale, Florida

Roberto Lopez-Rosado, MA
Instructor
Department of Physical Therapy
Florida Gulf Coast University
Fort Myers, Florida

Judith L. Schotland, Ph.D.
Assistant Professor
Department of Health Sciences
Boston University
Boston, Massachusetts

Howard Spector, Ph.D.
Lecturer
Oakland University
Rochester, Michigan

John Storsved, HSD, ATC/L
Clinical Assistant Professor
Purdue University
West Lafayette, Indiana

Mark D. Womble, Ph.D.
Associate Professor
Department of Biological Sciences
Youngstown State University
Youngstown, Ohio

Contents

<i>Preface</i>	vii
<i>Acknowledgments</i>	ix
UNIT I OVERVIEW OF BODY SYSTEMS AND THE LOWER LIMB	1
1. Introductory Terminology and Orientation to the Body	2
2. Osteology: The Study of Bone	12
3. Bones of the Pelvic Girdle and Lower Limb	17
4. Arthrology: The Study of Joints	26
5. Myology: The Study of Muscles	30
6. Muscles of the Hip and Thigh	35
7. Muscles of the Leg and Foot	47
8. Introduction to the Nervous System	58
9. Nerves of the Lower Limb	63
10. Introduction to the Cardiovascular System	72
11. Blood Vessels of the Lower Limb	76
12. Special Areas of the Lower Limb	82
13. Review of Unit I	88
UNIT II THE BACK AND THE UPPER LIMB	93
14. The Axial Skeleton	94
15. Muscles of the Axial Skeleton	102
16. Bones of the Pectoral Girdle and Upper Limb	104
17. Arthrology of the Upper Limb	111
18. Muscles of the Shoulder and Arm	112
19. Muscles of the Forearm and Hand	123
20. Nerves of the Upper Limb	132
21. Blood Vessels of the Upper Limb	138
22. Special Areas of the Upper Limb	143
23. Review of Unit II	147
UNIT III THE HEAD AND NECK	151
24. The Skull	152
25. The Brain	163
26. Meninges and Circulation of the Brain	173
27. Functions of the Cerebrum	181
28. Spinal Cord and Tracts	185
29. Cranial Nerves	194
30. Organs of Special Sense	203
31. Muscles and Vessels of the Head and Neck	209
32. The Autonomic Nervous System	218
33. Review of Unit III	224

UNIT IV THE ABDOMEN, PELVIS, AND THORAX	231
34. Muscles of the Abdomen and Pelvis	232
35. Digestive System and Peritoneum	236
36. Vessels and Nerves of the Abdomen and Pelvis	249
37. The Urinary System	259
38. The Male Reproductive System	265
39. The Female Reproductive System	272
40. The Endocrine System	279
41. The Thorax: Muscles, Nerve and Blood Supply	282
42. The Respiratory System	289
43. The Heart	299
44. Fetal Circulation	307
45. The Lymphatic System	310
46. Review of Unit IV	313
<i>Appendix Answers to Exercises and Student Activities</i>	319
<i>Index</i>	353

Overview of Body Systems and the Lower Limb

With Detailed Introductions to:

- Skeletal System
- Muscular System
- Nervous System
- Cardiovascular System

Introductory Terminology and Orientation to the Body

The language of anatomy must be learned in order to understand the discipline. You will be exposed to new terminology throughout the course so we can communicate accurately as we discuss anatomical structures.

■ OBJECTIVES

1. State the meaning of the important anatomical terms listed.
2. Use the terms of position in describing anatomical structures.
3. Describe the planes that are used in cutting anatomical material.
4. Define the regions of the body.

■ METHODS

1. Study the list of words below. Use your own body to locate body parts and terms of position.
2. Listen for the new words when they are used by the instructor; practice using them yourself.
3. Complete the activities and Exercise 1.

A. GENERAL TERMINOLOGY

1. **Gross Anatomy:** the study of large (gross) structures that can be seen with the naked eye.
2. **Histology:** microscopic study of cells and tissues.
3. **Tissue:** groups of cells that are similar in structure and that function together.
The four primary tissues are:
 - a. **epithelial**—forms the linings and coverings of free surfaces of the body.
 - b. **connective**—supportive and binding tissue found throughout the body.
Examples: bone, tendons, cartilage.
 - c. **muscle**—contractile tissue for movement.
 - d. **nerve**—communication cells capable of sending impulses.
4. **Organ:** groups of tissues that work together to perform a common function.
Examples: heart, lungs, kidneys, liver.
5. **System:** a group of organs working together to perform a common function.
Examples: circulatory, respiratory, urinary.
6. **Neuroanatomy:** study of the structure of the nervous system.
7. **Embryology:** study of the developing organism from the time of fertilization to birth.

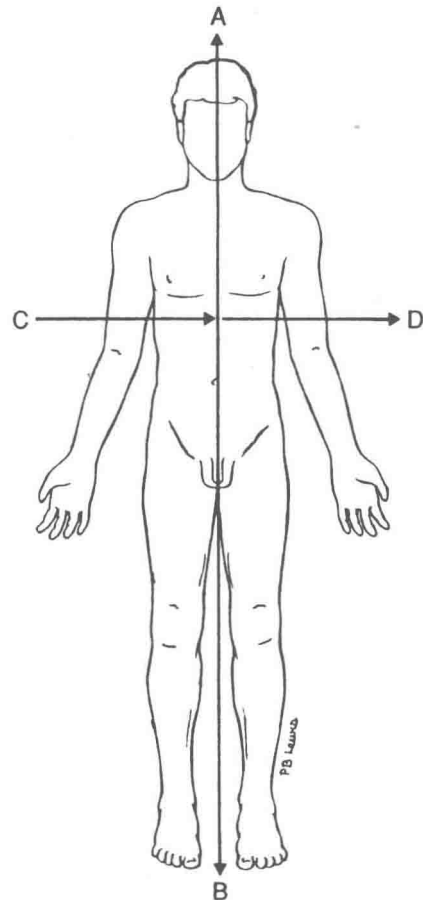
8. **Germ cell layers:** the three layers of embryonic tissue from which all body tissues are derived.
 - a. **endoderm**—innermost of three germ cell layers. It will form most of the linings of tubular structures of the body.
 - b. **ectoderm**—outer germ cell layer. Derivatives: skin and the nervous system.
 - c. **mesoderm**—layer between the endoderm and the ectoderm. Derivatives: muscles and connective tissues.
9. **Fascia:** compact layers of connective tissue that form a fibrous membrane. It invests the whole body, supporting and separating muscles and organs.
10. **Collagen:** the protein that makes up the fibers in connective tissue structures.
11. **Ligaments:** thickened connective tissue (collagen fibers), which serves to hold bones together.
12. **Tendons:** thickened, dense connective tissue that holds muscle to bone.
13. **Aponeurosis:** a broad, flat tendon.
14. **Regional study:** all the structures in an area are studied together. Example: lower extremity includes bones, muscles, nerves, and vessels.
15. **Systematic (systemic) study:** studying a complete system independent of region. Example: learning all the bones of the body.
16. **Anatomic position:** the body is standing erect, face toward observer, with feet together and parallel, the arms at the sides and palms directed forward.

B. DIRECTIONAL TERMINOLOGY

See Figure 1–1A and B (Anterior and Lateral Views).

FIGURE 1–1A
ANTERIOR VIEW

1. **Anterior (ventral):** refers to the front surface of the body.
2. **Posterior (dorsal):** refers to the back surface of the body.
3. **Superior (cranial):** nearer the head end, line A.
4. **Inferior (caudal):** farther from head end, line B.
5. **Superficial (external):** nearer the surface.
6. **Deep (internal):** farther from the surface.
7. **Medial:** nearer the mid-plane of the body (C).
8. **Lateral:** farther from the mid-plane of the body (D).
9. **Proximal:** nearest the point of origin. If used with extremities, closer to the attachment. If used with an organ, closer to the organ.
10. **Distal:** farthest from point of origin.

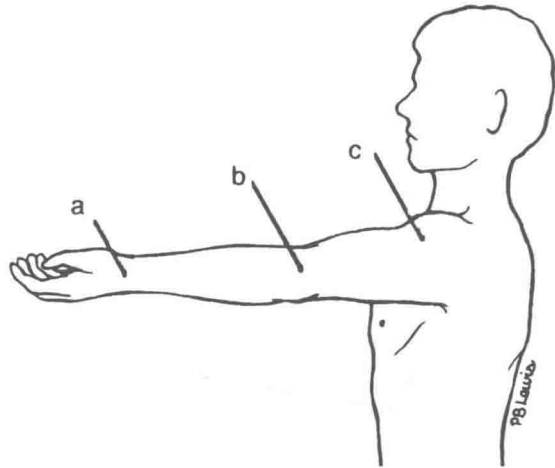


■ Student Activities

Using the terms “proximal” and “distal,” fill in the blanks to compare the relative positions of the shoulder, elbow, and wrist in Figure 1-1B.

FIGURE 1-1B
LATERAL VIEW

1. a is _____ to b;
b is _____ to a.
2. c is _____ to b;
b is _____ to c.
3. c is _____ to a;
a is _____ to c.



C. PLANES, REGIONS, AND CAVITIES OF THE BODY

To study anatomical material it is often advantageous to look at internal structures by making cuts in specific planes. For instance, a coronal plane would be used in some areas, but a transverse section (cross section) provides a better view of muscles around a bone in the limbs.

FIGURE 1-2
PLANES OF THE BODY

1. **Median (midsagittal) plane:** a vertical plane that divides the body into right and left halves. (*Color it yellow.*)
2. **Sagittal plane:** (not illustrated) a vertical plane parallel to the median plane.
3. **Coronal (frontal) plane:** a vertical plane at right angles to the median plane. It divides the body into anterior and posterior portions. (*Color it light blue.*)
4. **Transverse plane:** a horizontal plane at right angles to both the median and frontal planes. It cuts the body into superior and inferior portions.

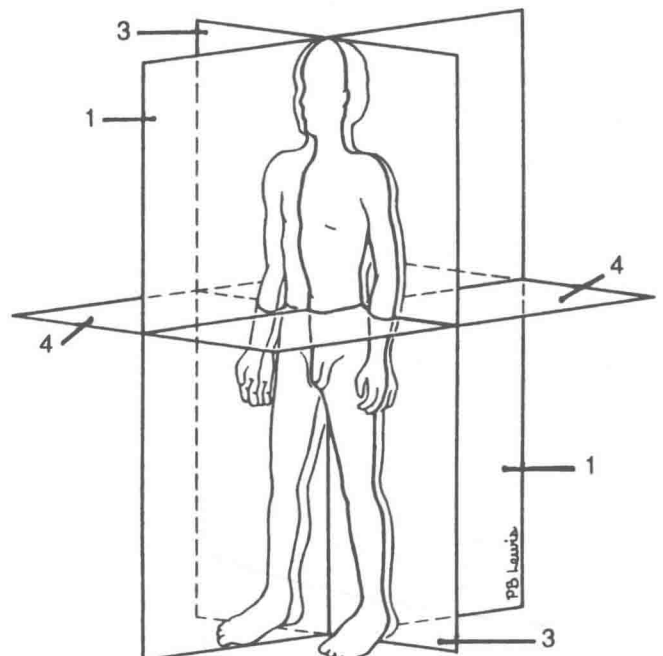


FIGURE 1-3
REGIONS OF THE BODY

1. Head and neck
2. Upper limb
3. Thorax
4. Abdomen
5. Pelvis
6. Lower limb

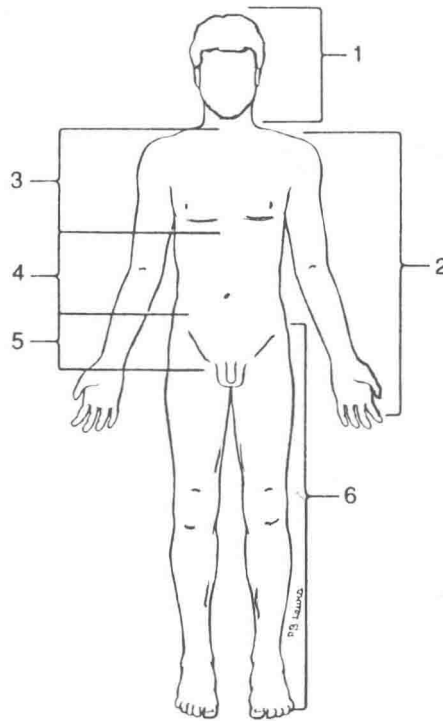
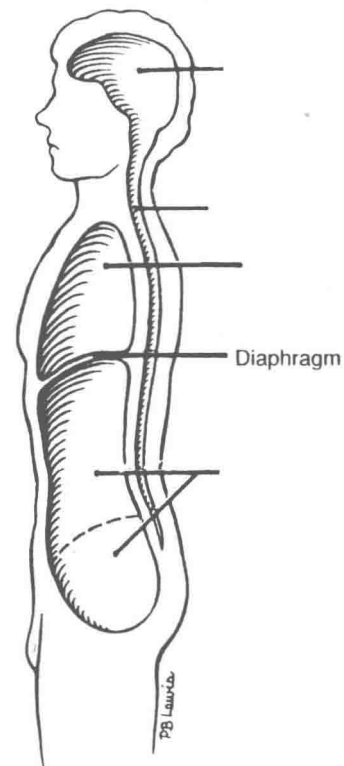


FIGURE 1-4
BODY CAVITIES

Many organs of the body are located in body cavities. Ventrally, a large cavity is subdivided by the diaphragm. Above the diaphragm, the thoracic cavity houses the lungs and the heart; below the diaphragm, the abdominopelvic cavity contains the major organs of digestion, reproduction, and the urinary system.

The cranial cavity houses the brain; the spinal cavity houses the spinal cord and spinal nerves. Together these are referred to as the dorsal body cavity.



■ Label the cavities in Figure 1-4.

D. OVERVIEW OF BODY SYSTEMS

In order for the body to work as a unified whole, many systems must work together. The anatomy of the systems will be illustrated as we encounter them in the various regions of the body. Figures 1–5 to 1–13 complete the general terminology and introductory overview of the body.

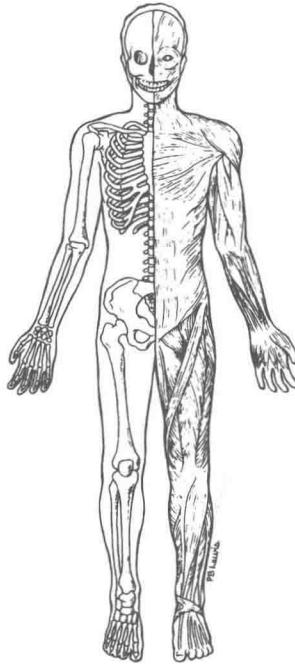
**FIGURE 1–5
SKELETAL SYSTEM**

Structural Components:

- Bones
- Cartilage
- Tendons
- Ligaments
- Joints

Functions:

- Support
- Protection (organs)
- Leverage in movement
- Produce blood cells
- Storage of minerals



MUSCULAR SYSTEM

Structural Components:

- Skeletal muscle
- Cardiac muscle (heart)
- Smooth muscle (walls of hollow organs)

Functions:

- Movement
- Heat production

**FIGURE 1–6
CIRCULATORY SYSTEM**

Components:

- Heart
- Blood vessels
- Blood

Functions:

- Transports oxygen and nutrients to the cells, and transports carbon dioxide and wastes away.
- Carries hormones and other substances to areas of the body where they are needed.

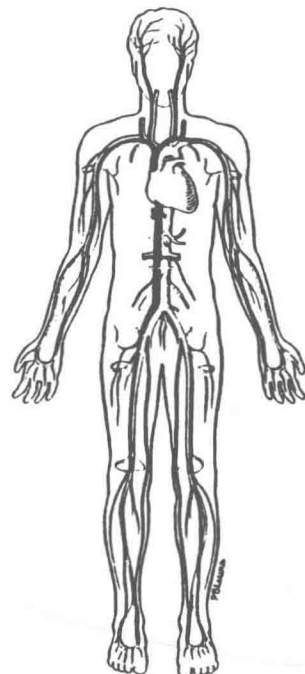


FIGURE 1-7
LYMPHATIC SYSTEM

Components:

- Lymph vessels and nodes
- Spleen
- Thymus gland
- Tonsils

(With red bone marrow, these are structures of the *immune system*, a functional system.)

Functions:

- Returns lymph (formerly interstitial fluid) to the cardiovascular system.
- Filters blood and lymph.
- Produces white blood cells to protect the body from disease.

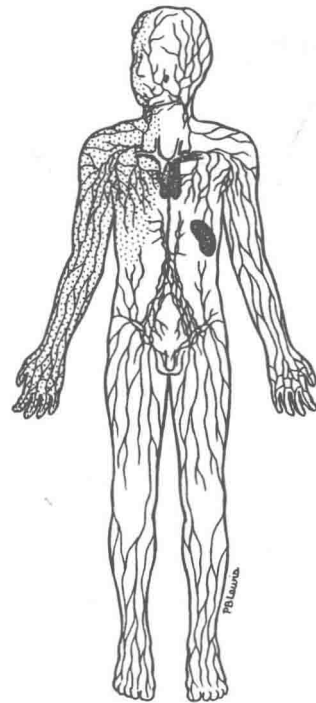


FIGURE 1-8
NERVOUS SYSTEM

Components:

- Brain
- Spinal cord
- Nerves
- Sense organs: eyes, ears, tongue, and sensory receptors in the skin

Function:

- Communication system that detects changes in internal and external body environment and, by way of a nerve impulse, responds by producing some effect in muscle or gland.

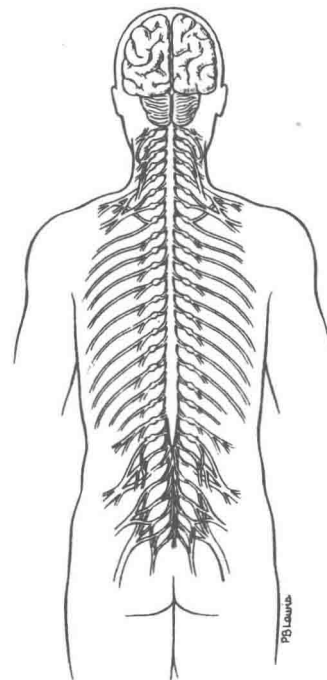


FIGURE 1-9
ENDOCRINE SYSTEM

Components:

- Hormone-producing structures:
- Pituitary, pineal, thyroid, parathyroid, and adrenal glands
- Ovaries, testes, and pancreas

Functions:

- Communications system that uses hormones as chemical messengers.
- Helps maintain homeostasis by regulating body activities.

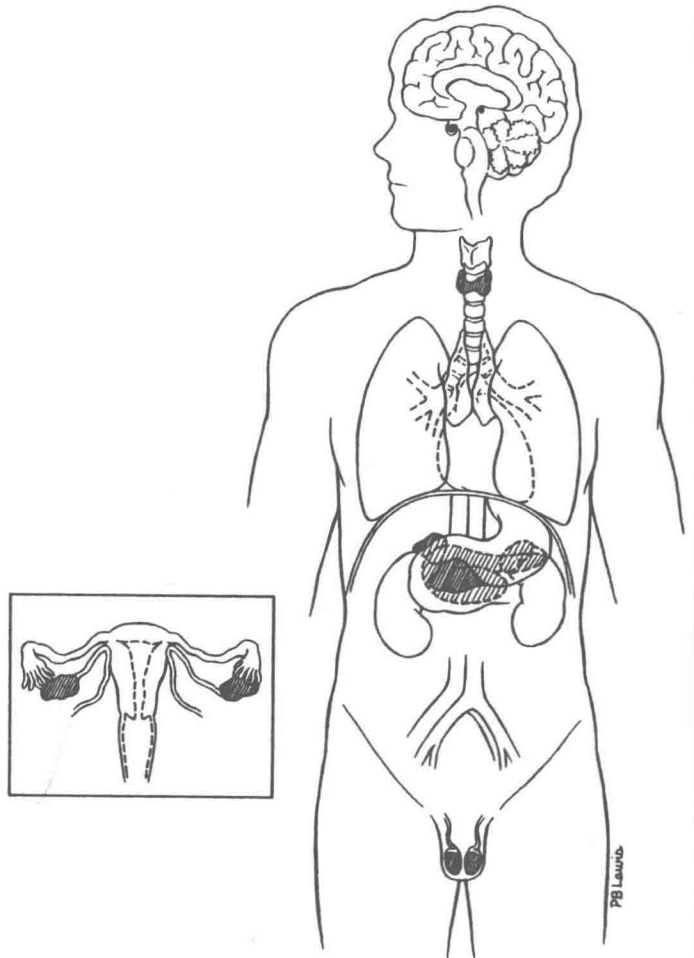


FIGURE 1-10
RESPIRATORY SYSTEM

Components:

- Nasal cavity
- Pharynx
- Larynx
- Trachea
- Bronchi
- Lungs

Functions:

- Supplies oxygen and removes carbon dioxide.
- Helps regulate acid-base balance.

