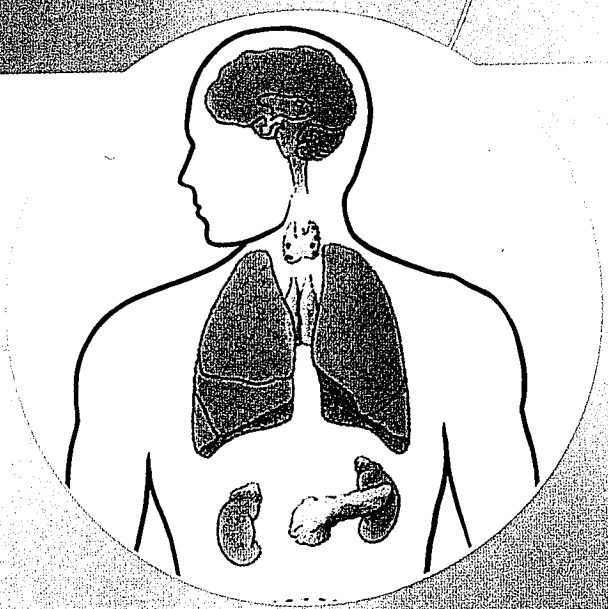
3

Organ Systems of the Body



Study Tips

Chapter Two should be a review of your general biology course; most of what is in this chapter should sound familiar.

The section on cell structures begins with the plasma membrane. It is made up mostly of phospholipids, but the most important part of the membrane structure to remember is the proteins embedded in the phospholipids. They play important roles in a number of systems in the body such as the nervous or endocrine systems. The organelles may seem to have strange-sounding names but many of the names can give you a clue about what they do. *-some* means "body" or "structure," *lysis* means "to digest" or "destroy," so the name *lysosome* tells you what it does. Ribosomes are made of ribonucleic acid. *Endo-* means "inside of," *plasmic* means "liquid" and *reticulum* means "net-like," so *endoplasmic reticulum* is self-explaining. Flash cards are probably helpful in learning this material. The transport processes of osmosis and dialysis are special cases of diffusion, osmosis with water and dialysis with solutes. Filtration uses a pressure rather than a concentration difference to move substances. *Phago* means "eat," *pino* means "drink," *cyto* means "cell," and *-asis* means "condition." *Phagocytosis* and *pinocytosis* are descriptions of what is going on in the cell. When studying protein synthesis, keep the goal of the process in mind. The cell wants a protein made. The DNA has the plans, but the ribosome is the factory. The DNA needs to tell the ribosome what to build (transcription), and the factory needs to have the pieces in the correct order (translation). Use flash cards to study the phases of mitosis; remember that the phases in mitosis are based on what is happening to the chromosomes. Tissue types are also a flash card topic. It may help to remember that epithelial tissues are covering or protective tissues and that the important thing about connective tissues is the matrix surrounding the cells.

In your study groups, go over the flash cards for the organelles, mitosis, and tissues. Be sure to discuss the steps of protein synthesis and the cell transport processes. Go over the questions in the back of the chapter and discuss possible test questions.

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Objectives

AFTER YOU HAVE COMPLETED THIS CHAPTER, YOU SHOULD BE ABLE TO:

1. Define and contrast the terms *organ* and *organ system.*
2. List the 11 major organ systems of the body.
3. Identify and locate the major organs of each major organ system.
4. Briefly describe the major functions of each major organ system.
5. Identify and discuss the major subdivisions of the reproductive system.

The words organ and *system* were discussed in Chapter 1 as having special meanings when applied to the body. An **organ** is a structure made up of two or more kinds of tissues organized in such a way that the tissues can together perform a more complex function than can any tissue alone. A **system** is a group of organs arranged in such a way that they can together perform a more complex function than can any organ alone. This chapter gives an overview of the 11 major organ systems of the body.

In the chapters that follow, the presentation of information on individual organs and an explanation of how they work together to accomplish complex body functions will form the basis for the discussion of each organ system. For example, a detailed description of the skin as the primary organ of the integumentary system will be covered in Chapter 4, and information on the bones of the body as organs of the skeletal system will be presented in Chapter 5. A knowledge of individual organs and how they are organized into groups makes much more meaningful the understanding

of how a particular organ system functions as a unit in the body.

Recent discoveries that have allowed scientists to culture embryonic "stem cells" in the laboratory and then control the differentiation of these primitive cells into specific cell and tissue types, such as muscle or nerve, are exciting and complex advances in biology that will have a profound impact on human health. Although many scientific and ethical questions remain unanswered, the potential now exists for cell, tissue, and organ "engineering" that may well permit repair or total replacement of diseased or damaged organs in a functioning organ system.

When you have completed your study of the major organ systems in the chapters that follow, it will be possible to view the body not as an assembly of individual parts but as an integrated and functioning whole. This chapter names the systems of the body and the major organs that compose them, and it briefly describes the functions of each system. It is intended to provide a basic "road map" to help you anticipate and prepare for the more detailed information that follows in the remainder of the text.

Organ Systems of the Body

In contrast to cells, which are the smallest structural units of the body, organ systems are its largest and most complex structural units. The 11 major organ systems that compose the human body are listed below.

1. Integumentary
2. Skeletal
3. Muscular
4. Nervous
5. Endocrine
6. Cardiovascular (circulatory)
7. Lymphatic
8. Respiratory
9. Digestive
10. Urinary
11. Reproductive
    a. Male subdivision
    b. Female subdivision

Examine Figure 3-1 to find a diagrammatic listing of the body systems and the major organs in each. In addition to the information contained in Figure 3-1, each system is presented in visual form in Figures 3-2 through 3-13. Visual presentation of material is often useful in understanding the interrelationships that are so important in anatomy and physiology.

Integumentary System

Note in Figure 3-2 that the skin is the largest and most important organ in the **integumentary** (in-teg-yoo-MEN-tar-ee) **system.** Its weight in most adults is 20 pounds or more, accounting for about 16% of total body weight and making it the body's heaviest organ. The integumentary system includes the skin and its **appendages,** which include the hair, nails, and specialized sweat- and oil-producing glands. In addition, a number of microscopic and highly specialized sense organs are embedded in the skin. They permit the body to respond to various stimuli such as pain, pressure, touch, and changes in temperature.

The integumentary system is crucial to survival. Its primary function is *protection.* The skin protects underlying tissue against invasion by harmful bacteria, bars entry of most chemicals, and minimizes the chances of mechanical injury to underlying structures. In addition, the skin regulates body temperature by sweating, synthesizes important chemicals, and functions as a sophisticated sense organ.

Skeletal System

The sternum or breastbone, the humerus, and the femur shown in Figure 3-3 are examples of the 206 individual organs (bones) found in the **skeletal system.** The system includes not only bones but also related tissues such as cartilage and ligaments that together provide the body with a rigid framework for support and protection. In addition, the skeletal system, through the existence of **joints** between bones, makes possible the movements of body parts. Without joints, we could make no movements; our bodies would be rigid, immobile hulks. Bones also serve as storage areas for important minerals such as calcium and phosphorus.

FIGURE 3-1

Body systems and their organs.

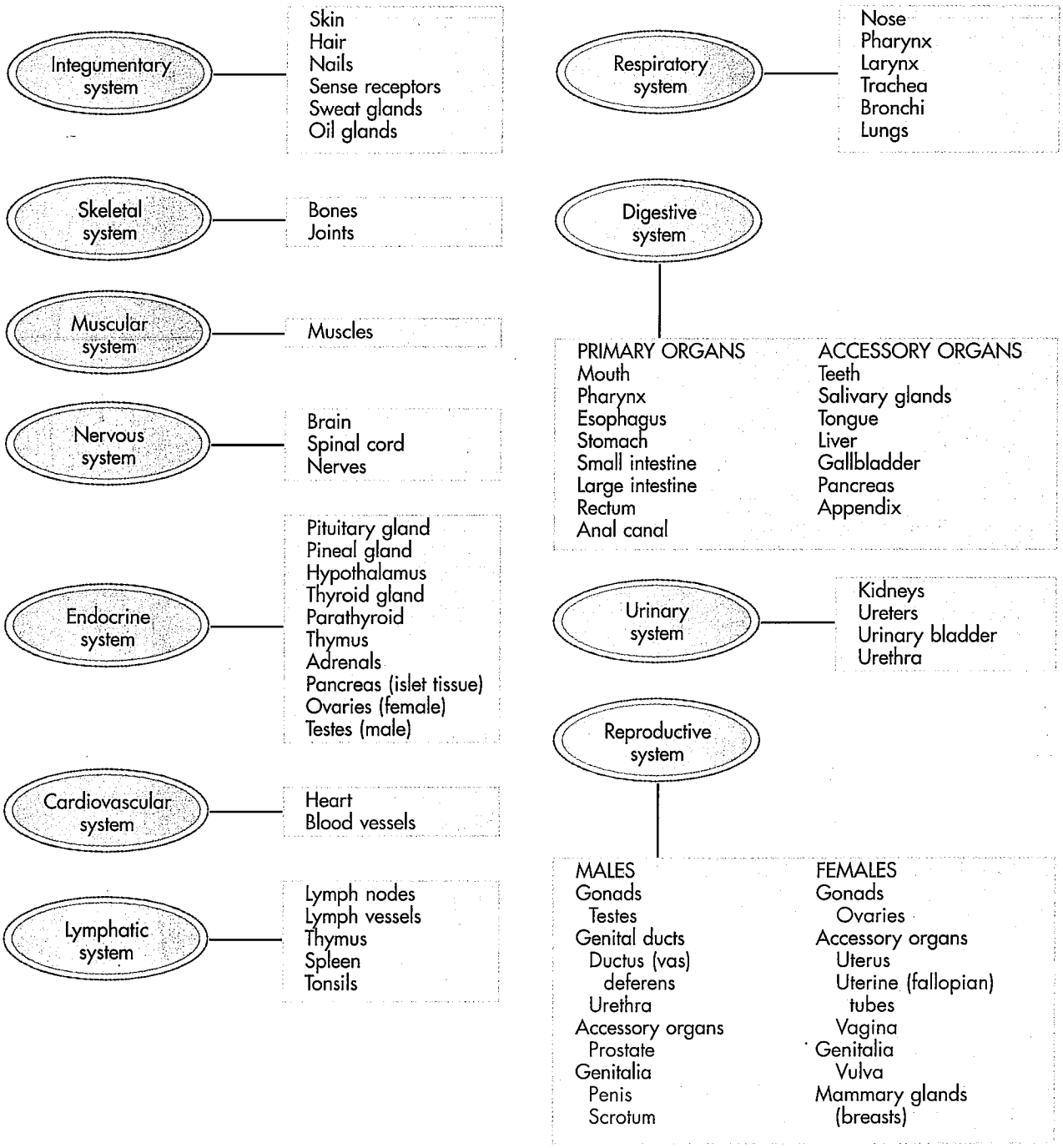


FIGURE 3-2

Integumentary system.

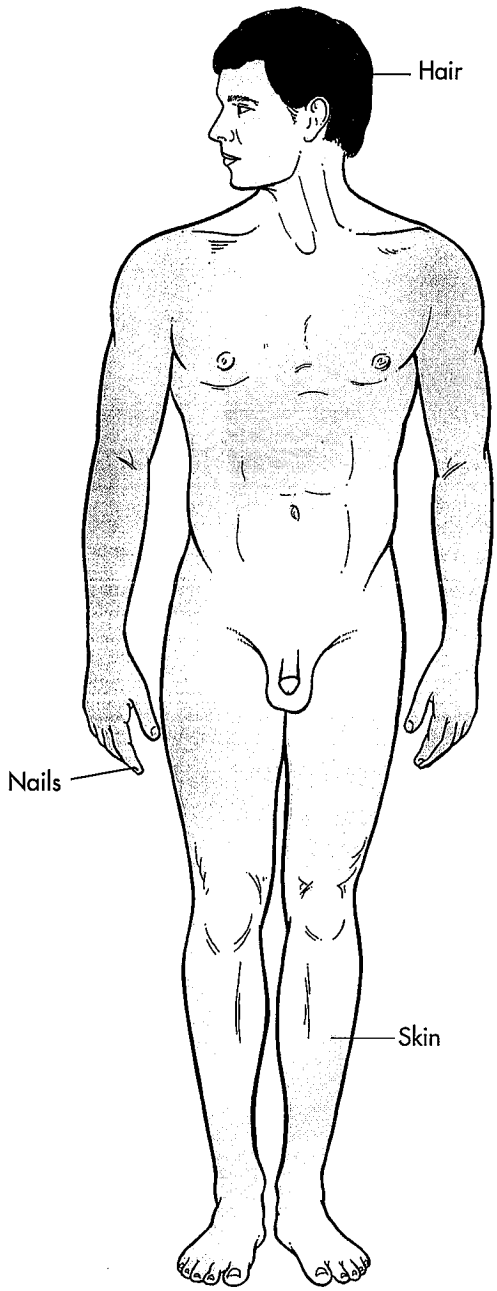
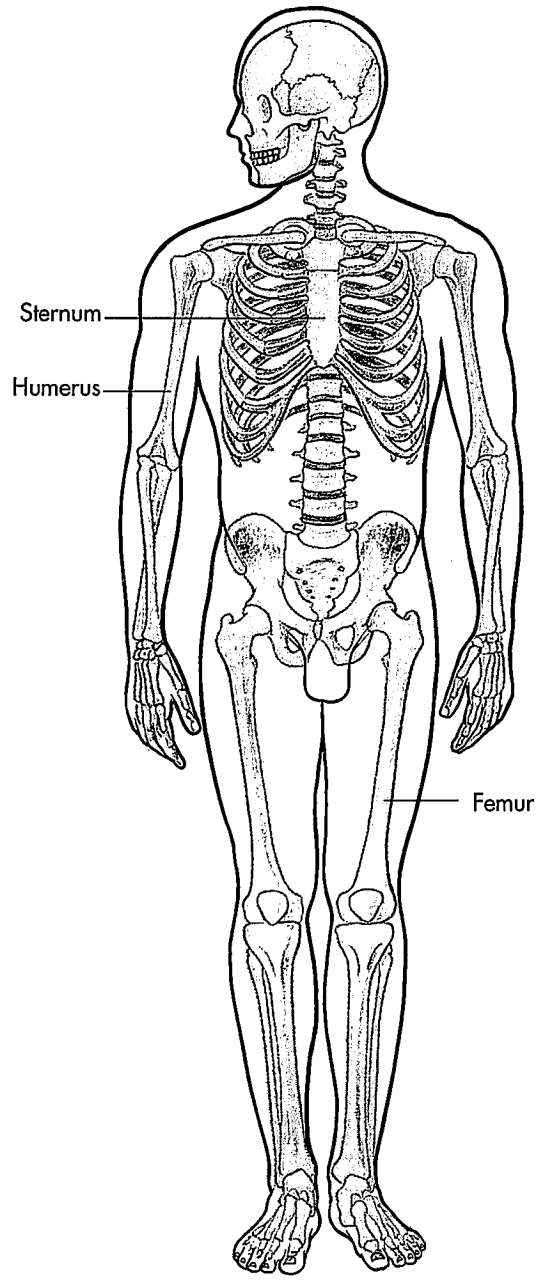


FIGURE 3-3

Skeletal system.



The formation of blood cells in the red marrow of certain bones is another crucial function of the skeletal system.

Muscular System

Individual skeletal muscles are the organs of the muscular system. Muscles not only produce movement and maintain body posture but also generate the heat required for maintaining a constant core body temperature. The skeletal muscles are called **voluntary muscles** because their contractions are under conscious control. In addition to the skeletal or voluntary muscles that constitute the muscular system, two other important types of muscle tissue are found in the body. **Involuntary** or **smooth muscle** tissue is found in blood vessel walls, other tubular structures, and in the lining of hollow organs such as the stomach and small intestine. **Cardiac muscle** is the specialized muscle tissue of the heart.

The tendon labeled in Figure 3-4 represents how tendons attach muscles to bones. When stimulated by a nervous impulse, muscle tissue shortens or contracts. Voluntary movement occurs when skeletal muscles contract because of the way muscles are attached to bones and the way bones articulate or join together with one another in joints.

Nervous System

The brain, spinal cord, and nerves are the organs of the **nervous system.** As you can see in Figure 3-5, nerves extend from the brain and spinal cord to every area of the body. The extensive networking of the components of the nervous system makes it possible for this complex system to perform its primary functions. These include the following:

1. Communication between body functions
2. Integration of body functions
3. Control of body functions
4. Recognition of sensory stimuli

These functions are accomplished by specialized signals called **nerve impulses.** In general, the functions of the nervous system result in rapid activity that lasts usually for a short duration. For

FIGURE 3-4

Muscular system.

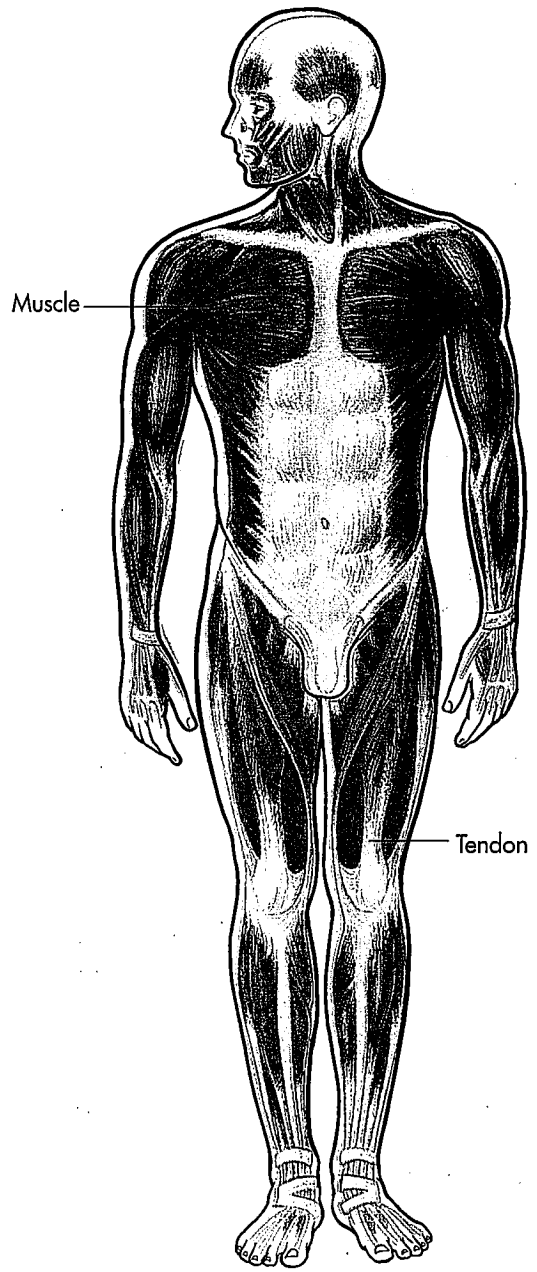


FIGURE 3-5

Nervous system.

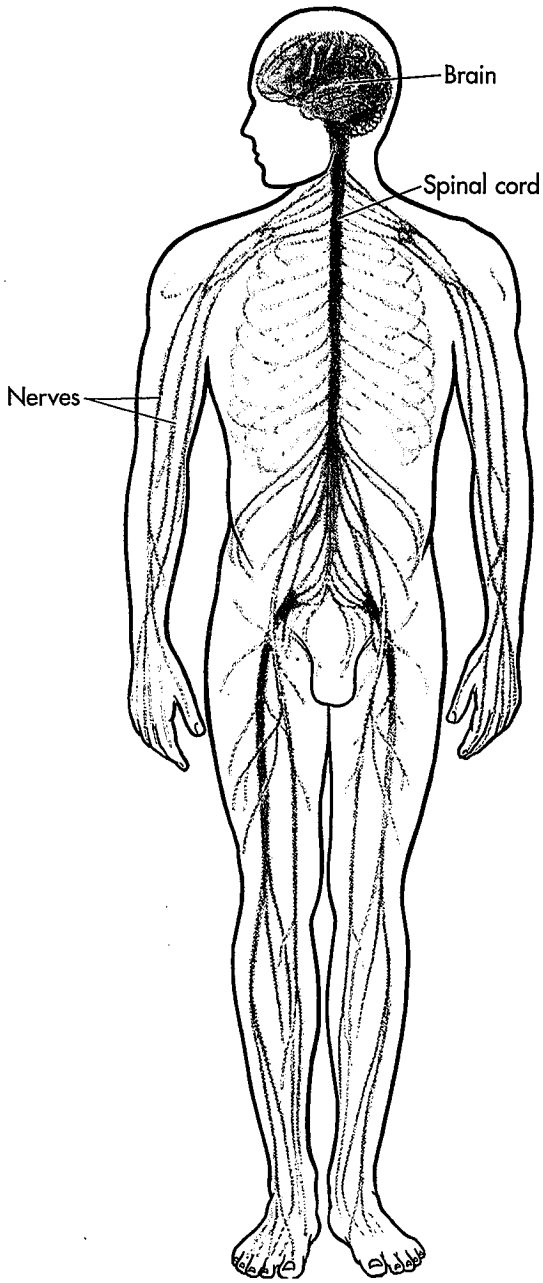
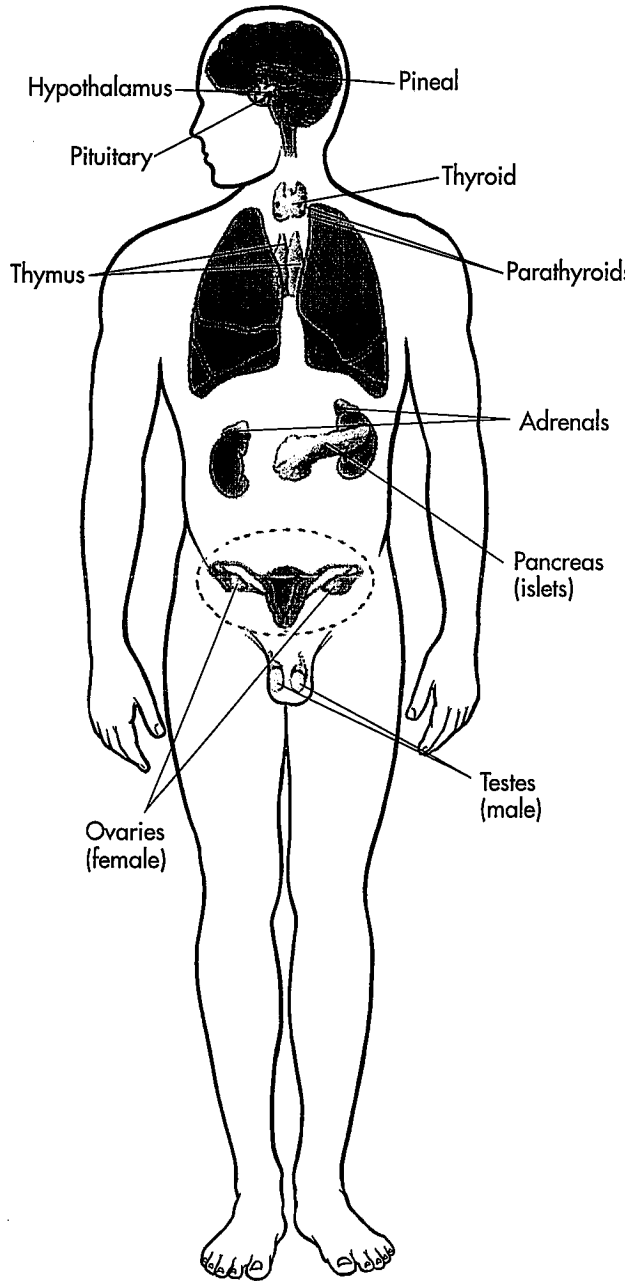


FIGURE 3-6

Endocrine system.



example, we can chew our food normally, walk, and perform coordinated muscular movements only if our nervous system functions properly. The nerve impulse permits the rapid and precise control of diverse body functions. Other types of nerve impulses cause glands to secrete fluids. In addition, elements of the nervous system can recognize certain **stimuli** (STIM-yoo-lye), such as heat, light, pressure, or temperature, that affect the body. When stimulated, these specialized components of the nervous system, called **sense organs** (discussed in Chapter 8), generate nervous impulses that travel to the brain or spinal cord where analysis or relay occurs and, if needed, appropriate action is initiated.

Endocrine System

The **endocrine system** is composed of specialized glands that secrete chemicals known as **hormones** directly into the blood. Sometimes called *ductless glands*, the organs of the endocrine system perform the same general functions as the nervous system: communication, integration, and control. The nervous system provides rapid, brief control by fast-traveling nerve impulses. The endocrine system provides slower but longer-lasting control by hormone secretion; for example, secretion of growth hormone controls the rate of development over long periods of gradual growth.

In addition to controlling growth, hormones are the main regulators of metabolism, reproduction, and other body activities. They play important roles in fluid and electrolyte balance, acid-base balance, and energy metabolism.

As you can see in Figure 3-6, the endocrine glands are widely distributed throughout the body. The **pituitary** (pi-TOO-i-TAIR-ee) **gland, pineal** (PIN-e-al) **gland,** and **hypothalamus** (hi-po-THAL-ah-mus) are located in the skull. The **thyroid** (THY-roid) and **parathyroid** (PAIR-ah-THY-roid) **glands** are in the neck, and the **thymus** (THY-mus) **gland** is in the thoracic cavity, specifically in the mediastinum (see Figure 1-4, p. 5). The **adrenal** (ah-DRE-nal) **glands** and **pancreas** (PAN-kree-as) are found in the abdominal cavity. Note in Figure 3-6 that the ovaries in the female and the testes in the male also function as endocrine glands.

Cardiovascular (Circulatory) System

The **cardiovascular** or **circulatory system** consists of the heart, which is a muscular pumping device as shown in Figure 3-7, and a closed system of vessels made up of **arteries, veins,** and **capillaries.** As the name implies, blood contained in this system is pumped by the heart around a closed circle or circuit of vessels as it passes through the body.

The primary function of the circulatory system is *transportation.* The need for an efficient transportation system in the body is critical. Transportation needs include continuous movement of oxygen and carbon dioxide, nutrients, hormones, and other important substances. Wastes produced by the cells are released into the bloodstream on an ongoing basis and are transported by the blood to the excretory organs. The circulatory system also helps regulate body temperature by distributing heat throughout the body and by assisting in retaining or releasing heat from the body by regulating blood flow near the body surface. Certain cells of the circulatory system can also become involved in the defense of the body or immunity.

Lymphatic System

The **lymphatic system** is composed of **lymph nodes, lymphatic vessels,** and specialized lymphatic organs such as the **tonsils, thymus,** and **spleen.** Note that the thymus in Figure 3-8 functions as an endocrine and as a lymphatic gland. Instead of containing blood, the lymphatic vessels are filled with lymph, a whitish, watery fluid that contains lymphocytes, proteins, and some fatty molecules. No red blood cells are present. The lymph is formed from the fluid around the body cells and diffuses into the lymph vessels. However, unlike blood, lymph does not circulate repeatedly through a closed circuit or loop of vessels. Instead, lymph flowing through lymphatic vessels eventually enters the circulatory system by passing through large ducts, including the **thoracic duct** shown in Figure 3-8, which in turn connect with veins in the upper area of the thoracic cavity. Collections of lymph nodes can be seen in the axillary (armpit) and in the inguinal

FIGURE 3-7

Cardiovascular (circulatory) system.

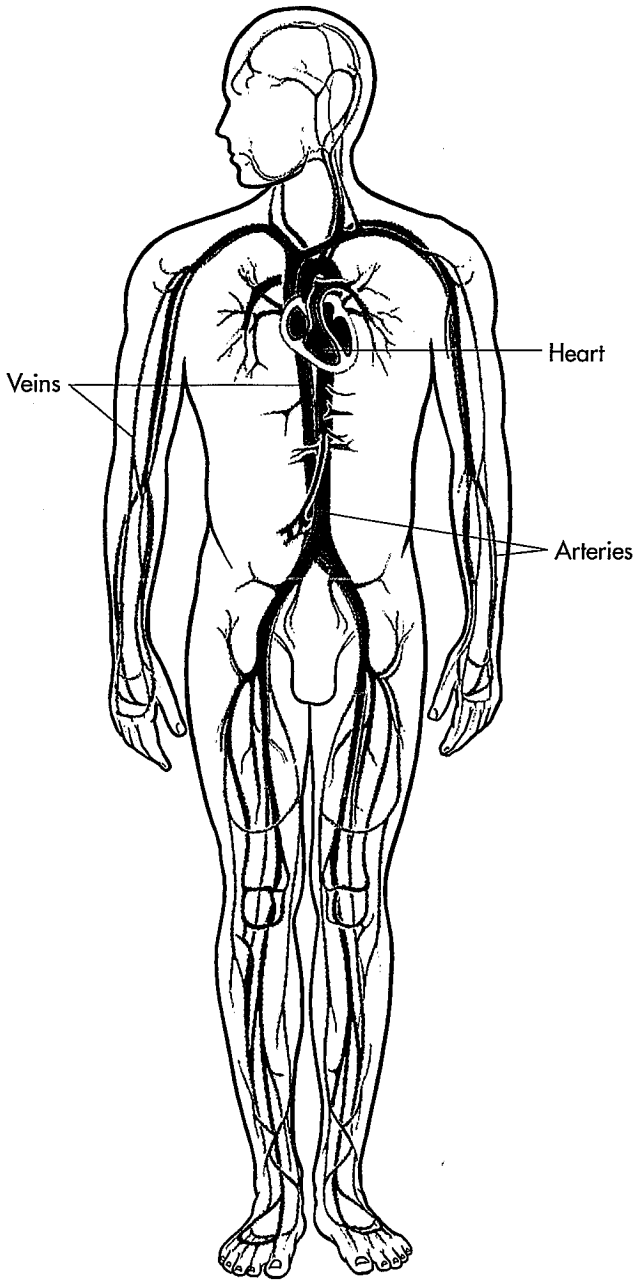
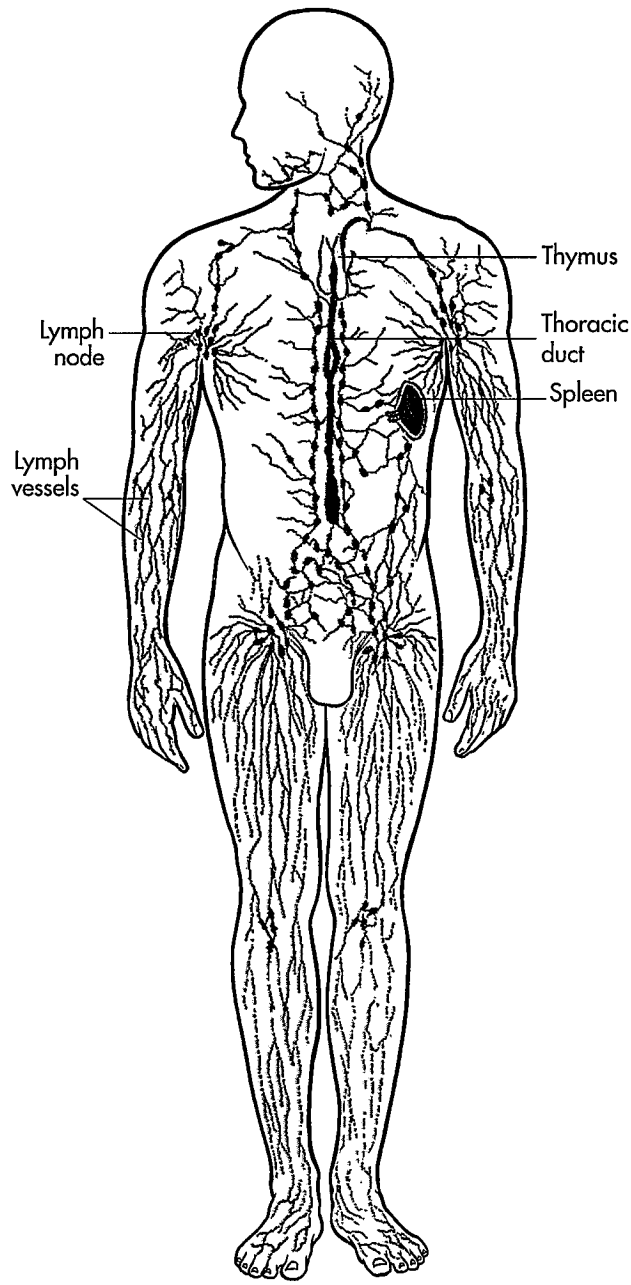


FIGURE 3-8

Lymphatic system.



(groin) areas of the body in Figure 3-8. The formation and movement of lymph are discussed in Chapter 11.

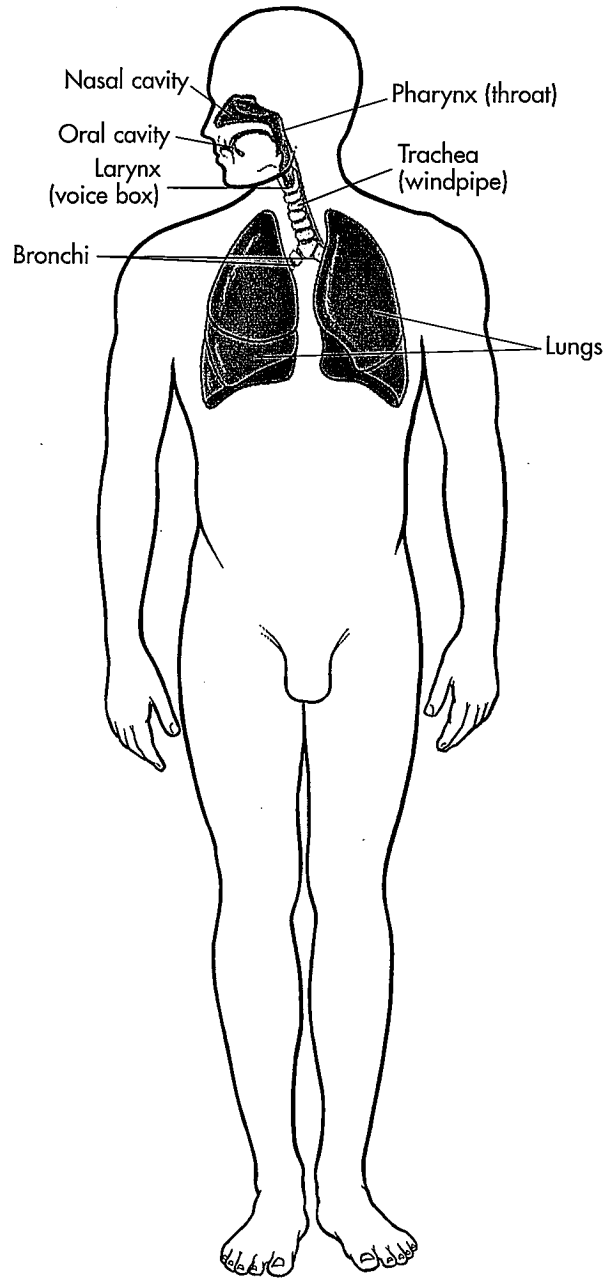
The functions of the lymphatic system include movement of fluids and certain large molecules from the tissue spaces around the cells and movement of fat-related nutrients from the digestive tract back to the blood. The lymphatic system is also involved in the functioning of the immune system, which plays a critical role in the defense mechanism of the body against disease.

Respiratory System

The organs of the respiratory system include the **nose, pharynx** (FAIR-inks), **larynx** (LAR-inks), **trachea** (TRAY-kee-ah), **bronchi** (BRON-ki), and **lungs** (Figure 3-9). Together these organs permit the movement of air into the tiny, thin-walled sacs of the lungs called **alveoli** (al-VE-o-li). In the alveoli, oxygen from the air is exchanged for the waste product carbon dioxide, which is carried to the lungs by the blood so that it can be eliminated from the body. The organs of the respiratory system perform a number of functions in addition to permitting movement of air into the alveoli. For example, if you live in a cold or dry environment, incoming air can be warmed and humidified as it passes over the lining of the respiratory air passages. In addition, inhaled irritants such as pollen or dust passing through the respiratory tubes can be trapped in the sticky mucus that covers the lining of many respiratory passages and then eliminated from the body. The respiratory system is also involved in regulating the acid-base balance of the body—a function that will be discussed in Chapter 18.

FIGURE 3-9

Respiratory system.

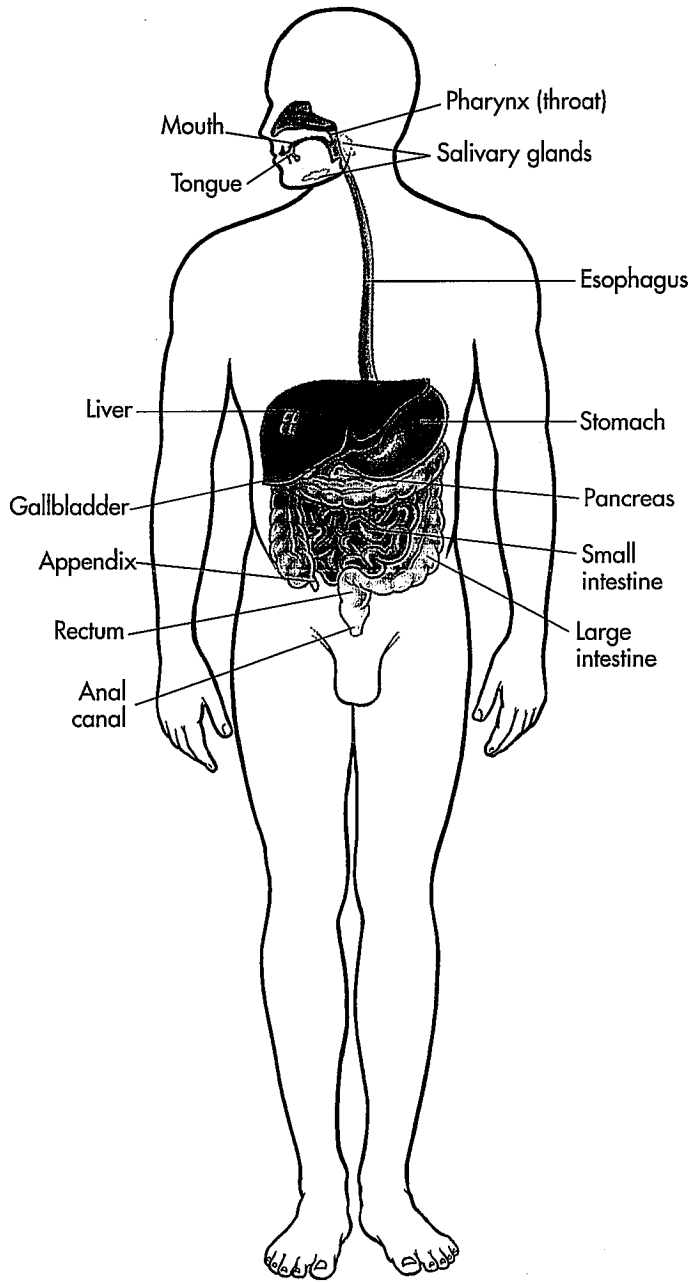


Digestive System

The organs of the **digestive system** (Figure 3-10) are often separated into two groups: the *primary organs* and the *secondary* or *accessory organs* (see Figure 3-1). They work together to ensure proper digestion and absorption of nutrients. The primary organs include the mouth, pharynx, esophagus, stomach, small intestine, large intestine, rectum, and anal canal. The accessory organs

FIGURE 3-10

Digestive system.



of digestion include the teeth, salivary glands, tongue, liver, gallbladder, pancreas, and appendix.

The primary organs of the digestive system form a tube, open at both ends, called the **gastrointestinal** (GAS-tro-in-TES-ti-nal) or **GI tract.** Food that enters the tract is digested, its nutrients are absorbed, and the undigested residue is eliminated from the body as waste material called **feces** (FEE-seez). The accessory organs assist in the mechanical or chemical breakdown of ingested food. The appendix, although classified as an accessory organ of digestion and physically attached to the digestive tube, is not functionally important in the digestive process. However, inflammation of the appendix, called **appendicitis** (ah-PEN-di-SYE-tis) is a very serious clinical condition and frequently requires surgery.

Urinary System

The organs of the **urinary** system include the **kidneys, ureters** (u-REE-ters), **bladder,** and **urethra** (yoo-RE-thrah).

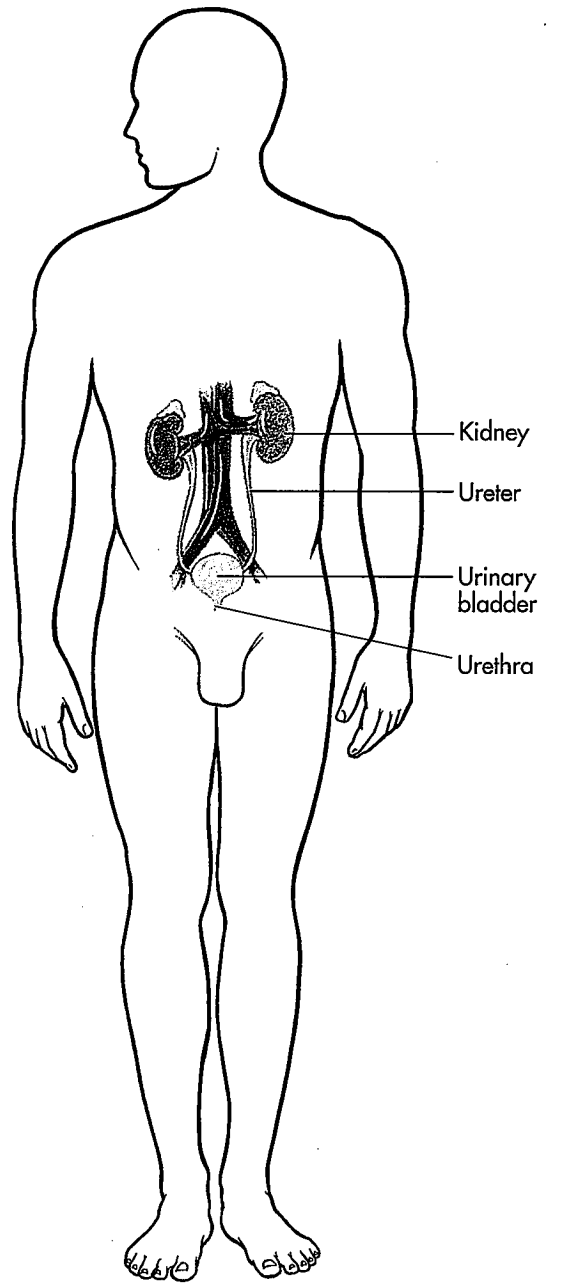
The kidneys (Figure 3-11) "clear" or clean the blood of the waste products continually produced by the metabolism of nutrients in the body cells. The kidneys also play an important role in maintaining the electrolyte, water, and acid-base balances in the body.

The waste product produced by the kidneys is called **urine** (YOOR-in). After it is produced by the kidneys, it flows out of the kidneys through the ureters into the urinary bladder, where it is stored. Urine passes from the bladder to the outside of the body through the urethra. In the male the urethra passes through the penis, which has a double function: it transports urine and semen or seminal fluid. Therefore it has urinary and reproductive purposes. In the female the urinary and reproductive passages are completely separate, so the urethra performs only a urinary function.

In addition to the organs of the urinary system, other organs are also involved in the elimination of body wastes. Undigested food residues and metabolic wastes are eliminated from the intestinal tract as feces, and the lungs rid the body of carbon dioxide. The skin also serves an excretory function by eliminating water and some salts in sweat.

FIGURE 3-11

Urinary system.



Reproductive System

The normal function of the **reproductive system** is different from the normal function of other organ systems of the body. The proper functioning of the reproductive systems ensures survival, not of the individual but of the species—the human race. In addition, production of the hormones that permit the development of sexual characteristics occurs as a result of normal reproductive system activity.

Male Reproductive System

The male reproductive structures shown in Figure 3-12 include the **gonads** (GO-nads), called **testes** (TES-teez), which produce the sex cells or **sperm;** one of the important **genital ducts,** called the **vas deferens** (vas DEF-er-enz); and the **prostate** (PROSS-tate), which is classified as an **accessory organ** in the male. The **penis** (PEE-nis) and **scrotum** (SKRO-tum) are supporting structures and together are known as the **genitalia** (jen-i-tail-yah). The urethra, which is identified in Figure 3-11 as part of the urinary system, passes through the penis. It serves as a genital duct that carries sperm to the exterior and as a passageway for the elimination of urine. Functioning together, these structures produce, transfer, and ultimately introduce sperm into the female reproductive tract, where fertilization can occur. Sperm produced by the testes travel through a number of genital ducts, including the vas deferens, to exit the body. The prostate and other accessory organs, which add fluid and nutrients to the sex cells as they pass through the ducts and the supporting structures (especially the penis), permit transfer of sex cells into the female reproductive tract.

Female Reproductive System

The female **gonads** are the **ovaries.** The **accessory organs** shown in Figure 3-13 include the **uterus** (YOO-ter-us), **uterine** (YOO-ter-in) or **fallopian tubes,** and the **vagina** (vah-JYE-nah). In the female the term ***vulva*** (VUL-vah) is used to describe the external genitalia. The breasts or **mammary glands** are also classified as external accessory sex organs in the female.

The reproductive organs in the female produce the sex cells or **ova;** receive the male sex cells

FIGURE 3-12

Male reproductive system.

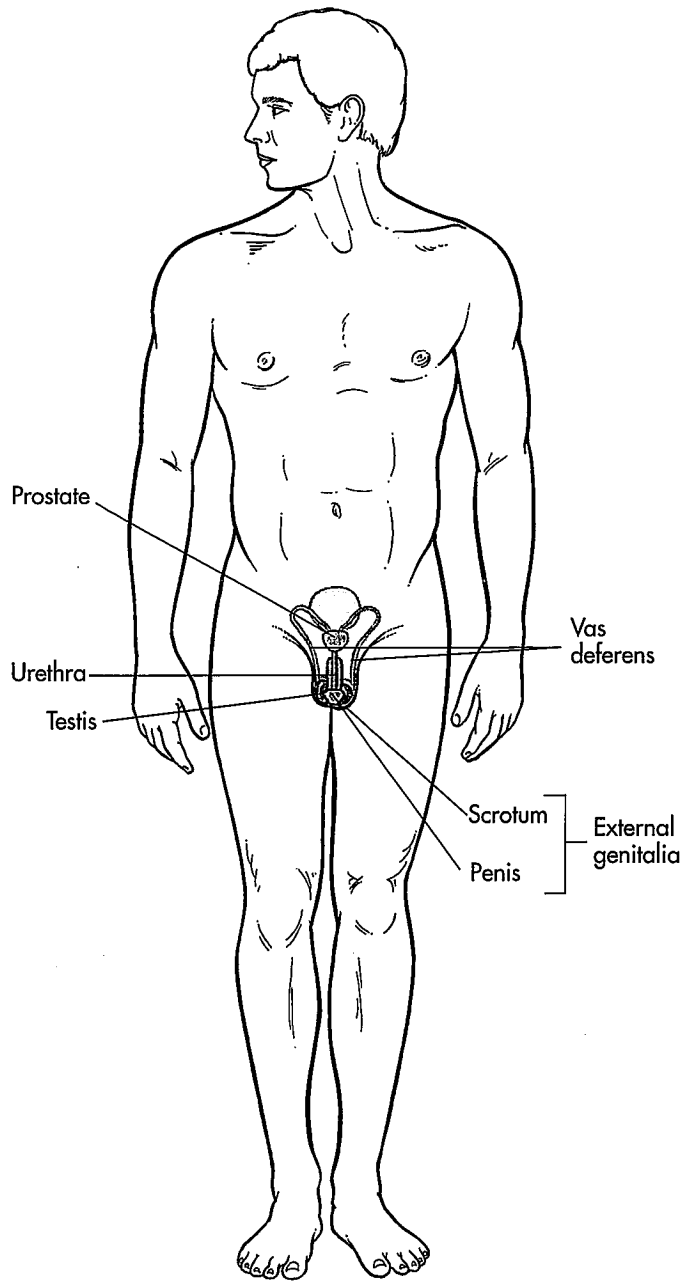
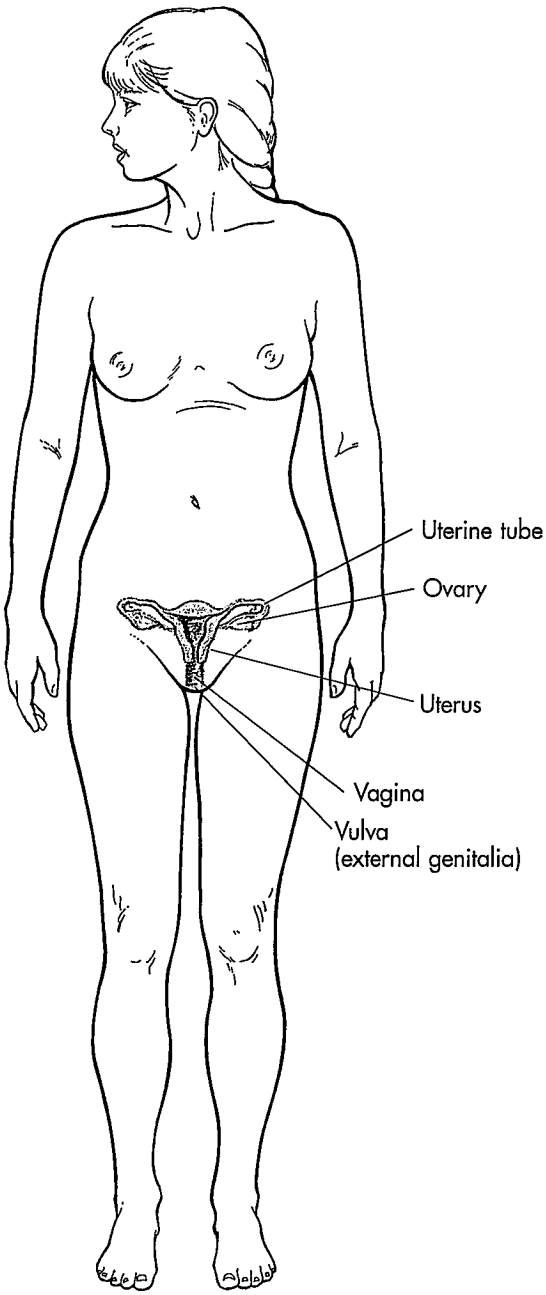


FIGURE 3-13

Female reproductive system.



HEALTH & WELL-BEING

Cancer Screening Tests

A knowledge of the structure and function of the body organ systems is a critically important "first step" in understanding and using information that empowers us to become more sophisticated guardians of our own health and well-being. For example, a better understanding of the reproductive system helps individuals participate in a more direct and personal way in cancer prevention screening techniques.

Breast and testicular self-examinations to detect cancer are two important ways that women and men can participate directly in protecting their own health. Instruction in these techniques is an important part of many home health care educational outreach services. Although specific instructions for these self-tests lie beyond the scope of a textbook of normal anatomy and physiology, it is important to note that this information is readily available from the American Cancer Society and from most hospitals, clinics, and health care providers.

HEALTH & WELL-BEING

Paired Organs

Have you ever wondered what advantage there might be in having two kidneys, two lungs, two eyes, and two of many other organs? Although the body could function well with only one of each, most of us are born with a pair of these organs. For paired organs that are vital to survival, such as the kidneys, this arrangement allows for the accidental loss of one organ without immediate threat to the survival of the individual. Athletes who have lost one vital organ through injury or disease are often counseled against participating in contact sports that carry the risk of damaging the remaining organ. If the second organ is damaged, total loss of a vital function, such as sight, or even death may result.

(sperm); permit fertilization and transfer of the sex cells to the uterus; and allow for the development, birth, and nourishment of offspring.

The Body as a Whole

As you study the more detailed structure and function of the organ systems in the chapters that follow, always relate the system and its component organs to the body as a whole. No one body system functions entirely independently of other systems. Instead, you will find that they are structurally and functionally interrelated and interdependent.

Outline Summary

DEFINITIONS AND CONCEPTS

A Organ—a structure made up of two or more kinds of tissues organized in such a way that they can together perform a more complex function than can any tissue alone

B Organ system—a group of organs arranged in such a way that they can together perform a more complex function than can any organ alone.

C A knowledge of individual organs and how they are organized into groups makes more meaningful the understanding of how a particular organ system functions as a whole

ORGAN SYSTEMS

A Integumentary system (Figure 3-2)
- 1 Structure—organs
  - a Skin
  - b Hair
  - c Nails
  - d Sense receptors
  - e Sweat glands
  - f Oil glands
- 2 Functions
  - a Protection
  - b Regulation of body temperature
  - c Synthesis of chemicals
  - d Sense organ

B Skeletal system (Figure 3-3)
- 1 Structure
  - a Bones
  - b Joints
- 2 Functions
  - a Support
  - b Movement (with joints and muscles)
  - c Storage of minerals
  - d Blood cell formation

C Muscular system (Figure 3-4)
- 1 Structure
  - a Muscles
    - (1) Voluntary or striated
    - (2) Involuntary or smooth
    - (3) Cardiac
- 2 Functions
  - a Movement
  - b Maintenance of body posture
  - c Production of heat

D Nervous system (Figure 3-5)
- 1 Structure
  - a Brain
  - b Spinal cord
  - c Nerves
  - d Sense organs
- 2 Functions
  - a Communication
  - b Integration
  - c Control
  - d Recognition of sensory stimuli
- 3 System functions by production of nerve impulses caused by stimuli of various types
- 4 Control is fast-acting and of short duration

E Endocrine system (Figure 3-6)
- 1 Structure
  - a Pituitary gland
  - b Pineal gland
  - c Hypothalamus
  - d Thyroid gland
  - e Parathyroid glands
  - f Thymus gland
  - g Adrenal glands
  - h Pancreas
  - i Ovaries (female)
  - j Testes (male)
- 2 Functions
  - a Secretion of special substances called hormones directly into the blood
  - b Same as nervous system—communication, integration, control
  - c Control is slow and of long duration
  - d Examples of hormone regulation:
    - (1) Growth
    - (2) Metabolism
    - (3) Reproduction
    - (4) Fluid and electrolyte balance

F Cardiovascular (circulatory) system (Figure 3-7)
- 1 Structure
  - a Heart
  - b Blood vessels
- 2 Functions
  - a Transportation
  - b Regulation of body temperature
  - c Immunity (body defense)

Outline Summary—cont'd

G Lymphatic system (Figure 3-8)
- 1 Structure
  - a Lymph nodes
  - b Lymphatic vessels
  - c Thymus
  - d Spleen
- 2 Functions
  - a Transportation
  - b Immunity (body defense)

H Respiratory system (Figure 3-9)
- 1 Structure
  - a Nose
  - b Pharynx
  - c Larynx
  - d Trachea
  - e Bronchi
  - f Lungs
- 2 Functions
  - a Exchange of waste gas (carbon dioxide) for oxygen in the lungs
  - b Area of gas exchange in the lungs called alveoli
  - c Filtration of irritants from inspired air
  - d Regulation of acid-base balance

I Digestive system (Figure 3-10)
- 1 Structure
  - a Primary organs
    - (1) Mouth
    - (2) Pharynx
    - (3) Esophagus
    - (4) Stomach
    - (5) Small intestine
    - (6) Large intestine
    - (7) Rectum
    - (8) Anal canal
  - b Accessory organs
    - (1) Teeth
    - (2) Salivary glands
    - (3) Tongue
    - (4) Liver
    - (5) Gallbladder
    - (6) Pancreas
    - (7) Appendix
- 2 Functions
  - a Mechanical and chemical breakdown (digestion) of food
  - b Absorption of nutrients
  - c Undigested waste product that is eliminated is called *feces*
  - d Appendix is a structural but not a functional part of digestive system
  - e Inflammation of appendix is called *appendicitis*

J Urinary system (Figure 3-11)
- 1 Structure
  - a Kidneys
  - b Ureters
  - c Urinary bladder
  - d Urethra
- 2 Functions
  - a "Clearing" or cleaning blood of waste products—waste product excreted from body is called *urine*
  - b Electrolyte balance
  - c Water balance
  - d Acid-base balance
  - e In male, urethra has urinary and reproductive functions

K Reproductive system (Figures 3-12 and 3-13)
- 1 Structure
  - a Male
    - (1) Gonads—testes
    - (2) Genital ducts—vas deferens, urethra
    - (3) Accessory gland—prostate
    - (4) Supporting structures—genitalia (penis and scrotum)
  - b Female
    - (1) Gonads—ovaries
    - (2) Accessory organs—uterus, uterine (fallopian) tubes, vagina
    - (3) Supporting structures—genitalia (vulva), mammary glands (breasts)
- 2 Functions
  - a Survival of species
  - b Production of sex cells (male: sperm; female: ova)
  - c Transfer and fertilization of sex cells
  - d Development and birth of offspring
  - e Nourishment of offspring
  - f Production of sex hormones

New Words

Review the names of organ systems and individual organs in Figures 3-1 through 3-13.

appendix
cardiovascular
endocrine
feces
gastrointestinal (GI) tract
genitalia
hormone
integumentary
lymphatic
nerve impulse
stimuli
urine

Review Questions

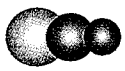
1. Define *organ* and *organ system.*
2. Give examples of the stimuli to which the skin organs can respond.
3. How is the skin able to assist in the body's ability to regulate temperature?
4. What is the function of tendons?
5. What are some of the differences between the lymphatic and cardiovascular systems?
6. Name the organs that help rid the body of waste. What type of waste does each organ remove?
7. Besides bone, what other types of tissues are included in the skeletal system
8. List the eleven organ systems discussed in this chapter.
9. Most of the organ systems have more than one function. List two functions for the following systems: integumentary system, skeletal system, muscular system, lymphatic system, respiratory system and urinary system.
10. What is unique about the reproductive system?

Critical Thinking

11. Explain the differences between the nervous and endocrine systems. Include what types of functions are regulated and the "message carriers" for each system.
12. The term *balance* is used in this chapter. This is another term for *homeostasis.* Go through the functions of the systems and list the homeostatic functions they have.

Chapter Test

1. The primary organs of the digestive system make a long tube called the _____.
2. _____ is another term for voluntary muscle.
3. _____ is another term for involuntary muscle.
4. The nervous system can generate special electrochemical signals called _____.
5. The _____, _____, _____, and _____ are called the appendages of the skin.
6. The _____ is part of both the lymphatic and endocrine systems.
7. The _____ is part of both the male reproductive and urinary systems.
8. The gonads for the male reproductive system are the _____; for the female reproductive system the gonads are the _____.
9. The skeletal system is composed of bone tissue and these two related tissues: _____ and _____.



Chapter Test—cont'd

Match the function in Column B with the correct system in Column A.

COLUMN A	COLUMN B
10. ___ Integumentary	a. Provides movement, body posture, and heat
11. ___ Skeletal	b. Uses hormones to regulate body functions
12. ___ Muscular	c. Transports fatty nutrients from the digestive system to the blood
13. ___ Nervous	d. Physical and chemical change in nutrients and absorption of
14. ___ Endocrine nutrients	e. Cleans the blood of metabolic wastes and regulates electrolyte balance
15. ___ Cardiovascular	f. Protection of underlying structures, sensory reception, and regulation of body temperature
16. ___ Lymphatic	g. The transport of substances from one part of the body to another
17. ___ Respiratory	h. Ensures the survival of the species rather than the individual
18. ___ Digestive	i. Uses electrochemical signals to integrate and control body functions
19. ___ Urinary	j. Exchanges oxygen and carbon dioxide and regulates acid-base balance
20. ___ Reproductive	k. Provides a rigid framework for the body and stores minerals

Study Tips

Chapter Three is the perfect "big picture" chapter. It is a preview for most of the remaining chapters in the text. Put the name of the system on one side of a flash card and the function of that system and its organs on the other side. Notice how each organ contributes to the function of the system. Before you begin the chapter dealing with a particular system, it would be helpful to get an overview of that system by reviewing the synopsis of that system in this chapter.

In your study groups, go over the flash cards. Discuss how several systems need to be involved in accomplishing one function in the body such as getting food or oxygen to the cells. Go over the questions in the back of the chapter and discuss possible test questions.