A Cosmetologist's Introduction to Anatomy and Physiology

Student Guide

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A Cosmetologist's Introduction to Anatomy and Physiology

First Edition

Student Guide

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Modules of Instruction

Module Contents

Student Components

Student Guide

Student Workbook

* Assignment Sheets

* Assignment Sheets are located in the Student Workbook.

Prerequisites:
None

Learning Activities Sheet

Student Name _____

Directions

Place a checkmark in the appropriate box as you complete each of the steps below.

❑ 1. **Take** Pretest provided by your instructor.

❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.

❑ 3. **Read** Module Objective Sheet.

❑ 4. **Study** Information Sheet, Objectives 1 through 6, and Student Supplement 1.

❑ 5. **Research** Online resources to learn more about the organization of the human body. Your instructor will list several Web sites on the blanks below. Visit at least two of the following Internet sites.

- _____
- _____
- _____
- _____
- _____

❑ 6. **Do** Assignment Sheet 1, "Complete the Crossword Puzzle of Terms (Objectives 1–6)."

❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 8. If the evaluation is not satisfactory, repeat Steps 4, 6, and 7.

❑ 8. **Do** Assignment Sheet 2, "Construct a Model of an Organ of the Human Body."

Learning Activities Sheet

❑ 9.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 10. If the evaluation is not satisfactory, repeat Steps 4, 8, and 9.
❑ 10.	**Do**	Assignment Sheet 3, “Analyze a Cosmetology Scenario.”
❑ 11.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 12. If the evaluation is not satisfactory, repeat Steps 4, 10, and 11.
❑ 12.	**Do**	Assignment Sheet 4, “Complete Module 1 Review.”
❑ 13.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 14. If the evaluation is not satisfactory, repeat Steps 4, 12, and 13.
❑ 14.	**Take**	Written Test provided by your instructor.
❑ 15.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 16. If the evaluation is not satisfactory, follow your instructor's recommendations concerning a review of the above learning activities.
❑ 16.	**Check**	With your instructor for any additional assignments to be completed.
❑ 17.	**Do**	Additional assignments listed below.
		_____
		_____
		_____
❑ 18.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test and assignment sheets. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

Module Objective

After completing this module, you should be able to use anatomical terms to identify the general regions of the body, arrange the major body structures in order of increasing complexity, and match the major organs and structures in each of the major organ systems with their descriptions. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test.

Specific Objectives

After completing this module, you should be able to:

1. Define the terms *anatomy* and *physiology*.
2. Label the general regions of the body.
3. Arrange the major body structures in order of increasing complexity.
4. Match the major organ systems with their functions.
5. Match the major organs and structures in each of the major organ systems with their descriptions.
6. Select from a list primary physiological characteristics of the body that are affected by the hormones of the endocrine system.
7. Complete the crossword puzzle of terms (Objectives 1–6). (Assignment Sheet 1)
8. Construct a model of an organ of the human body. (Assignment Sheet 2)
9. Analyze a cosmetology scenario. (Assignment Sheet 3)
10. Complete Module 1 review. (Assignment Sheet 4)

Information Sheet

Objective 1

The terms *anatomy* and *physiology*

Key terms:

- **Organism** (oŕ-guh-niz-uhm)—A living person, animal, or plant
- **Organ** (oŕ-guhn)—A special structure within the body that is arranged in an organized manner to perform a specific function

a. **Anatomy** (uh-nat´-uh-me)—The scientific study of the structure of an **organism** that describes the size, shape, construction, and relative positions of the **organs** in the body

b. **Physiology** (fiz-e-awĺ-uh-je)—The scientific study of the functions of an organism that describes how the organs work independently and in relation to the whole organism

Objective 2

General regions of the body

Key terms:

- **Gland** (gland´)—Any of the various structures within the body that produce specific chemicals to help with the functions of the body
  - ✔ **Note:** There are glands in all parts of the body. You will study about them in relation to the systems that they support.
- **Vital organ** (vit´-uhl oŕ-guhn)—An organ that must function properly in order for the life of the organism to continue
  - ✔ **Note:** The heart, liver, and brain are vital organs. If these organs do not function properly, the person will die.

a. **Head**

✔ **Note:** The head (see Figure 1) includes the area of the body above the neck, principally the cranium and face along with internal structures. Of obvious importance is the brain, but the head's internal structures also include the components of the mouth, nose, eyes, ears, as well as several **glands**.

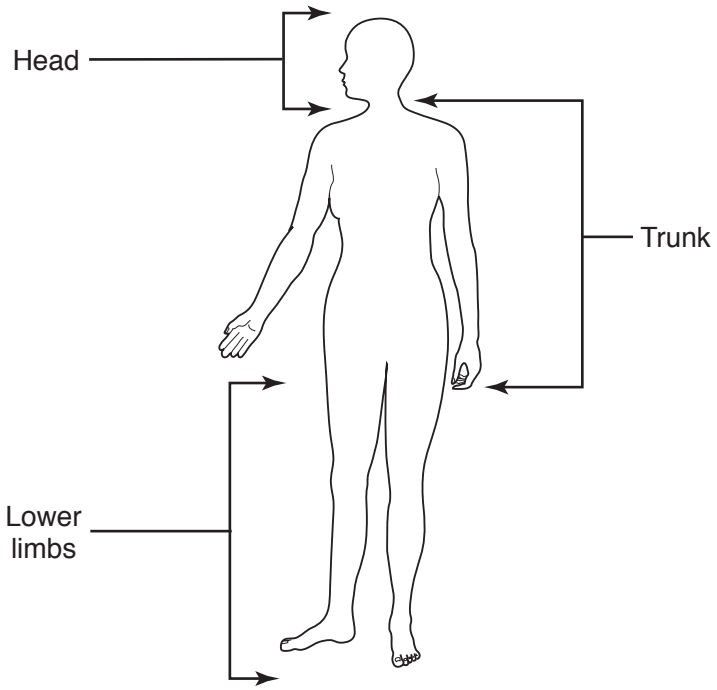
b. **Trunk**

✔ **Note:** The trunk (see Figure 1) is also called the torso (toŕ-so) and consists of the neck, back, chest (thorax), abdomen, and pelvis. The majority of the **vital organs** are contained in the trunk.

c. **Limbs**

✔ **Note:** The limbs (see Figure 1), or extremities (ik-streḿ-uht-ez), consist of the arms, legs, hands, and feet. They are important in movement but do not contain vital organs.

Figure 1—General regions of the body



Objective 3

The major body *structures* in order of increasing complexity

Key term:

- **Structure** (struhḱ-chuhr)—A part of the body, such as the heart, a bone, a gland, a cell, or a limb

✔ **Note:** Like all substances, the human body is composed of atoms, which in turn make molecules. Atoms and molecules form chemical elements and compounds. Certain combinations of chemicals exhibit the characteristic called *life*, which means that that combination of chemicals can move, grow, convert food into energy, and reproduce. The smallest bunches of chemicals that exhibit life are called *cells*. Cells include bacteria and organisms such as amoebas. All plants and animals, including humans, are made of cells. Cells form more-complex structures called *tissue*. Tissue can be organized to perform a specific function within a plant or animal. This organized structure is called an *organ*. Organs that work together in the performance of related functions are called *organ systems* or simply *systems*. The integrated systems thus make up the living creature called an *organism*.

a. Cell

b. Tissue

c. Organ

d. Organ system

e. Organism

Objective 4

Major organ *systems* and their correct functions

✔ **Note:** The 12 major body systems and their functions in the body are presented in this objective and are further discussed and illustrated in Objective 5.

Key terms:

- **System** (siś-tuhm)—A group of organs and related structures that work together to perform a common function
  - ✔ **Note:** The functioning of the body is supported by a number of systems that perform specific purposes. Each system consists of one or more organs and additional structures that connect these organs and tie them to other systems.
- **Metabolism**—The processes that lead to chemical reaction in the body
  - ✔ **Note:** Chemical reactions take place because of the natural interactions of specific substances due to the addition of energy such as heat.
- **Hormone** (hoŕ-mon)—A substance containing amino acid that originates in an organ or gland, moves through the blood to another part of the body, and stimulates activity in that region by chemical reaction

a. **Integumentary system** (in-teǵ-yuh-ment-uh-re siś-tuhm)—Protects the organism from injury, disease, and infection; aids in the regulation of temperature, the excretion of wastes, and the reception of sensations

b. **Skeletal** (skeĺ-uht-uhl) **system**—Provides the framework for the body and works to protect and support the body

c. **Muscular** (muhś-kyuh-luhr) **system**—Provides for body movement and support

d. **Nervous** (nuhŕ-vuhs) **system**—Coordinates body activities by receiving, interpreting, and conducting messages to all the other systems of the body

e. **Special senses** (spesh´-uhl senś-es)—Function in receiving sensations such as sight, smell, hearing, touch, and taste

✔ **Note:** Traditionally, we think of the body as having the five senses mentioned above. In reality, all sensations occur in the brain as a result of impulses provided by sense receptors all over the body or concentrated in particular areas.

f. **Digestive** (di-jeś-tiv) **system**—Receives, breaks down, and absorbs food substances and excretes waste products

g. **Circulatory** (suhŕ-kyuh-luh-tor-e) **system**—Transports materials throughout the body by carrying oxygen and nutrients in the blood to all the cells of the body and carrying away the waste products of the cells

h. **Respiratory** (reś-puh-ruh-tor-e) **system**—Takes in oxygen from the air and gives off carbon dioxide, which is produced by cell **metabolism**

i. **Urinary** (yuŕ-uh-ner-e) **system**—Serves in removing waste products from the blood and in excreting wastes in the form of urine

j. **Reproductive** (re-pruh-duhḱ-tiv) **system**—Involved with reproduction and childbirth

k. **Endocrine** (eń-duh-kruhn) **system**—Serves to regulate various body functions through glands that secrete **hormones** directly into the blood to slow down or increase the activity of the cells

✔ **Note:** Secretions from the endocrine glands affect various processes throughout the body, such as metabolism, growth, and secretions from other organs.

l. **Immune** (im-yuń) **system**—Provides protection against disease and infection

Objective 5

Major organs and structures in each of the major organ systems

a. **Integumentary system**—Skin, hair, nails, duct glands (see Figure 2)

b. **Skeletal system**—Bones, joints, cartilage, connective tissue (see Figure 3)

Figure 2—Integumentary system

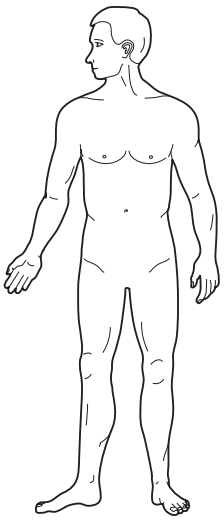
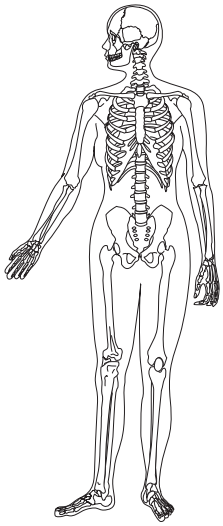


Figure 3—Skeletal system



c. **Muscular system**—Skeletal, smooth, and cardiac muscles (see Figure 4)

d. **Nervous system**—Brain, spinal cord, peripheral nerves (see Figure 5)

Figure 4—Muscular system

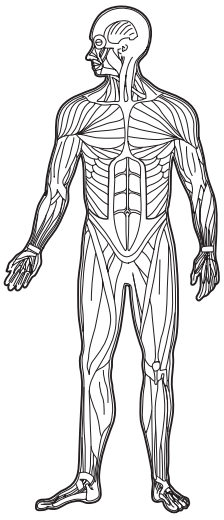
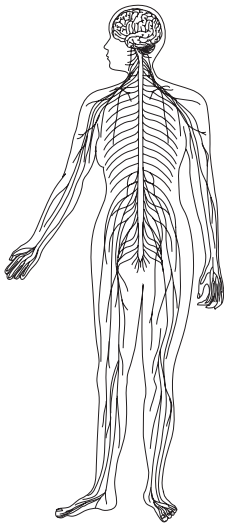


Figure 5—Nervous system



e. **Special senses**—Eyes, ears, nose, taste buds (see Figure 6)

f. **Digestive system**—Mouth, pharynx, esophagus, stomach, large and small intestines, and accessory organs such as the gallbladder and pancreas (see Figure 7)

Figure 6—Special senses

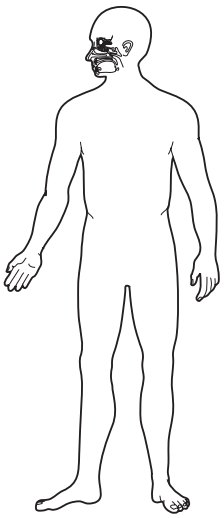
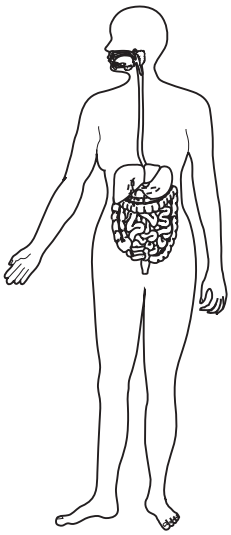


Figure 7—Digestive system



g. **Circulatory system**—Heart, blood vessels, blood, lymphatic tissues (see Figures 8-a and 8-b)

Figure 8-a—Circulatory system (Lymphatic)

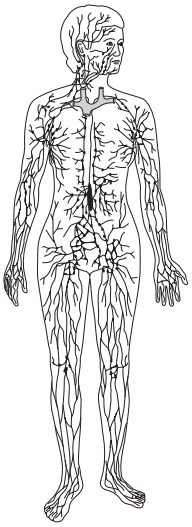
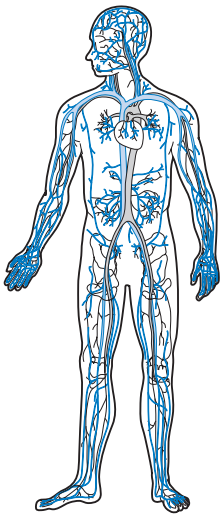


Figure 8-b—Circulatory system (Blood)



h. **Respiratory system**—Lungs, nose, pharynx, larynx, trachea (see Figure 9)

i. **Urinary system**—Kidneys, ureter, bladder, urethra (see Figure 10)

Figure 9—Respiratory system

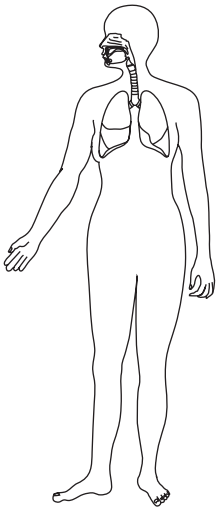
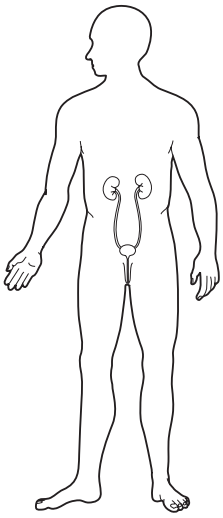


Figure 10—Urinary system



j. **Reproductive system**—Sex organs and ducts to the outside (see Figures 11-a and 11-b)

Figure 11-a—Reproductive system (Female)

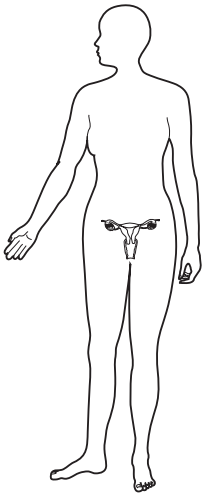
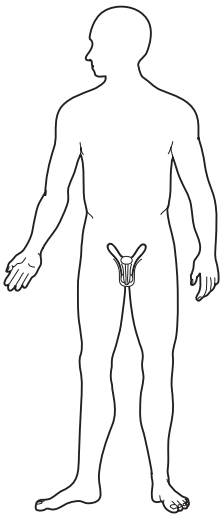


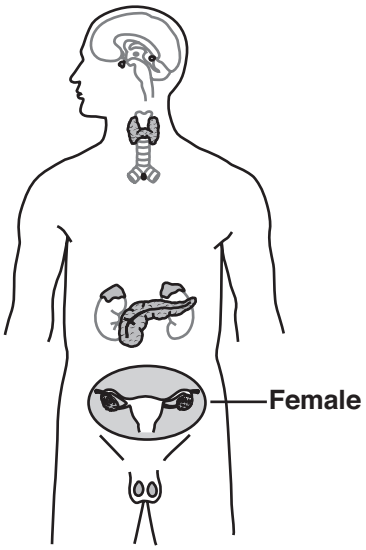
Figure 11-b—Reproductive system (Male)



k. **Endocrine system**—Ductless glands (see Figure 12)

Examples: Thyroid, pituitary

Figure 12—Endocrine system



l. Immune system—White blood cells, antibodies

Objective 6

Primary physiological characteristics of the body that are affected by the hormones of the endocrine system

✔ **Note:** In essence, hormones affect the functioning of the body by adjusting chemical reactions in the body. These effects may be to speed up or slow down a chemical reaction, to produce other chemicals that can be used by the body, to start or stop a reaction, or to cause special effects that are not part of the normal functioning of the body.

a. Rate of metabolism

b. Metabolism of specific substances such as carbohydrates and calcium

c. Growth and development processes

✔ **Note:** A primary hormone of the pituitary gland is the melanocyte-stimulating (muh-lá-nuh-sit) hormone that influences melanin formation. Melanin is a protein that serves as a pigment to provide color to the skin, hair, and eyes.

d. Secretion of other hormones

e. Development and functioning of the reproductive organs

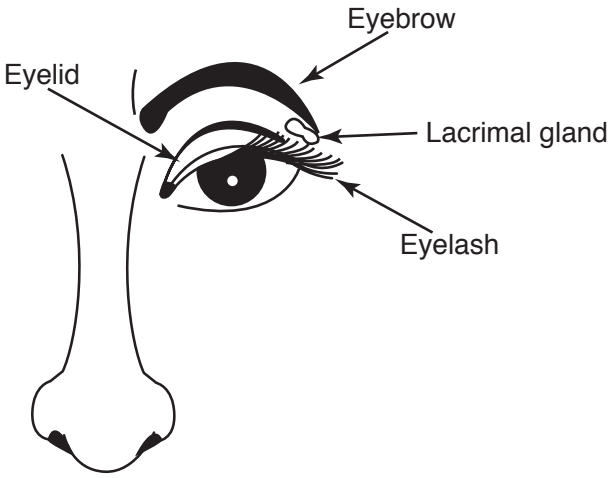
f. Development of higher mental functions

g. Ability of the body to meet conditions of stress

h. Resistance to disease

Student Supplement 1—Accessory Structures of the Eye

Figure 1—Accessory structures of the eye



Key term:

- **Lacrimal** (la-kruh´-muhl)—Of or pertaining to tears

1. **Eyebrow**—The arch of hairs growing along the ridge formed by the supraorbital arch of the frontal bone

2. **Eyelash**—One of many cilia growing in triple rows along the border of the eyelids

   ✔ **Note:** The eyebrows and the eyelashes help protect the eye against the entry of foreign objects.

3. **Eyelid**—A movable fold of thin skin over the eye, consisting of loose connective tissue containing a thin plate of fibrous tissue lined with mucous membrane

   ✔ **Note:** The eyelids open and close as a result of stimuli such as foreign objects and light.

4. **Lacrimal gland**—One of a pair of small, almond-shaped glands located in the upper, outer portion of each orbit, which secretes tears that keep the anterior surface of the eye moist and free from irritating particles

Module Contents

Student Components

Student Guide

Student Workbook

* Assignment Sheets

* Assignment Sheets are located in the Student Workbook.

Prerequisites:
Module 1

Learning Activities Sheet

Student Name _____

Directions

Place a checkmark in the appropriate box as you complete each of the steps below.

❑ 1. **Take** Pretest provided by your instructor.

❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.

❑ 3. **Read** Module Objective Sheet.

❑ 4. **Study** Information Sheet, Objectives 1 through 10.

❑ 5. **Research** Online resources to learn more about biochemistry and microbiology. Your instructor will list several Web sites on the blanks below. Visit at least two of the following Internet sites.

- _____
- _____
- _____
- _____
- _____

❑ 6. **Do** Assignment Sheet 1, "Complete the Crossword Puzzle of Terms (Objectives 1–10)."

❑ 7. **Stop** Have your instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to Step 8. If the evaluation is not satisfactory, repeat Steps 4, 6, and 7.

❑ 8. **Study** Information Sheet, Objectives 11 through 18.

❑ 9. **Do** Assignment Sheet 2, "Complete the Crossword Puzzle of Terms (Objectives 11–18)."

Learning Activities Sheet

	❑	10. **Stop**	Have your instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to Step 11. If the evaluation is not satisfactory, repeat Steps 8 through 10.
	❑	11. **Do**	Assignment Sheet 3, "Construct a Model of a Typical Cell."
	❑	12. **Stop**	Have your instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to Step 13. If the evaluation is not satisfactory, repeat Steps 8, 11 and 12.
	❑	13. **Study**	Information Sheet, Objectives 19 through 24.
	❑	14. **Do**	Assignment Sheet 4, "Complete the Crossword Puzzle of Terms (Objectives 19–24)."
	❑	15. **Stop**	Have your instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to Step 16. If the evaluation is not satisfactory, repeat Steps 13 through 15.
	❑	16. **Do**	Assignment Sheet 5, "Develop a Presentation on Bacteria, Viruses, Fungi, or Parasites."
	❑	17. **Stop**	Have your instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to Step 18. If the evaluation is not satisfactory, repeat Steps 16 and 17.
	❑	18. **Do**	Assignment Sheet 6, "Analyze Cosmetology Scenarios."
	❑	19. **Stop**	Have your instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to Step 20. If the evaluation is not satisfactory, repeat Steps 4, 8, 13, 18 and 19.
	❑	20. **Do**	Assignment Sheet 7, "Complete Module 2 Review."
	❑	21. **Stop**	Have your instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to Step 22. If the evaluation is not satisfactory, repeat Steps 4, 8, 13, 20, and 21.

❑	22. **Take**	Written Test provided by your instructor.
❑	23. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 24. If the evaluation is not satisfactory, follow your instructor's recommendations concerning a review of the above learning activities.
❑	24. **Check**	With your instructor for any additional assignments to be completed.
❑	25. **Do**	Additional assignments listed below.

_____

_____

_____

❑	26. **Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test and assignment sheets. If the evaluation is satisfactory, proceed to the next module. If evaluation is not satisfactory, ask your instructor for further instructions.

***Permission to duplicate this form is granted.**

Module Objective Sheet

Module Objective

After completing this module, you should be able to describe the role of the major elements and compounds found in the human body, discuss the factors that affect cell growth and reproduction, and describe the classes of microorganisms found in the human body. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test.

Specific Objectives

After completing this module, you should be able to:

1. Define the terms *biochemistry* and *microbiology*.
2. Complete statements concerning the role of chemistry in human health.
3. Define the term *homeostasis*.
4. Define the terms *element* and *atom*.
5. Label the parts of an atom.
6. Define the term *molecule*.
7. Distinguish among the definitions of the terms *compound*, *mixture*, and *solution*.
8. Match the principal elements and compounds in the human body with their primary role.
9. Complete statements concerning the role of electrolytes in human health.
10. Discuss the role of acids and bases in human health.
11. State the cell theory.
12. Define the principal types of protoplasm.
13. Label the major parts of a cell.
14. Distinguish among the major parts of a cell.
15. Distinguish among the major parts of a cell nucleus.
16. Describe the specialized structures in cells.

Module Objective Sheet

17. Distinguish between functions of the specialized structures in cells.
18. List functions of a cell.
19. Match the classes of microorganisms with their descriptions.
20. Identify the classes of microorganisms as classified by their shape.
21. Complete statements that describe the characteristics of bacteria.
22. Complete statements that describe the characteristics of viruses.
23. Select from a list the characteristics of fungi.
24. Complete statements that describe common parasites that afflict humans.
25. Complete the crossword puzzle of terms (Objectives 1 through 10). (Assignment Sheet 1)
26. Complete the crossword puzzle of terms (Objectives 11 through 18). (Assignment Sheet 2)
27. Construct a model of a typical cell. (Assignment Sheet 3)
28. Complete the crossword puzzle of terms (Objectives 19 through 24). (Assignment Sheet 4)
29. Develop a presentation on bacteria, viruses, fungi, or parasites. (Assignment Sheet 5)
30. Analyze cosmetology scenarios. (Assignment Sheet 6)
31. Complete Module 2 review. (Assignment Sheet 7)

Information Sheet

Objective 1

The terms *biochemistry* and *microbiology*

Key terms:

- **Matter** (mat´-uhr)—That portion of the universe that has shape and substance
- **Energy** (eń-uhr-je)—The capacity to do work
  - ✔ **Note:** The definition presented here is the classic scientific definition of the term energy. Work can be understood as a force that can bring about change in matter or other types of energy.

a. **Biochemistry**—The study of chemistry as it relates to life

✔ **Note:** Everything in the universe exists as either **matter** or **energy**. Another name for matter is *chemical*, and the study of what matter is made of is called *chemistry*. The study of chemistry as it relates to life is referred to as *biological chemistry* or simply *biochemistry*. The two basic functions of chemicals in the body are to provide structure to the body and to provide a source of energy to support life.

b. **Microbiology**—The study of extremely small life

✔ **Note:** Bio- is a prefix that means life, and biology is the study of life. Another prefix is micro-, which means extremely small. Thus, microbiology is the study of extremely small life.

Objective 2

The role of chemistry in human health

Key terms:

- **Liquid** (liḱ-wuhd)—A state of matter in which the substance will take on the shape of a container but will not expand to fill a container with greater volume than the substance
- **Gas** (gaś)—A state of matter in which the substance will take on the shape of any container in which it is placed and will expand to fill the container
- **Solid** (sawĺ-uhd)—A state of matter in which the substance has a definite shape that is maintained unless acted upon by a force that is capable of changing that shape
- **Chemical reaction** (keḿ-i-kuhl re-aḱ-shuhn)—A process in which one or more chemicals that are exposed to other chemicals or sources of energy such as heat change their chemical composition to produce other chemicals and often other forms of energy
- **Respiration** (res-puh-rá-shuhn)—The physical and chemical processes by which an organism supplies its cells and tissues with oxygen and removes carbon dioxide

a. The body consists of various chemicals.

✔ **Note:** The major chemicals of the body are oxygen (65 percent), carbon (19 percent), hydrogen (10 percent), and nitrogen (3 percent). Water, which makes up almost three-fourths of a person's body weight, consists of oxygen and hydrogen. Matter exists in three primary forms: **liquids**, **gases**, and **solids**.

b. Most body activities involve **chemical reactions**.

✔ **Note:** The basic chemical reaction in the body is referred to as ***cell respiration***.

c. For a person to remain healthy, the chemicals within the body must remain properly balanced.

✔ **Note:** We obtain vitamins and minerals from the foods we eat. If a person's diet does not contain sufficient amounts of vitamins and minerals, his or her health can be affected.

d. The body also produces special chemicals that regulate body functions.

✔ **Note:** The organs and glands of the body produce various chemicals used to carry out body functions. Some specialized chemicals called hormones have specific roles in controlling growth, reproduction, and overall health.

e. Chemicals entering the body from the external environment can affect the balance of chemicals within the body and can disrupt normal physiological chemical reactions.

✔ **Note:** Chemicals enter the body through the nose, mouth, and other openings; through breaks in the skin; and through the skin itself.

f. Injuries and diseases can change the chemical balance within the body and can disrupt chemical reactions.

Objective 3

The term *homeostasis*

a. **Homeostasis** (ho-me-o-stá-suhs)—The state of the body in which conditions remain relatively stable despite changes in the environment

b. The human body functions best at a temperature between approximately 97° F and 99° F (36° C and 38° C). If the temperature of the outside environment drops, the body will increase its production of energy and reduce blood circulation in the extremities to ensure adequate warmth for the vital organs. On a hot day, the body will sweat more, which removes heat from the body and increases cooling of the skin due to the evaporation of the perspiration. These and other reactions to changes in the external and internal environment of the body help to maintain homeostasis.

Objective 4

The terms *element* and *atom*

Key term:

- **Atomic** (uh-tawḿ-ik) **number**—The number of protons, or positive charges, in the nucleus of an atom of a particular element

a. **Element**—One of more than 100 primary, simple substances that cannot be broken down by chemical means into any other substance

b. **Atom**—The smallest division of an element that exhibits all the properties and characteristics of the element

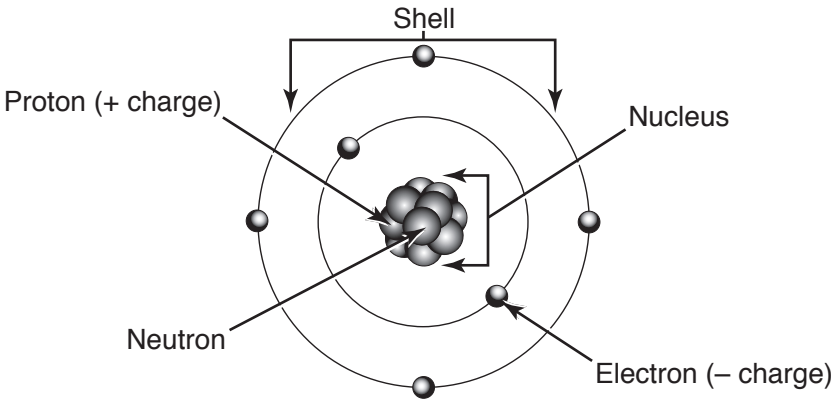
✔ **Note:** All matter is made up of three smaller particles: neutrons, electrons, and protons (see Objective 5). The number of protons in the nucleus of an atom determines the **atomic number** of the element.

Objective 5

Parts of an atom

✔ **Note:** All matter is made of particles called *atoms*. Atoms, in turn, consist of three smaller particles (see Figure 1). In the center of the atom, termed the *nucleus*, are *protons* and *neutrons*. The third particle is called an *electron*. Electrons go around the nucleus in orbits, with each electron following a separate path. The atoms of different materials differ in the number of each type of particle they contain. Generally, there are an equal number of electrons, protons, and neutrons in an atom. For example, a hydrogen atom contains one of each of the particles, while an oxygen atom consists of eight electrons, protons, and neutrons each. As the number of electrons increases, the additional groups of orbits that are required are found at greater distances from the nucleus. All the orbits that are at an equal distance from the nucleus are referred to as a *shell*. Each shell is capable of supporting a specific number of electrons. The electrons in the outer shell can be shared with other atoms to form *bonds*. Atoms that bond to each other form structures called *molecules* (see Objective 6).

Figure 1—Parts of an atom



Information Sheet

Key terms:

- **Nucleus** (nú-kle-uhs)—The structure in the center of an atom consisting of protons and neutrons and about which electrons orbit
  - ✔ **Note:** The nucleus of each element is unique to that substance. Hydrogen is the smallest atom, with one neutron and one proton in its nucleus. Helium has two neutrons and two protons. This progression continues through the natural elements up to uranium with 92 neutrons and protons. The number of protons and neutrons is used to identify each element and is called its atomic number. Two of the more-common elements in the body, along with hydrogen, are carbon, with an atomic number of 6, and oxygen, with an atomic number of 8.
- **Proton** (pró-tawn)—A positively charged particle that is a fundamental component of the nucleus of atoms
- **Neutron** (nú-trawn)—An elementary particle that is a fundamental component of the nucleus of atoms; it has no electric charge
- **Electron** (i-leḱ-trawn)—A negatively charged elementary particle of an atom
- **Shell** (sheĺ)—The set of electron orbits in an atom that have the same energy level
  - ✔ **Note:** The innermost shell of atoms can hold up to two electrons. Thus, hydrogen and helium have one shell. The second shell or energy level consists of electrons with orbits that are farther from the nucleus than the innermost shell. The second shell can have as many as eight electrons, which means that the elements up to atomic number 10 (neon) have only two shells. Additional shells hold eight electrons or up to a multiple of eight electrons.
- **Bond** (bawnd´)—The mechanism by which atoms link to one another to form molecules involving the loss of, gaining of, or sharing of electrons in the outer shell
  - ✔ **Note:** There are three types of chemical bonds among atoms. In an *ionic bond*, an atom gives up one or more electrons to another atom. This results in the atom having more protons than electrons, giving it a positive charge. The atom that gains electrons has more electrons than protons, meaning that the atom has a negative charge. The difference in charges holds the atoms together. In what is called *covalent bonding*, an atom that does not have an outer shell that is filled to its full capacity with electrons can share electrons with one or more other atoms. Finally, hydrogen is the smallest atom with only one proton and one electron. When hydrogen shares its electron with another atom, it causes a slightly positive charge in the atom, making it particularly attractive to oxygen and nitrogen atoms, which are slightly negative. This special attraction is referred to as *hydrogen bonding*. Hydrogen bonds are especially important in the human body because hydrogen bonds help hold water molecules together, as well as many of the proteins that are essential to body structure and functioning.

Objective 6

The term *molecule*

Molecule—A structure consisting of two or more atoms

✔ **Note:** A molecule may consist of atoms of the same element or atoms of two or more different elements. For example, oxygen in the air is often present as molecules of two atoms, which is written using the symbol for oxygen (O) and a subscript $_2$ to show that there are two atoms: O_2. Water is a compound, and its molecules consist of two hydrogen (H) atoms and one oxygen atom, represented symbolically as H_2O.

Objective 7

The terms *compound*, *mixture*, and *solution*

✔ **Note:** When substances are put together, they form relationships that may or may not involve a chemical reaction between them. A chemical reaction results in a change in the reacting chemicals. For example, in a reaction between two compounds, the atoms may be rearranged to form one or more other compounds or they may simply break into the elements that make up the original compounds. In other instances, nothing chemical happens between substances that are mixed together. Whether a reaction takes place depends on a number of factors—most importantly, the chemicals involved and the presence or absence of **catalysts**.

Key terms:

- **Catalyst** (kat´-uhl-uhst)—A substance that affects the rate of change in a chemical reaction without being changed chemically
  - ✔ **Note:** Generally, a catalyst will cause a reaction to begin or will cause the reaction to proceed at a faster rate. However, the catalyst itself is not affected by the reaction. Time, pressure, light, and other factors may also affect the efficiency of a chemical reaction.
- **Centrifuge** (seń-truh-fyuj)—A device that is used to separate the components of a solution or liquid mixture by spinning the substance
  - ✔ **Note:** One of the laws of physics deals with centrifugal force. Basically, this law is a variation on the law of inertia, which states, in part, that an object in motion tends to continue in motion in a straight line unless acted upon by another force.

a. **Compound**—A substance that consists of atoms of two or more different elements bonded together as molecules; to separate its components into other compounds and elements requires a chemical reaction

b. **Mixture**—A substance that consists of two or more combined components that do not interact chemically; to separate its components requires either a mechanical method or the application of energy

✔ **Note:** One method of separating mixtures in which the substances are different sizes is filtration in which the mixture is forced through a material that allows smaller substances to pass through while preventing the passage of larger particles. For example, a mixture may be spun in a **centrifuge** to separate substances based on their mass (weight). An electrical charge can be used to remove negative or positive ions.

c. **Solution**—A substance that consists of one or more components dissolved in a liquid; to separate its components, the energy of the substance must change so that the energy balance between the components prevents the liquid from being able to hold the dissolved material

Objective 8

Primary role of each of the principal elements and compounds in the human body

Key terms:

- **Organic compound** (or-gań-ik kawm-paund´)—A compound that contains carbon and hydrogen
- **Lubricate** (lú-bruh-kat)—To improve the ease of movement between two objects by applying a substance that reduces friction

✔ **Note:** Life on earth is referred to as being *carbon-based* because the physical structures of all organisms are made principally of compounds that contain carbon and hydrogen. Compounds that do not contain carbon and hydrogen, such as water, are referred to as *inorganic compounds*.

a. **Oxygen** (awḱ-si-juhn)—Required for the chemical reaction that releases energy from nutrients; one of the atoms in a water molecule; a key element in other compounds of importance to the body

✔ **Note:** The earth's atmosphere is approximately 21 percent oxygen, which we take into the body by breathing and, to a much lesser degree, through the breakdown of oxygen-containing compounds in nutrients. Oxygen is required for the release of energy within the cells. Oxygen is also an important part of water (H_2O). The body is approximately 60 to 75 percent water. Much of the rest of the body is composed of **organic compounds**, which often contain oxygen in their structure.

b. **Carbon dioxide** (kaŕ-buhn di-awḱ-sid)—Given off as a waste product of cell respiration

✔ **Note:** Carbon dioxide is a compound consisting of molecules with one carbon atom and two oxygen atoms (CO_2). When nutrients are converted to energy, excess atoms of carbon and oxygen combine to form carbon dioxide.

c. **Water** (wawt´-uhr)—Dissolves substances to make them more usable to the body; provides fluid to **lubricate** moving parts of the body; helps to maintain body temperature

✔ **Note:** The process of moving nutrients and chemicals through the body is highly dependent on water because most of these substances must be dissolved in order to pass through the body and into cells.

d. **Glucose** (glú-kos)—Serves as the primary energy source for the cells

Objective 9

Role of electrolytes in human health

Key terms:

- **Ion** (í-awn)—An atom or group of atoms with either a positive or a negative electrical charge
  ✔ **Note:** An atom that has fewer electrons than protons has a positive charge and is called a *positive ion* or *cation* (kat´-i-uhn). An atom that has more electrons than protons has a negative charge and is called a *negative ion* or *anion* (ań-i-uhn). The charge of an ion can play an important role in the transport of chemicals throughout the body.
- **Salt** (sawlt´)—A class of chemicals that have a positive ion other than hydrogen and a negative ion that is not a **hydroxyl**
- **Acid** (aś-uhd)—A substance that releases a hydrogen ion when dissolved
- **Base** (baś)—A substance that releases a hydroxide ion when dissolved
  ✔ **Note:** Base substances are also referred to as *alkaline* (aĺ-kuh-luhn).
- **Hydroxyl** (hi-drawk ´suhl)—An ion consisting of one hydrogen atom and one oxygen atom
- **Concentration** (kawn-sen-trá-shuhn)—The ratio of the components of a solution or mixture

a. An electrolyte is a substance that forms ions when it dissolves.

b. Electrolytes include **salts**, **acids**, and **bases** found throughout the body.

✔ **Note:** The fact that the ions have a positive or negative charge provides the body with a mechanism for moving these substances from one place to another, as ions with similar charges tend to move away from each other while those with different charges tend to move toward each other.

c. Body functions are most efficient when the **concentrations** of the electrolytes are within specific ranges.

d. Electrolytes are lost through sweating and through the elimination of body waste.

Objective 10

Role of acids and bases in human health

a. Acids and bases are classed as strong, using a value called *pH*, with the most- acidic substances having a value toward 0 and the most-basic substances having a value toward 14.

✔ **Note:**The pH scale represents the potential hydrogen that a substance can accommodate. Thus, the 0 end of the scale shows that a hydrogen ion shows no reaction with another hydrogen ion, while a hydroxide ion at the 14 end of the scale will easily react with a hydrogen ion to form water. At the midpoint of the scale is pure water with a value of 7, showing that it is neither acidic nor alkaline.

b. Body fluids have a normal pH value with a narrow range above and below that value.

✔ **Note:** The normal pH of blood is 7.35 to 7.45, meaning that it is slightly alkaline. Intracellular fluid has a pH of approximately 6.8 or slightly more-acidic than pure water.

c. If the pH value of a fluid goes above or below its ideal range, chemical reactions will be affected.

d. Normal human activities can lead to major shifts in pH.

✔ **Note:** Changes in diet, changes in exercise, environmental exposures, and illness can affect the pH balance in the body. However, normal cell respiration would also lead to an increase in acidity if the body did not have mechanisms to compensate for such changes.

Objective 11

Cell theory

Key term:

- **Protoplasm** (prot´-uh-plaz-uhm)—The complex mass of proteins and other organic and inorganic materials that is capable of exhibiting the characteristics of life

a. All organisms are made of small, enclosed bodies called *cells* and of the products of those cells.

b. Cells are small bits of organized protoplasm encased in a thickened membrane. In multicellular organisms, cells tend to have a specialized function that contributes to the overall functioning of the organism.

Objective 12

Principal types of protoplasm

a. **Nucleoplasm** (nú-kle-uh-plaz-uhm)—The protoplasm found in the nucleus of a cell

✔ **Note:** All human cells except mature red blood cells have a nucleus.

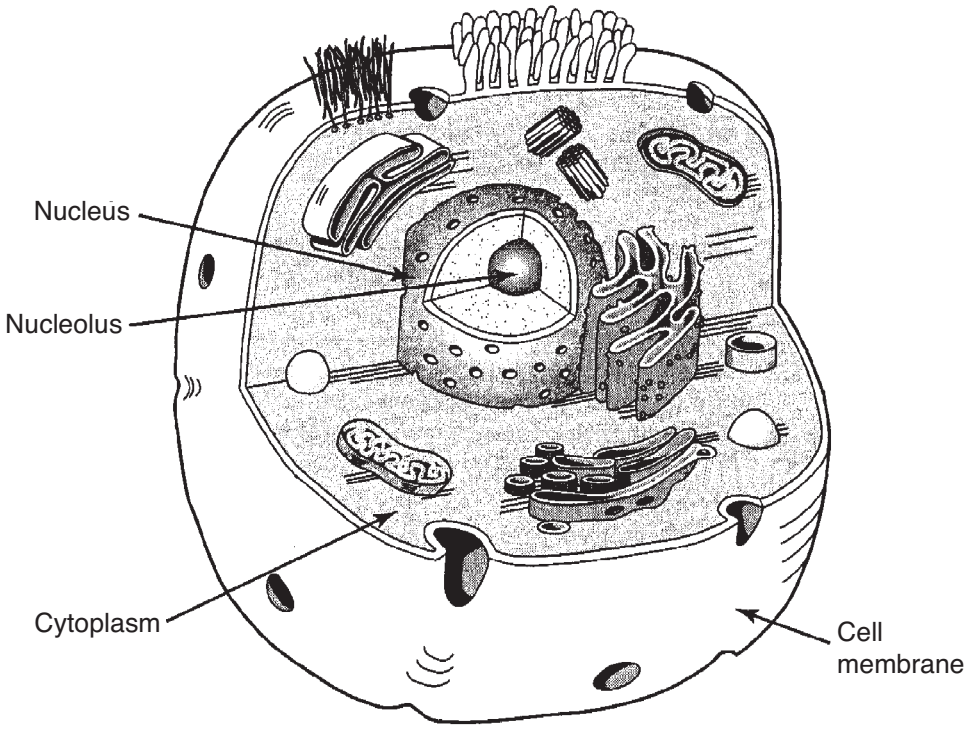
b. **Cytoplasm** (sit´-uh-plaz-uhm)—The protoplasm found outside the nucleus of a cell

Objective 13

Major parts of a cell (see Figure 2 below)

✔ **Note:** Cells contain specialized structures that perform specific functions in maintaining the cell as a living body. The exact structures and their arrangements will vary from cell to cell depending on the type of parent organism, the cell's role within the parent organism, and the cell's stage of life. The cell shown in Figure 2 is representative of cells in general and is not intended to be a specific cell or to reflect the structure of all cells.

Figure 2—Major parts of a cell



Information Sheet

Objective 14

Major parts of a cell and their functions

Key term:

- **Permeability** (puhr-me-uh-biĺ-uht-e)—The characteristic of a material to allow other substances to pass through it
  - ✔ **Note:** An important function of a cell is to take in substances such as oxygen and nutrients and to release substances such as carbon dioxides and enzymes. However, the membrane must prevent substances such as toxins from entering the cell. For this reason, the cell membrane is said to be *selectively permeable*.

a. **Nucleus**—Regulates cellular structure and activities, including reproduction of the cell (see Figure 2 on page 15)

b. **Cell membrane**—Allows some molecules to enter the cell while preventing entry by other molecules (see Figure 2)

✔ **Note:** The cell membrane is sometimes referred to as the *plasma membrane*. The membrane exhibits selective **permeability**—it selects the chemicals that are allowed to pass through it, permitting some to pass in or out easily and keeping others out completely.

c. **Cytoplasm**—Provides structure to the cell and supports other parts of the cell (see Figure 2)

Objective 15

Major parts of a cell nucleus

a. **Nuclear membrane**—A thickening of the outer surface of the nucleus protoplasm that regulates the movement of materials into and out of the nucleus

b. **Chromosome** (kró-muh-som)—One of several strands of DNA that contains the genetic code that determines inherited traits

✔ **Note:** Human cells contain 23 pairs of chromosomes that carry the genetic code.

c. **Nucleolus** (nu-klé-uh-luhs)—A dense spherical structure within the nucleus that is involved in protein synthesis and that forms ribosomal RNA (see Figure 2)

Objective 16

Specialized structures in cells

a. **Flagellum** (fluh-jeĺ-uhm)—A single hair-like projection on a sperm cell

b. **Cilia** (siĺ-e-uh)—Hair-like projections of the cells that form the mucous lining of the respiratory system and other passageways

Objective 17

Functions of specialized structures in cells

a. **Flagellum**—Helps to propel a cell

b. **Cilia**—Help to propel fluid in one direction over the surface of cells

Objective 18

Functions of a cell

a. To absorb materials to support cell functions

Examples: oxygen, nutrients

b. To metabolize nutrients

c. To metabolize oxygen

d. To release energy

e. To synthesize protein

f. To excrete waste products

g. To reproduce itself

h. To support functions specific to that kind of cell

✔ **Note:** The body contains hundreds of types of cells that serve specialized functions to support the purposes of the organ system in which the cells originate.

Objective 19

Classes of microorganisms

Key terms:

- **Unicellular** (yu-ni-seĺ-yuh-luhr)—Consisting of one cell
- **Cyst** (sist´)—A capsule that forms around microorganisms before they enter dormant periods
- **Host** (host´)—The organism that provides the resources required to sustain a parasitic relationship
- **Spore** (spoŕ)—The dormant form of a bacterium or the reproductive form of a fungus
- **Invertebrate** (in-vuhrt´-uh-brat)—An organism that does not have an internal skeleton and, specifically, a spinal column
- **Exoskeleton** (ek-so-skeĺ-uht-uhn)—A characteristic of some organisms in which the outer tissue of parts of the body are hardened to the point that they support attached softer tissues
- **Allergy** (aĺ-uhr-je)—A condition of being highly sensitive to foreign substances that enter the body often because the person's immune system does not respond to the antigen of the substance

a. **Bacterium** (bak-tiŕ-e-uhm)—A widely distributed **unicellular** organism that may or may not cause disease

✔ **Note:** The plural of bacterium is bacteria.

b. **Virus** (ví-ruhs)—A subcellular organism that reproduces as a parasite within other organisms and, consequently, is pathogenic

✔ **Note:** Viruses are smaller than bacteria.

c. **Protozoan** (prot-uh-zó-uhn)—A unicellular organism that is adapted for life in water and forms **cysts** that pass from **host** to host

✔ **Note:** The plural of protozoan is protozoa. They generally spread from food or water contaminated with cysts.

d. **Fungus** (fuhń-guhs)—A unicellular or multicellular organism that reproduces by means of **spores** and that may be pathogenic or nonpathogenic

✔ **Note:** The plural of fungus is *fungi*. Many fungi, such as molds and mushrooms, live on dead matter and help to decompose it. Unicellular fungi are called *yeast*, and many of them are pathogenic to humans, causing yeast infections in moist areas of the body, athlete's foot, ringworm, and other conditions.

e. **Worm** (wuhrḿ)—A multicellular organism that in its parasitic form can be pathogenic to humans

✔ **Note:** Parasitic worms can produce very serious infestations because they live inside the body and feed on the host's blood and nutrients. Flukes, tapeworms, pinworms, and hookworms are examples of worms that infect humans.

f. **Arthropod** (aŕ-thruh-pawd)—An **invertebrate** organism with six or more jointed legs and an **exoskeleton**

✔ **Note:** All insects, arachnids (such as spiders), and creatures such as lobsters and crabs are arthropods. Some arthropods are parasitic on humans, including ticks, lice, and mites. Many, such as bees, spiders, and scorpions, carry toxins that can be harmful to humans, especially persons with **allergies** to arthropod venom. Arthropods such as ticks, fleas, flies, and mosquitoes can present additional risks to humans by carrying infectious organisms that enter the bloodstream when the arthropod bites.

Objective 20

Classes of microorganisms as classified by their shape

✔ **Note:** One of the means of classifying bacteria and some other unicellular organisms is by their shape. Three of the common microorganism shapes—bacillum (buhsiĺ-uhm), coccus (kawḱ-uhs), and spirillum (spi-riĺ-uhm)—are illustrated in Figures 3 through 5 below. A bacillum is any rod-shaped bacterium; a coccus is any round, spherical, or oval bacterium; and a spirillum is any coiled bacterium.

Figure 3—Bacillum

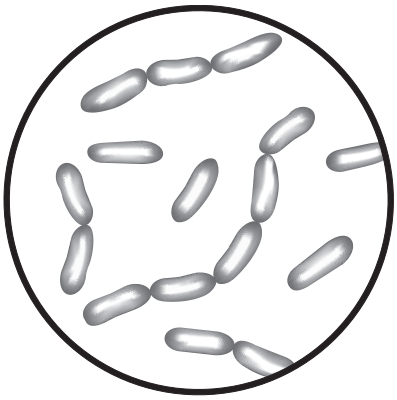


Figure 4—Coccus

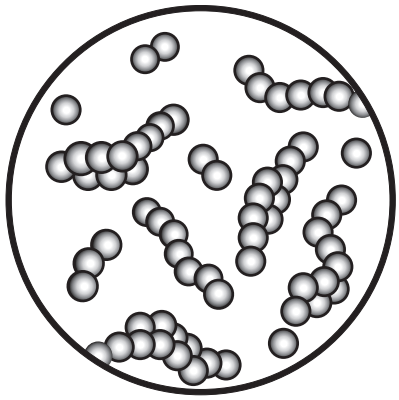
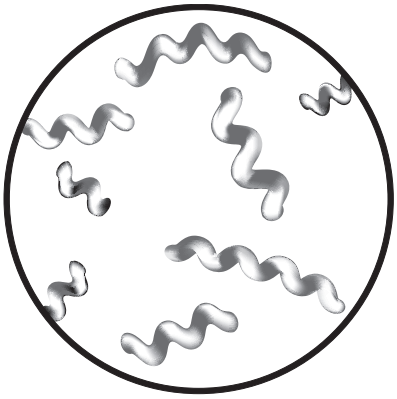


Figure 5—Spirillum



Objective 21

Characteristics of bacteria

a. The tough outer cell wall gives a bacterium its shape.

b. Cocci and bacilli often colonize with each other so that another way of identifying bacteria is by the shape of their colonies.

✔ **Note:** The shape of the bacterial groups is added as a prefix to the shape of the organism. Thus, cocci that forms clusters are called *staphylococcus* (staf-uh-lokawḱ-uhs), those that form chains are called *streptococcus* (strep-tuh-kawḱ-uhs), and those that form pairs are called *diplococcus* (dip-lo-kawḱ-uhs). There are also strepto- and diplo- forms of bacilli.

Information Sheet

Objective 22

Characteristics of viruses

a. Viruses are nucleic acids within shells of protein.

b. Each virus exhibits a shape that is characteristic of that virus.

c. Viruses can only reproduce when they are within the living cells of a host organism.

d. A virus will use the nucleic acid and enzymes of an infected cell to produce other viruses, often multiplying to the point that the host cell ruptures and dies.

e. The severity of a viral disease depends on the type of cells that are infected.

f. Some viruses can become dormant so that they present no signs of infection and then become active again after a period of time, even years later.

g. Some viruses can be transmitted from a pregnant woman to her fetus.

h. Antiviral medications are difficult to develop because viruses reside inside cells, use the cell's chemicals to reproduce, and offer few functions that can be attacked without harming the host organism.

Objective 23

Characteristics of fungi

✔ **Note:** Fungi (fuhń-ji; singular fungus, fuhń-guhs) are a type of plant. Fungi do not have chlorophyll and must extract their nutrition from an external source, such as decaying organic matter or a live host. Many types of fungi are capable of infecting humans.

a. Fungi may be unicellular or multicellular.

b. Some fungi are normally found in and on the body.

c. Fungal infections may result from the use of antibiotics or reduced resistance due to injuries or diseases.

d. Most fungal infections are superficial but can spread to the inside of the body through spores.

Objective 24

Common parasites that afflict humans

Key term:

- **Vectors** (veḱ-tuhrs) **of disease**—The conditions that tend to promote the spread of a disease, such as when the bite of an arthropod allows pathogens to enter a person's bloodstream

a. Parasitic worms live off nutrients in the host's body, in the host's blood, or on the host itself.

b. Many parasitic worms have several stages of life involving eggs, larvae, and adult stages.

c. Parasitic worms generally inhabit specific body sites.

d. For some species of parasitic worms, the inhabited site varies with the stage of development and may even involve more than one host species.

e. Mites and lice generally afflict the surface of a host's body and present little direct risk to the host.

f. Parasites such as lice, fleas, mosquitoes, and ticks may be **vectors of disease**.

Module Contents

Student Components

Student Guide

Student Workbook

* Assignment Sheets

* Assignment Sheets are located in the Student Workbook.

Prerequisites:
Modules 1 & 2

Learning Activities Sheet

Student Name _____

Directions

Place a checkmark in the appropriate box as you complete each of the steps below.

❑ 1. **Take** Pretest provided by your instructor.

❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.

❑ 3. **Read** Module Objective Sheet.

❑ 4. **Study** Information Sheet, Objectives 1 through 4.

❑ 5. **Research** Online resources to learn more about infection, immunology, and sanitation. Your instructor will list several Web sites on the blanks below. Visit at least two of the following Internet sites.

- _____
- _____
- _____
- _____
- _____

❑ 6. **Do** Assignment Sheet 1, "Complete the Crossword Puzzle of Terms (Objectives 1–4)."

❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 8. If the evaluation is not satisfactory, repeat Steps 4, 6, and 7.

❑ 8. **Study** Information Sheet, Objectives 5 through 12.

❑ 9. **Do** Assignment Sheet 2, "Complete the Crossword Puzzle of Terms (Objectives 5–12)."

Learning Activities Sheet

❑	10. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 11. If the evaluation is not satisfactory, repeat Steps 8 through 10.
❑	11. **Do**	Assignment Sheet 3, "Conduct a Sanitation Inspection of the Salon/Laboratory and Classroom."
❑	12. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 13. If the evaluation is not satisfactory, repeat Steps 11 and 12.
❑	13. **Do**	Assignment Sheet 4, "Analyze Cosmetology Scenarios."
❑	14. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 15. If the evaluation is not satisfactory, repeat Steps 4, 8, 13, and 14.
❑	15. **Do**	Assignment Sheet 5, "Complete Module 3 Review."
❑	16. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 17. If the evaluation is not satisfactory, repeat Steps 4, 8, 15, and 16.
❑	17. **Take**	Written Test provided by your instructor.
❑	18. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 19. If the evaluation is not satisfactory, follow your instructor's recommendations concerning a review of the above learning activities.
❑	19. **Check**	With your instructor for any additional assignments to be completed.
❑	20. **Do**	Additional assignments listed below.

_____

_____

_____

❑	21. **Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test and assignment sheets. If the evaluation is satisfactory, proceed to next module. If evaluation is not satisfactory, ask your instructor for further instructions.

***Permission to duplicate this form is granted.**

Module Objective Sheet

Module Objective

After completing this module, you should be able to name the sources of the microorganisms that cause disease, describe the body's defense-mechanism processes, and describe methods used to control the spread of microorganisms. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test.

Specific Objectives

After completing this module, you should be able to:

1. Define the term *infection*.
2. Complete statements that describe the effects of infection on a human host.
3. Complete statements that describe methods used to reduce the spread of infection.
4. Match types of infections and diseases with their descriptions.
5. Complete statements that describe the role of the body's portals of entry and portals of exit in the spread of infectious diseases.
6. Match the body's physical barriers to infection with their functions.
7. Define the types of immunity.
8. Match methods used to control the spread of microorganisms with their definitions.
9. State reasons certain industries must control the growth of microorganisms.
10. Match types of antimicrobial-control methods with their descriptions.
11. List factors that contribute to the spread of nosocomial infections.
12. Match organisms that cause common nosocomial infections with the infections they cause.
13. Complete the crossword puzzle of terms (Objectives 1–4). (Assignment Sheet 1)
14. Complete the crossword puzzle of terms (Objectives 5–12). (Assignment Sheet 2)

15. Conduct a sanitation inspection of the salon/laboratory and classroom. (Assignment Sheet 3)

16. Analyze cosmetology scenarios. (Assignment Sheet 4)

17. Complete Module 3 review. (Assignment Sheet 5)

Information Sheet

Objective 1

The term *infection*

Key terms:

- **Toxin** (tawḱ-suhn)—A substance that is harmful to cells
- **Disease** (diz-eź)—A specific illness or disorder characterized by a recognizable set of signs and symptoms and attributable to heredity, infection, diet, or environment
- **Host** (host´)—An organism that serves as a permanent or temporary home for another organism

a. **Infection** (in-feḱ-shuhn)—An invasion of a body by organisms and the reaction of the body to the presence of those organisms and to the **toxins** that they produce

b. It is also defined as the presence and multiplication of an organism that results in harm or **disease** to a **host**.

✔ **Note:** Very small organisms, referred to as microorganisms, can enter the body during respiration, ingestion, and sexual contact; through wounds; and by other conditions that provide openings into the body (see Objective 5).

Objective 2

The effects of infection on a human host

Key terms:

- **Pathogen** (path´-uh-juhn)—An organism that is capable of producing disease in another organism
- **Symptom** (sim{p}´-tuhm)—A condition that occurs in association with a disease and that can be evidence of the presence of the disease
  Examples: Fever, chills, sluggishness, rash, loss of appetite, watery eyes

a. The harmful effects of an infection on a host may be the direct result of an action taken by a **pathogen** or the result of toxins produced by the pathogen.

✔ **Note:** An infecting organism generally causes illness by disrupting the normal activities of a host's cells and, thus, organs.

b. The ability of an infecting organism to harm a host is referred to as *virulence* (viŕ-{y}uh-luhns).

c. The ability of a host to avoid infection and reduce harm caused by an infecting organism is called *resistance* (ri-ziś-tuhns).

d. An infection may result in observable **symptoms** in a host, or the infection may occur without symptoms.

e. The period of time between the incidence of infection and the appearance of symptoms in a host is referred to as the *incubation* (in-kyuh-bá-shuhn) period.

f. An infection in a host may be localized, limited to only one organ or site, or it may be systemic, affecting the entire body.

g. The host's body produces special cells that recognize pathogens and destroy them.

h. *Communicable* (kuh-myú-ni-kuh-buhl) diseases are infections that can be spread from one human host to another through direct or indirect contact.

Objective 3

Methods used to reduce the spread of infection

Key terms:

- **Antiseptic** (ant-uh-seṕ-tik)—A chemical used to destroy or reduce the growth of pathogens on a person
- **Disinfectant** (dis-uhn-feḱ-tuhnt)—A chemical used to destroy or reduce the growth of pathogens on objects
- **Sterilize** (steŕ-uh-liz)—To destroy all of the pathogens on an object or in a substance
- **Vaccination** (vak-suh-ná-shuhn)—The administration of a medication that increases the body's resistance to a specific pathogen
- **Antibiotic** (ant-i-bi-awt´-ik)—A special medication that slows or stops the growth of certain microorganisms

a. The spread of infection can be reduced by using **antiseptic** practices, cleaning with **disinfectants**, and **sterilizing** instruments and surgical materials.

b. Some infections can be prevented through **vaccinations**.

c. Once an infection has occurred, **antibiotics** can be used to improve the body's ability to fight the infection.

Objective 4

Types of infections and diseases

Key term:

- **Illness**—The period of time during which a host exhibits symptoms of a disease

a. **Localized infection**—An infection that involves only one organ or site of a host's body

✔ **Note:** A localized infection may also be referred to as a *local infection*.

b. **Systemic infection**—An infection that has spread throughout a host's body from an initial site

c. **Acute** (uh-kyut´) **infection**—An infection that runs a rapid and severe course and then ends abruptly

Examples: Cold, measles, influenza

d. **Chronic** (krawń-ik) **infection**—An infection that lasts for a long period of time—from weeks to several years

Examples: Advanced tuberculosis, acquired immunodeficiency syndrome (AIDS)

e. **Primary disease**—The first-occurring infection within a period of **illness**

f. **Secondary disease**—A subsequent infection or complication to an existing condition

✔ **Note:** An illness may lower a person's resistance to fight other infections, allowing other organisms to become established.

Information Sheet

Objective 5

Role of the body's portals of entry and portals of exit in the spread of infectious diseases

✔ **Note:** Infections enter the body through openings called *portals of entry*. A portal of entry may be a natural opening, such as the mouth, or an injury, such as a cut. Infections can be communicated to others through openings called *portals of exit*. For example, when a **contagious** person sneezes, pathogens can exit with the mucus and droplets expelled from the nose.

Key terms:

- **Lesion** (lézhuhn)—A separation in tissue
  - ✔ **Note:** A lesion may be the result of a mechanical injury such as a cut or surgical incision, or it may be the result of an infection that causes the flesh to tear.
- **Sputum** (sp{y}ut´-uhm)—Substance expelled from the respiratory tract that may contain mucus, pus, cellular materials, blood, and other materials
- **Asymptomatic** (a-sim{p}-tuh-mat´-ik)—Being without symptoms
- **Carrier** (kaŕ-e-uhr)—An organism capable of spreading disease
  - ✔ **Note:** A carrier may exhibit symptoms of the disease or may be asymptomatic.
- **Contagious** (kuhn-tá-juhs)—Communicable, such as a disease that may be transmitted by direct or indirect contact

a. The most-common portals of entry for pathogens are breaks in the skin and natural body openings such as the nose and mouth.

b. The most-common portals of exit for pathogens are skin **lesions** and natural body openings such as the nose and mouth.

   ✔ **Note:** Pathogens are spread by persons coming into contact with the body fluids that leave by means of an infected person's portals of exit. Blood may be transferred from an open wound or by infected needles and instruments. Sputum and saliva carry pathogens from the lungs and mouth. Tears can transmit infections of the eyes.

c. Typically, a disease will spread from an infected host's portals of exit to a second host's portals of entry.

d. Hosts who have recovered from a disease or who are **asymptomatic** may be **carriers** and transmit the disease to others.

e. Pathogens that live in the soil, on other surfaces, or in contaminated foods can also enter the body through portals of entry.

✔ **Note:** Steps can be taken to reduce the risk of infection through antibacterial techniques. For example, if a person suffers a slight cut while using a razor or scissor, the wound should be washed and treated with an antibiotic. The wound may also be cleaned, medicated, and covered to prevent dirt and other contaminants from entering it.

Objective 6

Functions of the body's physical barriers to infection

Key term:

- **Cerumen** (suh-rú-muhn)—Earwax, a secretion of the ceruminous glands in the ear canal

a. **Perspiration**—Helps to cleanse the pores and raise the level of acidity on the skin

b. **Tears**—Rid the eyes of contaminants and help to seal and lubricate the eyelids to prevent entry of organisms

c. **Saliva**—Contains enzymes that help break down invading pathogens and prevent them from colonizing in the mouth

d. **Mucus**—Provides a coating that prevents pathogens from making direct contact with the skin

e. ***Cerumen***—Provides a coating that prevents pathogens from contacting delicate areas of the skin in the ear canal

Objective 7

Types of *immunity*

Key terms:

- **Immunity** (im-yú-nuht-e)—The state of being protected from the effects of a pathogen, generally due to having received a vaccination or because of the body's production of antibodies from a previous exposure to the organism
- **Immunology**—The study of the ways in which the body resists infection
- **Susceptibility** (suh-sep-tuh-bi Í-uht-e)—The degree to which a person is likely to contract a disease
- **Vaccine** (vaḱ-sen)—A suspension of diluted or killed microorganisms administered by injection or ingestion in order to stimulate the production of antibodies to promote an active immunity to that pathogen

a. **Genetic immunity**—Immunity based on one's inherited genetic makeup rather than on the production of antibodies

✔ **Note:** Essentially, the term genetic immunity means that an organism is not susceptible to a given pathogen that may invade it.

b. **Naturally acquired active immunity**—Long-term immunity acquired when a person contracts a disease and his or her body naturally produces antibodies in response to the pathogen and memory cells that protect that person from the pathogen

✔ **Note:** A naturally acquired active immunity may protect a person from a pathogen for many years or even for the rest of the person's life.

c. **Artificially acquired active immunity**—Long-term immunity acquired when a person is given a **vaccine** and his or her body produces antibodies in response to the vaccine and memory cells that protect that person from the pathogen

✔ **Note:** Booster vaccinations may be required to provide an individual with lifelong immunity from the pathogen.

Objective 8

Methods used to control the spread of microorganisms

a. **Antiseptic** (ant-uh-seṕ-tik)—A chemical used to destroy or reduce the growth of pathogens on people

b. **Disinfectant** (dis-uhn-feḱ-tuhnt)—A chemical used to destroy or reduce the growth of pathogens on objects

c. **Antibiotic** (ant-i-bi-awt´-ik)—A chemical used to treat bacterial infections

d. **Sterilization** (ster-uh-luh-zá-shuhn)—A process that destroys pathogens on surfaces

e. **Pasteurization** (pas-chuh-ruh-zá-shuhn)—A process of heating a food to destroy pathogens in the food

Objective 9

Reasons certain industries must control the growth of microorganisms

a. **Public health**—To prevent the spread of illness

b. **Food preservation**—To keep microorganisms from destroying food and to prevent the spread of disease through infected food

c. **Production of sterile products**—To prevent contamination of the products during the production process

d. **Research**—To produce pathogens under controlled circumstances to gain better understanding of them and to develop vaccines and other control measures for them

Objective 10

Types of antimicrobial-control methods

✔ **Note:** Physical methods are those techniques that kill or remove pathogens using physical barriers or energy transported by various means. There is not a chemical reaction or poisoning of the pathogen.

a. **Physical methods**

- **Barrier**—Physical method used to prevent microbes from reaching portals of entry, such as gloves or aprons
- **Moist heat**—Physical method used to kill microbes through the combined effect of heat and water that is at a temperature short of boiling
- **Dry heat**—Physical method used to kill microbes through the effects of heat from a source such as an oven or an infrared light
- **Pressurized steam**—Physical method used to kill all microbes and their spores through the effects of an autoclave
- **Cold**—Physical method that will not generally kill microbes but is used to slow their growth
- **Drying**—Physical method used to reduce the growth of fungi and some bacteria

b. **Chemical methods**

- **Antiseptic**—Chemical method used to destroy bacteria on living organisms
- **Disinfectant**—Chemical method used to destroy bacteria on inanimate objects
- **Sterilant**—Chemical method used to destroy all organisms on inanimate objects

Objective 11

Factors that contribute to the spread of nosocomial infections

a. Improper hand-washing techniques

b. Inappropriate use of antibiotics

✔ **Note:** Excessive use of antibiotics can cause the pathogens to become resistant to the effects of the medication.

c. False sense of security

d. Employees

✔ **Note:** The number of employees, the quality of their training, how conscientious they are, and other personal factors can contribute to the spread of infections in a salon or spa facility.

Objective 12

Organisms that cause common nosocomial infections

Key term:

- **Colitis** (ko-lit´-uhs)—An inflammatory condition of the large intestine characterized by severe diarrhea, bleeding, and ulceration of the mucosa of the intestine

a. **Staphylococcus aureus** (staf-uh-lo-kawḱ-uhs oŕ-e-uhs)—Responsible for a number of post-operative infections commonly referred to as staph infections

b. **Streptococcus** (strep-tuh-kawḱ-uhs) **species**—Involved in "strep" throat, scarlet fever, pneumonia, rheumatic heart disease, and other communicable conditions

c. **Esherichia coli** (esh-er-iḱ-i-uh kó-li)—Responsible for various infections referred to as **colitis**

✔ **Note:** E. coli is one of the most-common sources of nosocomial infections.

d. **Human immunodeficiency virus** (HIV)—Responsible for AIDS

✔ **Note:** HIV can be spread through body fluids.

e. **Hepatitis** (hep-uh-tit´-uhs) **B virus**—Responsible for hepatitis

✔ **Note:** Hepatitis B virus is one of three common strains, though other strains exist. Hepatitis B is a significant threat in health care because it can be spread through body fluids.

f. **Human papilloma** (hú-muhn pap-uh-ló-muh) **virus**—Associated with several types of cancer, including cancers of the mouth and cervix

Module Contents

Student Components

Student Guide

Student Workbook

* Assignment Sheets

* Assignment Sheets are located in the Student Workbook.

Prerequisites:
Modules 1–3

Learning Activities Sheet

Student Name _____

Directions

Place a checkmark in the appropriate box as you complete each of the steps below.

❑ 1. **Take** Pretest provided by your instructor.

❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.

❑ 3. **Read** Module Objective Sheet.

❑ 4. **Study** Information Sheet, Objectives 1 through 10.

❑ 5. **Research** Online resources to learn more about tissues. Your instructor will list several Web sites on the blanks below. Visit at least two of the following Internet sites.

- _____
- _____
- _____
- _____
- _____

❑ 6. **Do** Assignment Sheet 1, "Complete the Crossword Puzzle of Terms (Objectives 1–10)."

❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 8. If the evaluation is not satisfactory, repeat Steps 4, 6, and 7.

❑ 8. **Do** Assignment Sheet 2, "Develop a Presentation on Basic Tissue of the Human Body."

❑ 9. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 10. If the evaluation is not satisfactory, repeat Steps 4, 8 and 9.

Learning Activities Sheet

❑	10. **Do**	Assignment Sheet 3, “Complete Module 4 Review.”
❑	11. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 12. If the evaluation is not satisfactory, repeat Steps 4, 10, and 11.
❑	12. **Take**	Written Test provided by your instructor.
❑	13. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 14. If the evaluation is not satisfactory, follow your instructor's recommendations concerning a review of the above learning activities.
❑	14. **Check**	With your instructor for any additional assignments to be completed.
❑	15. **Do**	Additional assignments listed below.
		_____
		_____
❑	16. **Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test and assignment sheets. If the evaluation is satisfactory, proceed to next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

Module Objective Sheet

Module Objective

After completing this module, you should be able to describe types of tissues and the factors that determine muscle-tissue classifications. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test.

Specific Objectives

After completing this module, you should be able to:

1. Define the term *tissue*.
2. Match the basic types of tissue with their descriptions.
3. State the functions of the basic types of tissue.
4. Match the types of connective tissue with their functions.
5. Distinguish between the basic types of nerve tissue.
6. Match the basic parts of a neuron with their functions.
7. Complete statements that describe how neurons function in the nervous system.
8. Describe the factors that determine muscle-tissue classifications.
9. Define the term *organ*.
10. Complete statements that describe how organ systems function.
11. Complete the crossword puzzle of terms (Objectives 1–10). (Assignment Sheet 1)
12. Develop a presentation on basic tissue of the human body. (Assignment Sheet 2)
13. Complete Module 4 review. (Assignment Sheet 3)

Information Sheet

Objective 1

The term *tissue*

a. **Tissue**—A collection of cells that share a similar structure and are organized to perform a specific function

Objective 2

Basic types of tissue and their correct descriptions

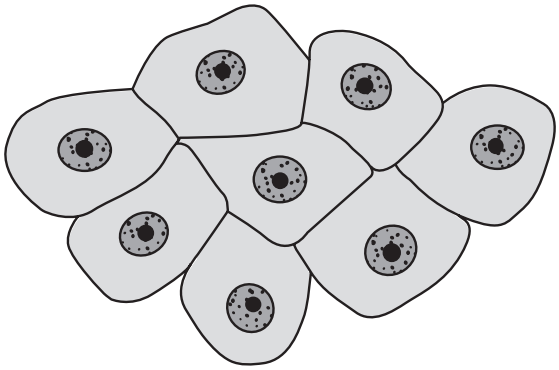
Key term:

- **Epithelium** (ep-uh-thé-le-uhm)—The covering of the internal organs of the body, also the lining of the vessels, body cavities, glands, and organs

a. **Epithelial** (ep-uh-thé-le-uhl) **tissue**—Tissue consisting of cells bound by connective material and varying in the number of layers and in the kinds of cells (see Figure 1)

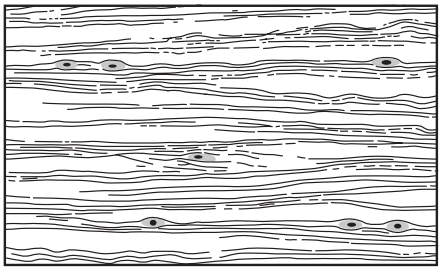
✔ **Note:** Epithelial tissue forms the **epithelium** found in different parts of the body.

Figure 1—Epithelial tissue (surface view)



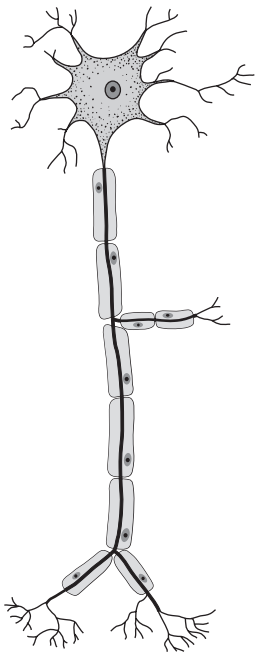
b. **Connective** (kuh-nek´-tiv) **tissue**—Dense tissue containing large numbers of cells and large amounts of intercellular material composed of fibers in a matrix or ground substance that may be liquid, gelatinous, or solid

Figure 2—Connective tissue (fibrous tissue)



c. **Nerve** (nuhrv´) **tissue**—Tissue consisting of one or more bundles of impulse-carrying fibers that connect the brain and the spinal cord with other parts of the body

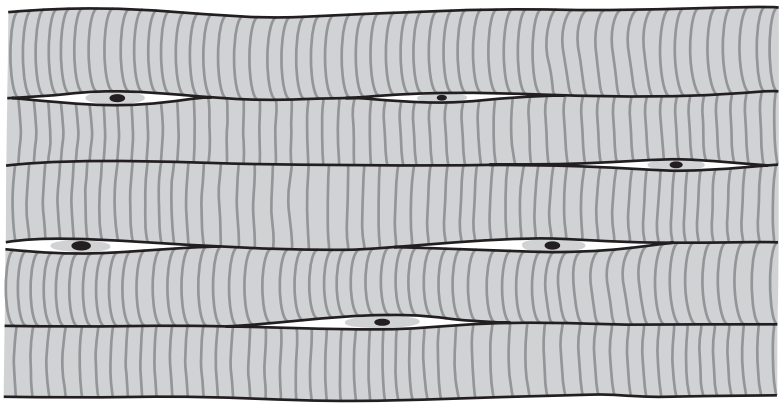
Figure 3—Nerve tissue (neuron)



d. **Muscle** (muhś-uhl) **tissue**—Tissue composed of fibers that are able to contract, causing and allowing movement of the parts and organs of the body

✔ **Note:** Objective 8 discusses the classifications of muscle tissue.

Figure 4—Muscle tissue (skeletal muscle tissue)



Objective 3

Functions of the basic types of tissue

a. **Epithelial tissue**—Provides a protective barrier against extreme temperatures, environmental contaminants, and invasions by microorganisms while allowing secretion and excretion of wastes

b. **Connective tissue**—Binds to other tissue structures to support and organize the body; binds to foreign cells to protect the body; binds to molecules to transport materials through the body

c. **Nerve tissue**—Conducts electrical signals through the body

d. **Muscle tissue**—Allows the movement of the movable structures of the body

Information Sheet

Objective 4

Types of connective tissue and their functions

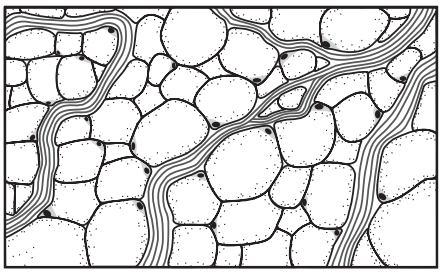
✔ **Note:** Connective tissue is the most-common tissue in the body. It protects and supports organs, transports substances, and binds body structures together.

Key terms:

- **Tendon** (teń-duhn)—A fibrous connective tissue that connects muscle to bones
- **Ligament** (liģ-uh-muhnt)—A fibrous connective tissue that joins one bone to another
- **Deep fascia** (deṕ fash´-uh)—A band of connective tissue that covers or binds together body structures within body cavities
- **Dermis** (duhŕ-muhs)—The connective tissue that makes up the inner layer of skin

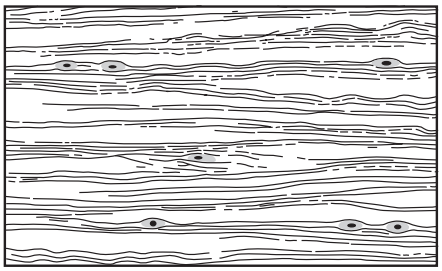
a. **Adipose** (ad´-uh-pos) **tissue**—Located under the skin; provides padding, insulation, and a place to store fats

Figure 5—Adipose tissue



b. **Fibrous** (fí-bruhs) **tissue**—Located in **tendons, ligaments, deep fascia**, **dermis**, and the kidneys; provides strong, flexible connections and the formation of scars

Figure 6—Fibrous tissue

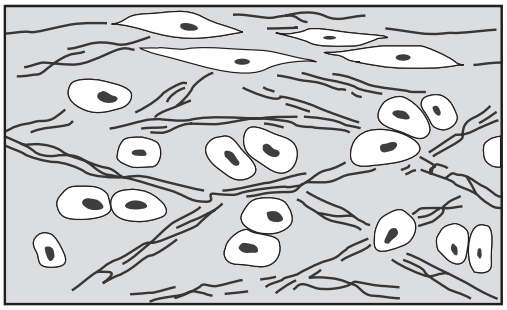


c. **Bone** (boń) **tissue**—Located in the skeleton; forms bones to support the body and protect organs and tissues

Figure 7—Bone tissue

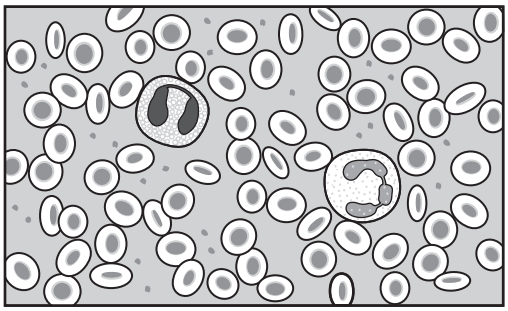
d. **Cartilage** (kart´-uhl-ij) **tissue**—Located in the nose, ears, trachea, and eustachian tubes and at bone joints; provides a firm-but-not-rigid structure and padding between bones

Figure 8—Cartilage tissue



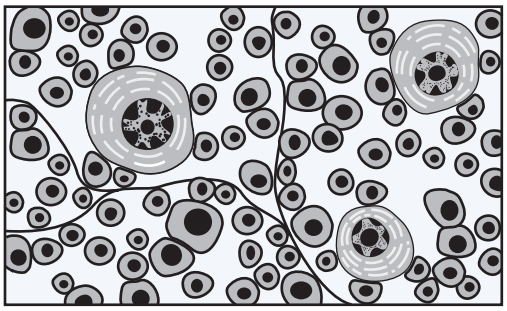
e. **Blood** (bluhd´) **tissue**—Located throughout the blood system; transports materials, including oxygen, throughout the body and combats foreign organisms and cells

Figure 9—Blood tissue



f. **Lymphatic** (lim-fat´-ik) **tissue**—Located in the lymph nodes, spleen, tonsils, and thymus; forms certain types of white blood cells

Figure 10—Lymphatic tissue

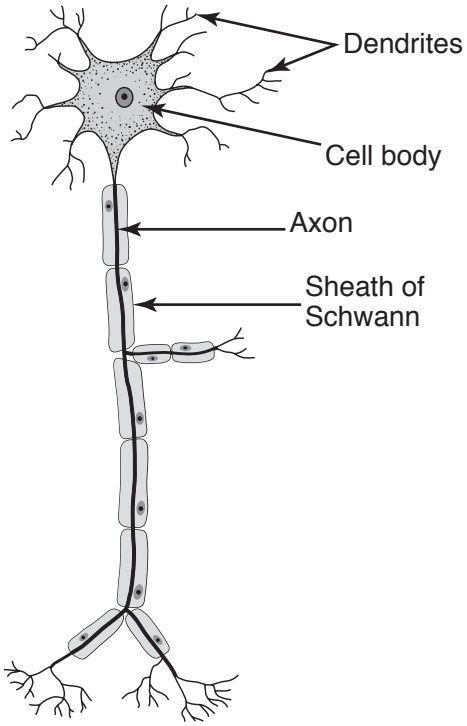


Objective 5

Basic types of nerve tissue

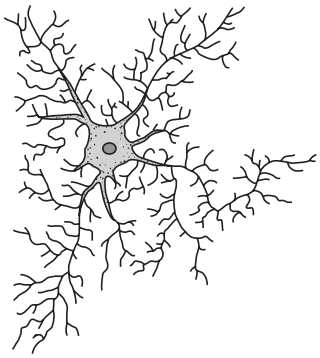
a. **Neurons** (nú-rawns)—The basic nerve-tissue cells of the nervous system that are capable of generating electrochemical impulses that carry information to and from the brain

Figure 11—Basic parts of a neuron



b. **Neuroglia** (nu-ró-gle-uh)—The supporting- or connecting-tissue cells of the central nervous system

Figure 12—Neuroglia



Objective 6

Functions of the basic parts of a neuron

✔ **Note:** Neurons consist of a cell body and two extensions: axons (aḱ-sawns) and dendrites (deń-drits). A neuron will have one axon but may have several dendrites (see Figure 11 on the previous page).

a. **Axon**—Carries nervous-system impulses from the cell body

b. **Dendrite**—Carries nervous-system impulses to the cell body

c. **Cell body**—Performs metabolic and reproductive functions for the cell

Objective 7

How neurons function in the nervous system

Key term:

- **Sheath** (sheth´)—A covering, especially a loose-fitting one

a. Neurons are surrounded by specialized cells that form the **Sheath** of Schwann, which electrically isolates neurons (see Figure 11).

b. The axon of one neuron is separated from a dendrite of an adjoining neuron by a space called a *synapse* (siń-aps).

c. Nerve-system impulses cannot cross the synapse unless it is filled with special chemicals called *neurotransmitters* (nur-o-tranz-mit´-uhrs).

d. There are three kinds of neurons as determined by their location and function: sensory, motor, and interneurons.

e. Sensory neurons, which are sometimes referred to as *afferent* (af´-uh-ruhnt) *neurons*, carry signals from receptors in the skin, skeletal muscles, joints, and organs to the central nervous system.

f. Motor neurons, which are sometimes referred to as *efferent* (ef´-uh-ruhnt) *neurons*, carry impulses from the central nervous system to effectors (i-feḱtuhrs) that cause responses in the muscles and glands.

g. Interneurons, which are located in the central nervous system, carry either sensory or motor impulses or connect motor and sensory neurons and support higher-order functions such as thinking and learning.

Objective 8

Factors that determine muscle-tissue classifications

Key terms:

- **Striated** (strí-at-uhd)—Lined with grooves
- **Voluntary** (vawl ´-uhn-ter-e)—Muscles that are consciously controlled by the will of a person
  Example: Muscles that move an arm
- **Involuntary**—Muscles that work automatically
  Example: Heart muscles
- **Skeletal** (skeĺ-uht-uhl)—**Striated, voluntary** muscle tissue attached to bones
- **Visceral** (viś-uh-ruhl)—Smooth, involuntary muscle tissue that lines the walls of hollow organs
- **Cardiac** (kard´-e-ak)—Striated, **involuntary** muscle tissue that composes the walls of the heart

a. **Structural composition**—Whether the muscle tissue is striated or smooth (nonstriated) (see Figures 13-15)

b. **Level of conscious control**—Whether the muscle is voluntary or involuntary

c. **Location**—Whether the muscle tissue is **skeletal**, **visceral**, or **cardiac**

Figure 13—Skeletal muscle tissue (striated tissue)

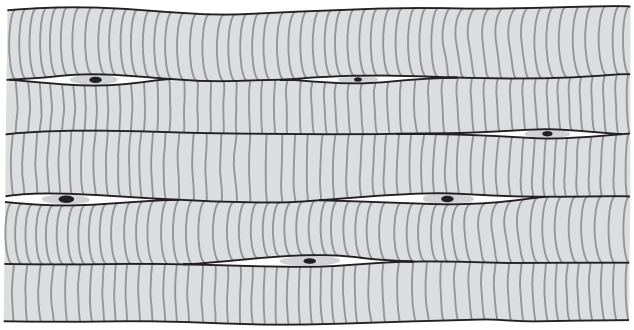


Figure 14—Visceral muscle tissue (smooth tissue)

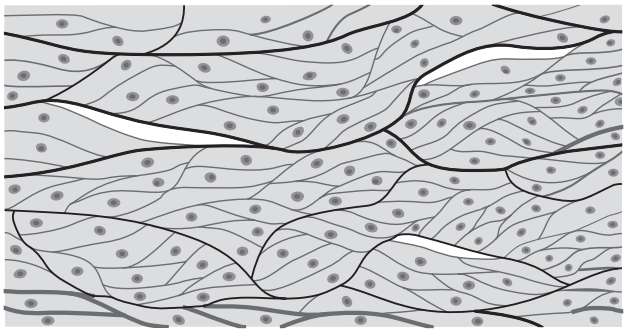
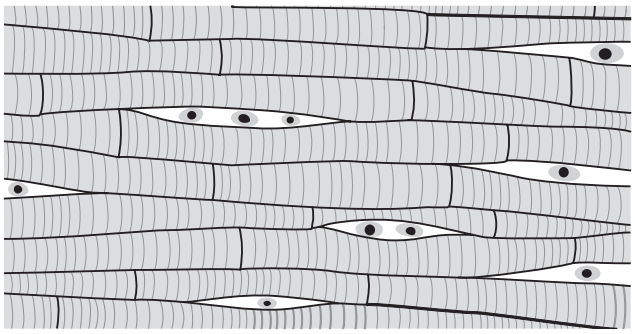


Figure 15—Cardiac muscle tissue (striated tissue)



Objective 9

The term *organ*

a. **Organ**—A structure consisting of two or more tissues that performs a specific function for the body

Information Sheet

Objective 10

How organ systems function

a. Organs are collections of tissues that are organized in such a way that they are able to perform specific functions.

b. The overall goal of these functions is to maintain a state of homeostasis in the body.

c. Each organ system monitors one or more conditions internal to the body or in the body's external environment.

Examples: Internal body temperature and external environmental temperature

d. The organs have feedback mechanisms that send signals to the central nervous system (CNS) about the conditions that they monitor.

e. The CNS provides response signals to organs in order to actuate regulation mechanisms designed to return the body to homeostasis.

Example: If the body is too hot, for example, the CNS may cause the body to sweat. Sweat carries heat from the body and air moving across the damp skin will make it feel cooler. If the body is too cold, the CNS may cause it to shiver to generate heat.

f. Many of the response mechanisms involve physical or chemical reactions.

g. Organs are also involved in the transport of materials throughout the body.

Examples: Blood carries oxygen and digested nutrients through the body; and the digestive tract moves food so that it can be absorbed.

Module Contents

Student Components

Student Guide

Student Workbook

* Assignment Sheets

* Assignment Sheets are located in the Student Workbook.

Prerequisites:
Modules 1–4

Learning Activities Sheet

Student Name _____

Directions

Place a checkmark in the appropriate box as you complete each of the steps below.

❑ 1. **Take** Pretest provided by your instructor.

❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.

❑ 3. **Read** Module Objective Sheet.

❑ 4. **Study** Information Sheet, Objectives 1 through 7.

❑ 5. **Research** Online resources to learn more about integumentary system. Your instructor will list several Web sites on the blanks below. Visit at least two of the following Internet sites.

- _____
- _____
- _____
- _____
- _____

❑ 6. **Do** Assignment Sheet 1, "Complete the Crossword Puzzle of Terms (Objectives 1–7)."

❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 8. If the evaluation is not satisfactory, repeat Steps 4, 6, and 7.

❑ 8. **Study** Information Sheet, Objectives 8 through 14.

❑ 9. **Do** Assignment Sheet 2, "Complete the Crossword Puzzle of Terms (Objectives 8–14)."

Learning Activities Sheet

❑	10. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 11. If the evaluation is not satisfactory, repeat Steps 8, 9, and 10.
❑	11. **Study**	Information Sheet, Objectives 15 and 16.
❑	12. **Do**	Assignment Sheet 3, "Complete the Crossword Puzzle of Terms (Objectives 15 and 16)."
❑	13. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 14. If the evaluation is not satisfactory, repeat Steps 11, 12, and 13.
❑	14. **Study**	Information Sheet, Objective 17.
❑	15. **Do**	Assignment Sheet 4, "Complete the Crossword Puzzle of Terms (Objective 17)."
❑	16. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 17. If the evaluation is not satisfactory, repeat Steps 14, 15, and 16.
❑	17. **Do**	Assignment Sheet 5, "Create a Graphic Organizer."
❑	18. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 19. If the evaluation is not satisfactory, repeat Steps 17 and 18.
❑	19. **Do**	Assignment Sheet 6, "Review the Structures,Layers and Glands of the Skin." (This is a class activity. Ask your instructor for more information.
❑	20. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 21. If the evaluation is not satisfactory, ask your instructor for further instructions.
❑	21. **Do**	Assignment Sheet 7, "Analyze Cosmetology Scenarios."
❑	22. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 23. If the evaluation is not satisfactory, repeat Steps 4, 8, 11, 14, 21, and 22.

❑ 23.	**Do**	Assignment Sheet 8, “Complete Module 5 Review.”
❑ 24.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 25. If the evaluation is not satisfactory, repeat Steps 4, 8, 11, 14, 23, and 24.
❑ 25.	**Take**	Written Test provided by your instructor.
❑ 26.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 15. If the evaluation is not satisfactory, follow your instructor's recommendations concerning a review of the above learning activities.
❑ 27.	**Check**	With your instructor for any additional assignments to be completed.
❑ 28.	**Do**	Additional assignments listed below.
❑ 29.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test and assignment sheets. If the evaluation is satisfactory, proceed to next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

_____

_____

***Permission to duplicate this form is granted.**

Module Objective Sheet

Module Objective

After completing this module, you should be able to identify the major structures of the integumentary system and state the functions of the major structures. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test.

Specific Objectives

After completing this module, you should be able to:

1. Define the term *integument*.
2. List the major structures that make up the integument.
3. Complete statements that describe the characteristics of the skin.
4. Select from a list functions of the skin.
5. Match major structures of the skin with their descriptions.
6. Match the layers of the epidermis with their descriptions.
7. Distinguish between the layers of the dermis.
8. Define the term *auxiliary appendage*.
9. Complete statements that describe the characteristics of hair.
10. Complete statements that describe the characteristics of nails.
11. Distinguish between the functions of glands located in the skin.
12. List the types of nerve endings found in the skin.
13. Label the major structures of the integument.
14. Match common disorders and diseases of the scalp and hair with their definitions.
15. Match common disorders and diseases of the sebaceous glands with their definitions.
16. Match common disorders and diseases of the skin with their definitions.
17. Match common disorders and diseases of the hand and nails with their definitions.

Module Objective Sheet

18. Complete the crossword puzzle of terms (Objectives 1– 7). (Assignment Sheet 1)

19. Complete the crossword puzzle of terms (Objectives 8–14). (Assignment Sheet 2)

20. Complete the crossword puzzle of terms (Objectives 15 and 16). (Assignment Sheet 3)

21. Complete the crossword puzzle of terms (Objective 17). (Assignment Sheet 4)

22. Create a graphic organizer. (Assignment Sheet 5)

23. Review the structures, layers, and glands of the skin. (Assignment Sheet 6)

24. Analyze cosmetology scenarios. (Assignment Sheet 7)

25. Complete Module 5 review. (Assignment Sheet 8)

Information Sheet

Objective 1

The term *integument*

a. **Integument** (in-teǵ-yuh-muhnt)—The structures that cover the exposed surfaces of the body

Objective 2

Major structures that make up the integument

a. **Skin**

✔ **Note:** The major structures of the skin are the epidermis, the dermis (true skin), and the hypodermis. You will study these structures in Objective 3 through Objective 7.

b. **Auxiliary appendages**

✔ **Note:** The auxiliary appendages of the integument include the hair and nails and several other structures. You will study the auxiliary appendages in Objective 8 through Objective 12.

Objective 3

Characteristics of the skin

Key term:

- **Melanin** (mel ´-uh-nuhn)—A protein that absorbs ultraviolet light to give coloration to body structures; also referred to as a *pigment*

a. The skin is the largest organ of the body.

b. Skin varies in depth over the body.

c. If skin is kept clean, it is the body's first line of defense against disease.

d. Skin color is the result of **melanin** and the amount of blood near the surface of the skin.

✔ **Note:** Melanin gives color to the hair and eyes as well as the skin. The greater the deposits of melanin, the darker the skin will appear. However, skin color is also affected by the amount of blood near the surface. For example, when someone exercises, blood circulation increases, which can give the skin a red appearance as the blood vessels dilate to support the increased flow. On the other hand, if a person experiences a trauma, the blood may pool in the vital organs, causing the skin to look pale.

Information Sheet

Objective 4

Functions of the skin

a. Provides a mechanical barrier against microorganisms, sunlight, and chemicals to protect the body

b. Houses nerve endings that sense pain, temperature, touch, and pressure

c. Helps to regulate body temperature

✔ **Note:** When the body is warm, the skin releases sweat to remove heat from the body and to provide cooling through evaporation. When the skin senses cold, it closes off its pores to prevent heat loss. The muscles attached to body hair may also tighten, causing goosebumps.

d. Excretes waste materials

e. Helps maintain fluid and electrolyte balance

✔ **Note:** The skin is a selectively permeable membrane. Sweat carries electrolytes with it so that electrolyte balance does not change too drastically during normal perspiration.

Objective 5

Major structures of the skin (See Figure 1)

Key terms:

- **Areola** (uh-ré-uh-luh)—A small space or a cavity within a tissue
- **Vascular** (vaś-kyuh-luhr)—Containing blood or lymph vessels
- **Sensitive** (seń-suht-iv)—Containing nerve endings and, therefore, can feel sensation
- **Areolar** (uh-ré-uh-luhr) **tissue**—A kind of connective tissue having little tensile strength and consisting of loosely woven fibers and **areolae**
- **Subcutaneous** (suhb-kyu-tá-ne-uhs)—Beneath the skin

a. **Epidermis**—The thin, nonvascular, nonsensitive outermost layer of the skin, consisting of stratified squamous epithelial tissue and including as the greater part of its thickness dead cells that are scraped off and replaced by the underlying cells

✔ **Note:** The epidermis serves to protect the body. It consists of four layers (see Objective 6), except on the palms of the hands and the soles of the feet, where there are five layers. The loss of the epidermis is simply the loss of cells that are already dead. The epidermis is the thickest on the soles of the feet and is thinnest on the eyelids and forehead.

b. **Dermis**—The thick, **vascular**, **sensitive** layer of the skin just below the epidermis, consisting of dense, fibrous connective tissue and containing the auxiliary appendages of the skin

✔ **Note:** The dermis consists of two layers (see Objective 7). The auxiliary appendages of the skin include hair and sweat glands.

c. **Dermal-epidermal junction**—A gel with fibrous structures that serve as a cement to hold the layers of the skin together

d. **Hypodermis**—The layer of **areolar tissue** and fat that lies beneath the dermis and exhibits varying amounts of fat content depending on factors such as body location, gender, nutrition, and health

✔ **Note:** The hypodermis is also called the ***subcutaneous*** *layer*.

Objective 6

Layers of the epidermis

✔ **Note:** Depending on the location in the body, the epidermis has either four or five layers. You will study three of the five layers, two of which are commonly treated by cosmetologists.

Key terms:

- **Stratum** (strat´-uhm)—The Latin term for "layer"
- **Corneum** (koŕ-ne-uhm)—The Latin term for "horn"
- **Keratin** (ker ´-uht-uhn)—A fibrous, sulfur-containing protein that is the primary component of the epidermis, hair, nails, and enamel of the teeth
- **Lucidum** (lú-sid-uhm)—The Latin term for "clear"
- **Germinativum** (jeŕ-muh-nat-iv-uhm)—The Latin term for "germination"
  ✔ **Note:** Germination is the process of seeds developing and growing. The term *germinativum* is a reference to the fact that cells are continually developing in this layer to provide cells for the outer layers of the epidermis.

a. **Stratum corneum**—The outermost layer of the epidermis where dead cells have been converted into **keratin** that continually flakes off (see Figure 1)

✔ **Note:** The stratum corneum is sometimes referred to as the horny layer because it is essentially a crust of dead cells.

b. **Stratum lucidum**—The water-repellent, transparent inner layer of the epidermis found only on the palms of the hands and the soles of the feet

✔ **Note:** The thin squamous cells of the stratum lucidum consist of keratin, which is water repellent. Without this water-repellent layer, humans would not be able to spend more than a few minutes in water before cell damage would occur.

c. **Stratum germinativum**—The innermost layer of the epidermis where columnar cells continually undergo mitosis to make new cells and push older cells outward (see Figure 1)

Objective 7

Layers of the dermis

Key terms:

- **Basale** (bá-suhl)—The Latin term for "base layer"
- **Papilla** (puh-pIĺ-uh)—A protrusion that extends into the epidermal area (see Figure 1)

a. **Papillary layer**—The outer layer of the dermis that lies next to the **basal** layer of the epidermis and is patterned with **papillae** and hollows

✔ **Note:** The papillary layer produces the external ridges of the skin that are evident in fingerprints and other skin patterns.

b. **Reticular layer**—The inner layer of the dermis that forms a network of interlacing cells and fibers, making this layer tough and elastic (see Figure 1)

✔ **Note:** The reticular layer has fibers of collagen that make the layer tough. Collagen fibers are also elastic, allowing the skin to stretch and return to its original shape.

Objective 8

The term *auxiliary appendage*

a. **Auxiliary appendage**—A formation of specialized cells within the skin that performs a particular function

Examples: Hair and nails

✔ **Note:** You will study the various auxiliary appendages in Objective 9 through Objective 12.

Objective 9

Characteristics of hair

Key terms:

- **Follicle** (fawĺ-i-kuhl)—A tube that extends from the dermis through the epidermis and to the surface of the skin
- **Arrector pili** (uh-reḱ-tor pé-li) **muscle**—Bundles of involuntary muscle fiber that contract against the follicle when the skin is cold or during certain emotional states, causing the hair shaft to stand upright
  - ✔ **Note:** In humans, the reaction of the arrector pili muscles results in goose bumps or gooseflesh.
- **Sebum** (seb´-uhm)—The oily secretion of the sebaceous glands of the skin; composed of keratin, fat, and cellular debris
  - ✔ **Note:** Combined with sweat, sebum forms a moist, oily, acidic film that is mildly antibacterial and antifungal and protects the skin and hair against drying. Because the shaft of a hair is exposed to the air outside the body, the hair would dry out and break off without the moisture provided by the sebum.

  Sebaceous (si-bá-shuhs) **gland**—The gland that is connected to the dermal shaft that surrounds the root of a hair

a. Hair grows from a **follicle** in the skin; at the base of the follicle is a bundle of stratum germinativum cells known as the germinal matrix; a dermal papilla joins the germinal matrix with capillaries that support the mitosis of the germinal-matrix cells (see Figure 1).

b. **Arrector pili muscles** are attached to the follicles (see Figure 1).

c. A hair consists of a part that protrudes from the skin—called the *shaft*—and a subdermal section—called the *root* (see Figure 1).

d. Hair color results from pigment within the shaft.

e. Hair is kept soft by **sebum** that is secreted by two or more **sebaceous glands** (see Figure 1).

f. Hair is found on all outer parts of the body except the penis and the contact areas of the hands and feet.

   ✔ **Note:** The amount of facial hair a person may have is an inherited characteristic. In some places of the world, facial hair is desirable because it holds in body heat.

g. Hair on humans has little practical function except for the eyelashes, nasal hairs, and hair on the ears, all of which provide some level of protection against dust and foreign matter.

h. Hair grows approximately one-half inch (13 millimeters) per month.

   ✔ **Note:** Hair growth is affected by nutrition, hormones, and even the climate. A person who is healthy and eats a well-balanced diet will generally have healthy hair.

Information Sheet

Objective 10

Characteristics of nails

✔ **Note:** Refer to Figure 2 in Objective 13 to view the major structures of a nail.

Key terms:

- **Nail** (nal)—A horny, translucent cover protecting the tip of each finger and toe and the underlying tissue associated within
- **Lunula** (looń-yuh-luh)—The Latin term meaning "little moon"; the crescent-shaped white area at the base of a nail
- **Cuticle** (kyut´-i-kuhl)—The thin edge of cornified epithelium at the base of a nail

a. Nails generally are smooth, curved, and unspotted and are firmly attached to the nailbed.

b. Nails consist of epidermal cells that have been converted to keratin (a protein substance) and should appear clear in color allowing the pink color of the dermis (skin) to be seen.

c. Nails grow from epithelial cells lying under the **lunula** at the proximal end of a nail.

d. Nails grow an average of one-eighth of an inch a month.

✔ **Note**: Nails grow faster in children and slower in the elderly.

e. The region under a nail is called the *subungual* (suhb-unǵ-gwuhl) *area (nail bed)*.

f. The skin surrounding a nail is called the ***cuticle***.

Objective 11

Functions of the glands in the skin

Key term:

- **Sweat** (swet´) **gland**—A small structure located in the deep layers of the dermis with a duct that exits through a pore in the epidermis (see Figure 1); the gland consists of a coiled tube surrounded by capillaries
  ✔ **Note:** Sweat glands are especially numerous on the palms, soles, and axillae (ak-siĺ-e) (armpits). A square inch of skin on the palms contains approximately 3000 sweat glands. Sweat glands are classed as eccrine (eḱ-ruhn) or apocrine (aṕ-uh-kruhn). Eccrine sweat glands are by far the most numerous and originate in the subcutaneous tissue.

a. **Sebaceous glands** (see Figure 1)

- Secrete sebum to lubricate and soften hair shafts.
- Prevent excessive water evaporation and water absorption through the skin
- Lessen the amount of heat lost through the skin

b. **Sweat glands**

- Help to maintain homeostasis of fluids and electrolytes and body temperature
- Excrete nitrogenous wastes

c. **Ceruminous glands**—Secrete cerumen

✔ **Note:** Ceruminous glands are modified sweat glands located in the external ear canal. Cerumen helps to keep the external ear from dehydrating.

Objective 12

Types of nerve endings found in the skin

a. **Touch**

b. **Pressure**

c. **Heat**

d. **Cold**

e. **Pain**

Information Sheet

Objective 13

Major structures of the integument

Figure 1—Major structures of the integument

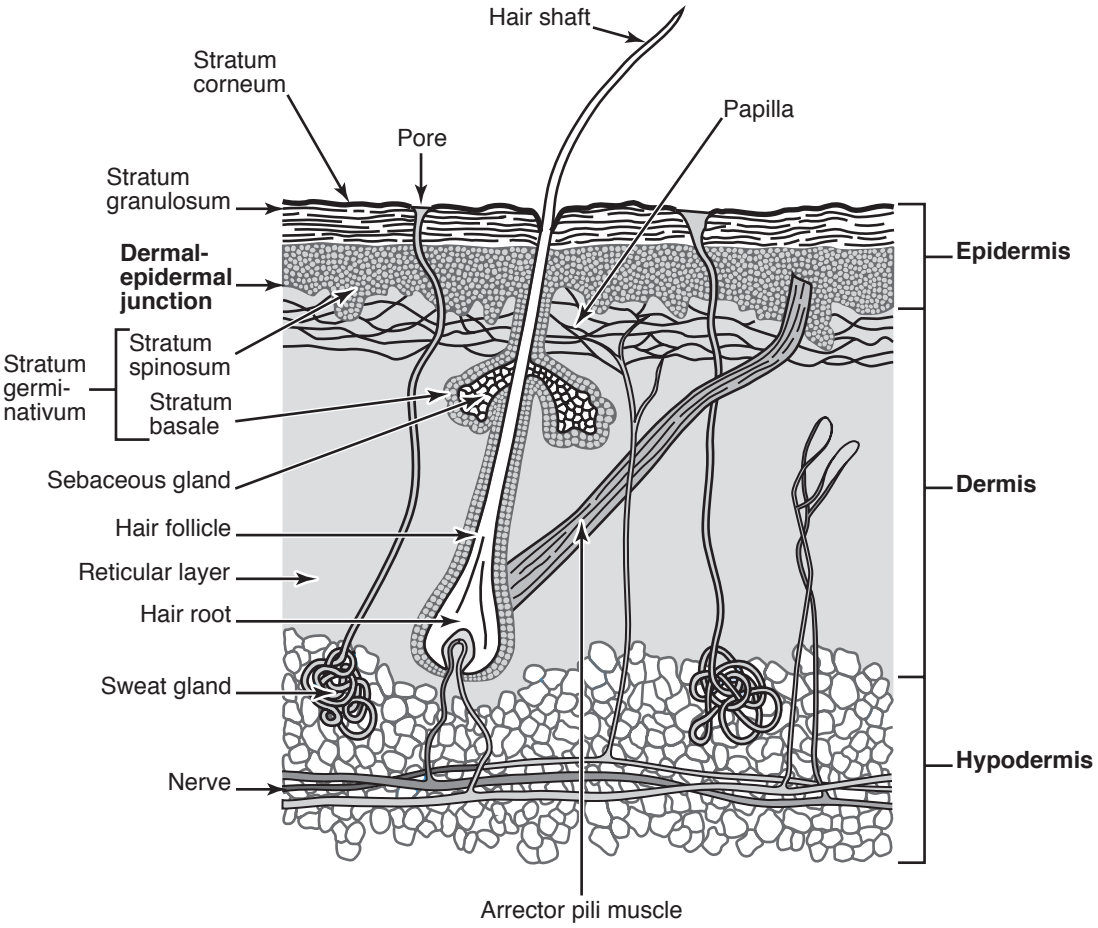
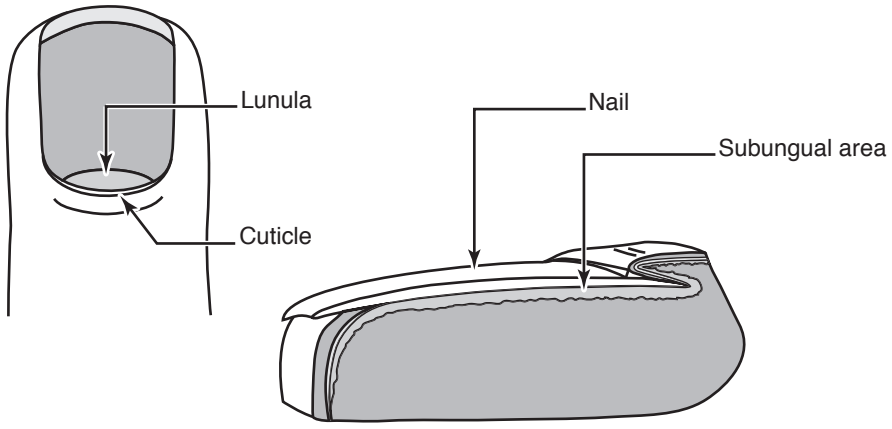


Figure 2—Major structures of the nail



Objective 14

Common disorders and diseases of the scalp and hair

Key term:

- **Alopecia** (alə´-pésha)—Baldness

a. **Alopecia areata**—Bald patches, usually caused by body disorders; hair generally grows back

b. **Alopecia prematura**—Hair loss early in life (before middle age)

c. **Alopecia senilis**—Hair loss later in life (after middle age)

d. **Alopecia universalis**—Hair loss over the body

e. **Albinism** (al´bə-niz´əm)—Condition characterized by the lack of pigment and normally affects eyes, skin, and hair

f. **Canities**—Grey hair

g. **Hypertrichosis**—Excessive hair growth

Caution: Never remove hair from moles, warts, or inflamed or diseased skin.

h. **Monilethrix**—Beaded hair

i. **Pediculosis capitis**—Head lice

✔ **Note** If there are symptom of head lice present, refer the client to the physician.

j. **Pili incarnati**—Ingrown hair

k. **Pityriasis**—Small white flakes appearing on hair or scalp; also known as dandruff

l. **Trichoptilosis**—Split ends

m. **Trichorrhexis nodosa**—Knotted hair

n. **Trichosis** (tri-ko´sis)—Any diseased condition of the hair

o. **Tinea capitis**—Ringworm caused by a vegetable parasite

✔ **Note** Refer the client to a physician for treatment.

Information Sheet

Objective 15

Common disorders and diseases of the sebaceous glands

Key term:

- **Pus** (puś)—An accumulation of white blood cells, pathogens, dead or damaged cells, and other substances associated with an infection

a. **Acne** (aḱ-ne)—An infection and inflammation of the sebaceous glands

✔ **Note:** Acne is evidenced by the pustules commonly referred to as pimples.

b. **Comedones** (kŏmi´-dō´nez)—Blackheads; mass of hardened sebum in a hair follicle

c. **Milium** (mil é-um)—Whitehead; small whitish mass in the epidermis, due to retention of sebum

d. **Keloid** (ke´loid´)—Thick scar resulting from excessive growth of fibrous tissue

e. **Rosacia** (ro-za´she-uh)—Acne rosacea; congestion appearing primarily on the cheeks and nose, characterized by redness, dilation of blood vessels, and the formation of papules and postules

f. **Seborrhea** (seb´ə-re´ə)—Overactivity of the sebaceous glands; usually produces a shiny appearance on the nose and forehead

g. **Hive** (hiv´)—A suddenly appearing raised patch that is usually redder than the surrounding skin; is often accompanied by severe itching; and is usually caused by an allergic reaction, infection, or stress

✔ **Note:** The term urticaria (uhrt-uh-kaŕ-e-uh) is also used to describe hives.

h. **Carbuncle** (kar´bung´kuhl)—A painful, pus-producing infection above and below the skin; can infect hair follicles

i. **Furuncle** (fyuŕ-uhn-kuhl)—An inflammation and infection of the dermis and subcutaneous tissue caused by bacteria that enter the skin through a hair follicle; a boil

j. **Vesicle** (veś-i-kuhl)—A blister; lesion containing clear fluid such as found with poison ivy

k. **Polyp** (pawĺ-uhp)—A growth that extends into the cavity of a mucous membrane or appears on the skin

l. **Pustule** (puhś-t{y}uhl)—An elevation of skin filled with **pus**

m. **Cyst** (sist´)—A sac that contains any fluid substance other than pus

n. **Fissure** (fish´-uhr)—Crack or break in the skin; found on hands, heels, and chapped lips

o. **Ulcer** (uhĺ-suhr)—An inflammatory lesion on the skin than may contain pus

Objective 16

Common disorders and diseases of the skin

a. **Dermatitis** (dur´ma-ti´tis)—Inflammatory condition of the skin

b. **Eczema** (ek´sə-ma)—Inflammatory, painful disease of the skin, acute or chronic in nature; characteristics may include both dry or moist lesions; all cases of eczema should be referred to a physician

c. **Herpes simplex** (hur´pēz sim´pleks´)—Fever blister or cold sores found on the lips or nostrils; caused by a virus; disease characterized by red, swollen, raised vesicles

d. **Psoriasis** (se-ri´ə-sis)—Skin disease characterized by red patches, covered with white-silver scales; rarely occurs on the face but is found on the scalp, elbows, knees, chest, and lower back; severe cases may be found on the hands and arms; bleeding points may occur but is not contagious

e. **Verruca** (və-roo´kə)—A wart that is caused by a virus and may be contagious; also known as "Plantar Warts"

f. **Tinea corporis** (tin-e-ə kor´pər-is)—Commonly known as ringworm; highly contagious fungal infection that affects the skin, scalp, or the nails; resembles many dermatitis but only a physician can determine the diagnosis

g. **Tinea pedis** (tin-e-ə ped´-is)—Medical term for athlete's foot or ringworm; a fungal infection of the foot; in advanced stages, deep, itchy, colorless vesicles appear and may be located on one foot or both; this condition is contagious; lesions dry as they heal

Information Sheet

Objective 17

Common disorders and diseases of the hand and nail

Key term:

- **Onychosis** (awn-i-ko-sis)—Technical term applied to any deformity or disease of the nail

a. Disorders

✔ **Note:** Disorders treatable by a cosmetologist if no infection is present are indicated with an asterisk *.

- **Agnail*** (hangnail)—Split cuticle that may become infected and bleed; caused by accidental injury, by pulling or tearing due to nail biting, or by improperly cutting or clipping the cuticle; also caused by dry cuticle
- **Corrugations** (Beau's lines)—Wavy ridges on the nail; caused by uneven growth patterns due to interruptions in growth from illness
- **Furrows**—Depressions in the nail; caused by an injury to the matrix, illness, or nutritional disturbance
- **Leukonychia***—White spots on the nail; caused by tiny air bubbles in the nail or by the presence of incompletely keratinized cells due to an injury to the nail base
- **Onychatrophia*** (atrophy)—Wasting away of the nail; caused by injury to the nail matrix or disease
- **Onychauxis*** (hypertrophy)—Overgrowth or thickening of the nail plate; can be caused by internal disturbance, local infection, continued trauma such as ill fitting shoes, or by heredity
- **Onychocryptosis**—Technical term for ingrown nails; may affect finger or toe
- **Onychocyanosis*** (blue nail)—Condition caused by poor blood circulation or heat disorder
- **Onychomalia*** (eggshell nail)—Thin nails caused by chronic illness, nerve disorder, or a systemic disturbance
- **Onychophagy** (bitten nails)—Nervous habit (causes unsightly nails and may cause infection) which causes individual to chew the nail; hardened cuticles may result in nail becoming permanently deformed

- **Onychorrhexis*** (split and brittle nails)—Caused by improper filing, excessive use of cuticle solvents and nail polish remover, or injury to the finger; also associated with extreme dryness of the hair present in certain grandular disorders.

- **Pterygium*** (cuticle overgrowth)—Forward growth of the cuticle which adheres to the base of the nail

b. Diseases

✔ **Note:** The following diseases are not treatable by a cosmetologist.

- **Mold**—Fungal infection caused by trapped moisture; green spot under artificial nail or polish on natural nail

- **Onychia**—Inflammation of the nail matrix, accompanied by pus formation

- **Onychogryposis**—Pertains to enlarged and increased curvature of the nail; often referred to as "claw nails"

- **Onycholysis**—A condition of the nail separating from the nail bed, usually caused by stress to long nails

- **Onychomycosis tinea ungium**—Ringworm of the nail; caused by vegetable parasite

- **Onychophosis**—Growth of horny epithelium in the nail bed

- **Onychophyma**—Swelling of the nail

- **Onychoptosis**—Periodic shedding of part or all of nail

* **Paronychia**—Infectious and inflammatory condition of tissue surrounding nail

Module Contents

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Prerequisites:
Modules 1–4

Learning Activities Sheet

Student Name _____

Directions

Place a checkmark in the appropriate box as you complete each of the steps below.

❑ 1. **Take** Pretest provided by your instructor.

❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.

❑ 3. **Read** Module Objective Sheet.

❑ 4. **Study** Information Sheet, Objectives 1 through 6.

❑ 5. **Research** Online resources to learn more about the skeletal system. Your instructor will list several Web sites on the blanks below. Visit at least two of the following Internet sites.

- _____
- _____
- _____
- _____
- _____

❑ 6. **Do** Assignment Sheet 1, "Complete the Crossword Puzzle of Terms (Objectives 1–6)."

❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 8. If the evaluation is not satisfactory, repeat Steps 4, 6, and 7.

❑ 8. **Study** Information Sheet, Objectives 7 through 13.

❑ 9. **Do** Assignment Sheet 2, "Complete the Crossword Puzzle of Terms (Objectives 7–13)."

Learning Activities Sheet

❑	10. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 11. If the evaluation is not satisfactory, repeat Steps 8, 9, and 10.
❑	11. **Do**	Assignment Sheet 3, "Locate and Identify Bones of the Cranium."
❑	12. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 13. If the evaluation is not satisfactory, repeat Steps 8, 11, and 12.
❑	13. **Do**	Assignment Sheet 4, "Locate and Identify Bones of the Face."
❑	14. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 15. If the evaluation is not satisfactory, repeat Steps 8, 13, and 14.
❑	15. **Do**	Assignment Sheet 5, "Analyze Cosmetology Scenarios."
❑	16. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 17. If the evaluation is not satisfactory, repeat Steps 4, 8, 15, and 16.
❑	17. **Do**	Assignment Sheet 6, "Complete Module 6 Review."
❑	18. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 19. If the evaluation is not satisfactory, repeat Steps 4, 8, 17, and 18.
❑	19. **Take**	Written Test provided by your instructor.
❑	20. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 21. If the evaluation is not satisfactory, follow your instructor's recommendations concerning a review of the above learning activities.

❑	21. **Check**	With your instructor for any additional assignments to be completed.
❑	22. **Do**	Additional assignments listed below.
❑	23. **Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test and assignment sheets. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

_____

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***Permission to duplicate this form is granted.**

Module Objective Sheet

Module Objective

After completing this module, you should be able to describe and identify the major divisions and bones of the skeletal system. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test.

Specific Objectives

After completing this module, you should be able to:

1. Define the term *skeletal system*.
2. State functions of the skeletal system.
3. Complete statements that describe the types of bones as classified by their location.
4. Match the long bones of the skeleton with their definitions.
5. Distinguish between major divisions of the human skeleton.
6. Label the major bones of the anterior and posterior appendicular skeleton.
7. Match the major bones of the cranium and face with their descriptions.
8. Label the major bones of the cranium and face.
9. Select from a list the characteristics of the hyoid bone.
10. Match regions and major bones and structures of the vertebral column with their descriptions.
11. Label the regions and the major bones and structures of the vertebral column.
12. Complete statements that describe the characteristics of the ribs and sternum.
13. Label the major bones and structures of the ribs and sternum.
14. Complete the crossword puzzle of terms (Objectives 1–6). (Assignment Sheet 1)
15. Complete the crossword puzzle of terms (Objectives 7–13). (Assignment Sheet 2)
16. Locate and identify bones of the cranium. (Assignment Sheet 3)

17. Locate and identify bones of the face. (Assignment Sheet 4)
18. Analyze cosmetology scenarios. (Assignment Sheet 5)
19. Complete Module 6 review. (Assignment Sheet 6)

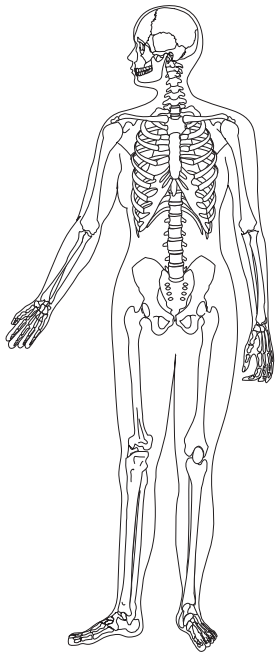
Information Sheet

Objective 1

The term *skeletal system*

a. **Skeletal system**—All of the bones and cartilage of the body that collectively provide the supporting framework for the muscles and organs (see Figure 1)

Figure 1—Skeletal system



Objective 2

Functions of the skeletal system

a. Provides support for the body

✔ **Note:** The skeletal system—also called the *skeleton*—is a framework of bones that are connected to each other by joints and by connective tissue called *ligaments* (lí-guh-muhnts). The ligaments also attach muscles to many of the body's bones. In this way, the body is built upon the skeletal system. Consequently, the shape of the body also follows the structure of the skeleton.

b. Gives shape to the body

c. Protects delicate vital organs

✔ **Note:** The very term *vital* indicates that an organ is necessary for a healthy life. Most internal organs are made of soft tissues, with cells that promote the exchange of materials in order to perform their functions. Most of the protection for these organs is provided by bones and overlying muscles. For example, the ribs protect the lungs, heart, spleen, and liver. The genitourinary organs and intestines are largely protected by the hips and pelvis.

d. Assists with body movements

✔ **Note:** Most body movements are the result of muscles pulling and pushing against skeletal structures. The bones not only provide tension points for the muscles, they also limit the range of motion (ROM) of the movement so that balance and strength are possible.

e. Manufactures blood cells

f. Stores calcium and phosphorus

Objective 3

Types of bones as classified by their location

✔ **Note:** Five basic types of bones are described on the next page. These bones are essentially classified by their shape (long, short, flat, irregular, and sesamoid), and their shapes serve specific functions and support the purpose of the body structure that houses each type of bone.

Key terms:

- **Carpals** (kaŕ-puhls)—The wrist bones (see Figure 2)
- **Tarsals** (taŕ-suhls)—The ankle bones that form the heel and the proximal or posterior half of the foot (see Figure 2)
  ✔ **Note:** The bones of the wrist and ankles are short and are generally rectangular or triangular bones that fit together to provide a segmented structure that is highly flexible yet strong.
- **Rib**—Any of the paired, curved, bony, or partly cartilaginous rods that stiffen the walls of the body
- **Scapula** (skaṕ-yuh-luh)—A shoulder blade (see Figure 2)
- **Ilium** (iĺe-uhm)—The flat portion of the hip (see Figure 2)
- **Cranial** (krá-ne-uhl) **bones**—The bones of the skull, particularly the bones that enclose the brain (see Figure 3)
- **Vertebra** (vuhŕ-tuh-bruh)—One of the bony or cartilaginous segments composing the spinal column (see Figure 5)
- **Sesamoid** (seś-uh-moid)—Any one of numerous small, round, bony masses embedded in certain tendons that may be subjected to compression and tension
- **Patella** (puh-té-luh)—The kneecap (see Figure 2)
  ✔ **Note:** The patella is the largest sesamoid bone in the skeleton.

a. **Long bones**—Found in the arms, legs, hands and feet

✔ **Note:** You will study the long bones of the skeleton in Objective 4.

b. **Short bones**—Include the **carpals** and **tarsals**

c. **Flat bones**—Include the **ribs**, **scapulae**, **ilium**, and **cranial bones**

d. **Irregular bones**—Include the **vertebrae** and facial bones; as with long, short, and flat bones, the irregular bones are made of spongy bone covered with compact bone

e. **Sesamoids**—Include the **patella** and small bones in the hands and feet

✔ **Note:** Sesamoids often develop in new locations due to the use of tendons; they consist of cartilage that ossifies with age.

Objective 4

The long bones of the skeleton (see Figure 2)

a. **Humerus** (hyú-muh-ruhs)—The long bone in the upper arm

b. **Radius** (rá-de-uhs)—The long bone on the thumb side of the forearm

c. **Ulna** (uhĺ-nuh)—The long bone on the little-finger side of the forearm

✔ **Note:** The ulna is longer than the radius.

d. **Femur** (fé-muhr)—The thighbone; the longest, strongest bone in the body

e. **Fibula** (fí-byuh-luh)—The long, slender bone on the lateral side of the lower leg

f. **Tibia** (tí-be-uh)—The shin bone; the largest bone in the lower leg

g. **Metacarpals** (me-tuh-kaŕ-puhls)—The long bones forming the framework of the palm of the hand

h. **Phalanges** (fuh´-lan-jes)—The miniature long bones of the fingers and the miniature long bones of the toes

✔ **Note:** There are three phalanges in each finger and two in each thumb. There are two phalanges in each great toe and three in each of the other toes.

i. **Metatarsals** (me-tuh-taŕ-suhls)—The long bones that form the framework of the sole of the foot

Objective 5

Major divisions of the human skeleton

a. **Axial skeleton**—Centers around the vertebral column and includes the bones of the skull, the ribs and sternum, and the vertebral column; contains 80 bones

b. **Appendicular skeleton**—Consists of the bones of the appendages that are attached to the axial skeleton and includes the bones of the shoulders, pelvis, arms, and legs; contains 126 bones (see Figure 2)

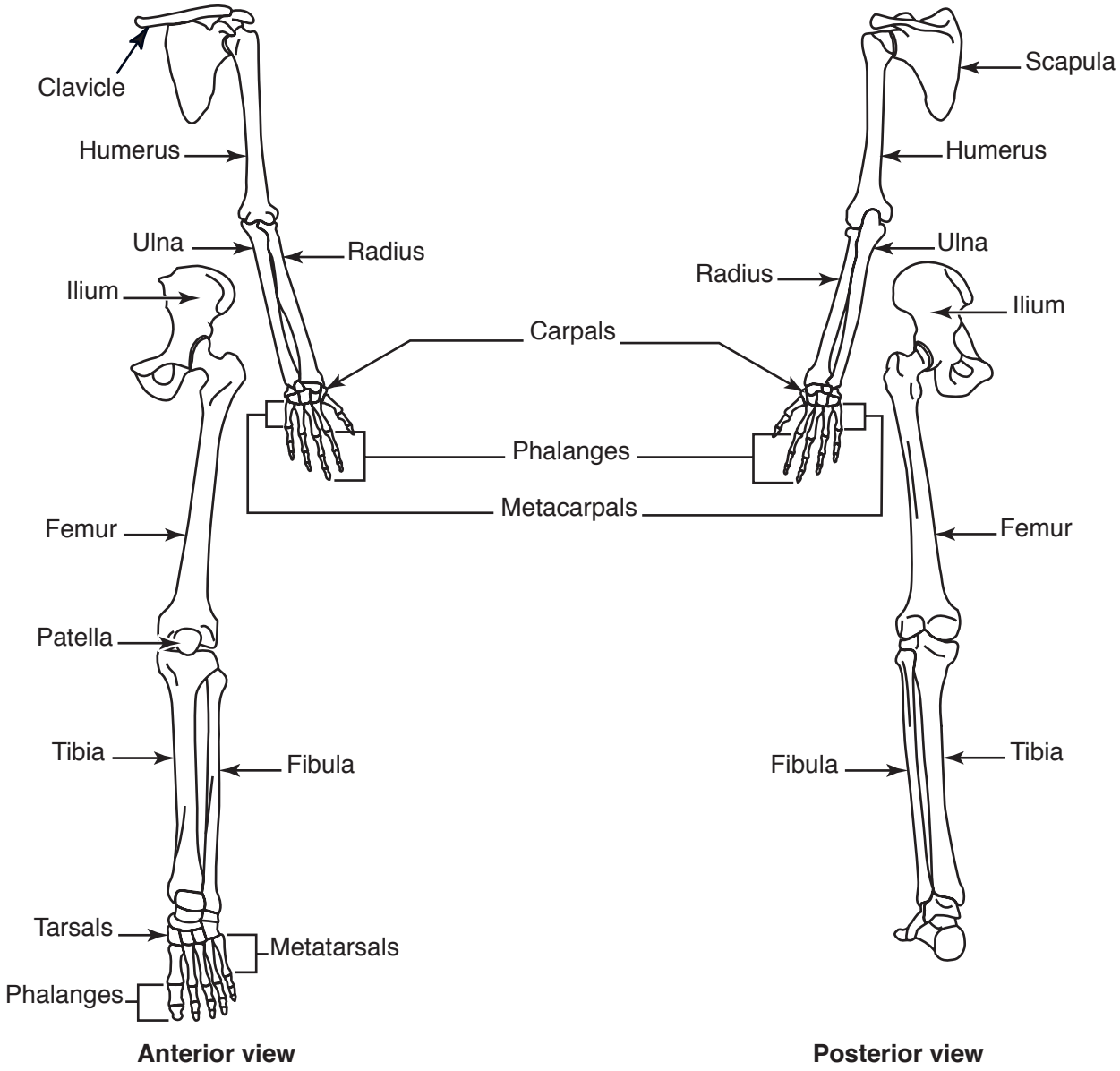
Objective 6

Major bones of the anterior and posterior appendicular skeleton

Key term:

- **Clavicle** (klá-vi-kuhl)—The collarbone

Figure 2—Appendicular skeleton



Objective 7

Descriptions of major bones of the cranium and face

Key terms:

- **Cranium** (krá-ne-uhm)—The bony part of the skull that holds the brain
  - ✔ **Note:** The cranium is composed of eight bones: the frontal, occipital, sphenoid, and ethmoid bones and the paired temporal and parietal bones.
- **Atlas** (at´-luhs)—The first vertebra of the neck
- **Orbit** (oŕ-bit)—One of a pair of bony, conical cavities in the skull that accommodate the eyeballs and associated structures

a. Major bones of the cranium (see Figure 3)

- **Frontal bone**—A single bone that forms the front of the skull
- **Occipital** (awk-sí-puh-tuhl) **bone**—The cuplike bone at the back of the skull that is marked by a large opening by which the skull articulates with the **atlas**
- **Parietal** (puh-rí-uh-tuhl) **bone**—Either of a pair of bones of the roof of the skull between the frontal bone and the occipital bone
- **Temporal** (teḿ-puh-ruhl) **bone**—Either of a pair of compound bones at the side of the skull that contains various cavities and recesses associated with the ear
- **Sphenoid** (sfé-noid) **bone**—The winged compound bone of the base of the skull and anterior to the temporal bone
- **Ethmoid** (eth´-moid) **bone**—A light, spongy, cubical bone forming much of the walls of the nasal cavity and part of those of the **orbits**

b. Major bones of the face (see Figure 4)

- **Maxilla** (maḱ-si-luh)—One of a pair of large bones that form the upper jaw
- **Nasal bone**—The bone forming the nasal cavity
- **Lacrimal** (lá-kruh-mal) **bone**—One of the smallest and most-fragile bones of the face, located at the anterior part of the medial wall of the orbit
- **Mandible** (mań-duh-buhl)—The large bone that forms the lower jaw
- **Alveolar** (al-vé-uh-ler) **process**—The portion of the maxilla or the mandible that forms the dental arch
- **Zygomatic bone**—One of a pair of bones that forms the prominence of the cheek and part of the orbit; a cheekbone

Information Sheet

Objective 8 | **Major bones of the cranium and face**

Figure 3—Major bones of the cranium

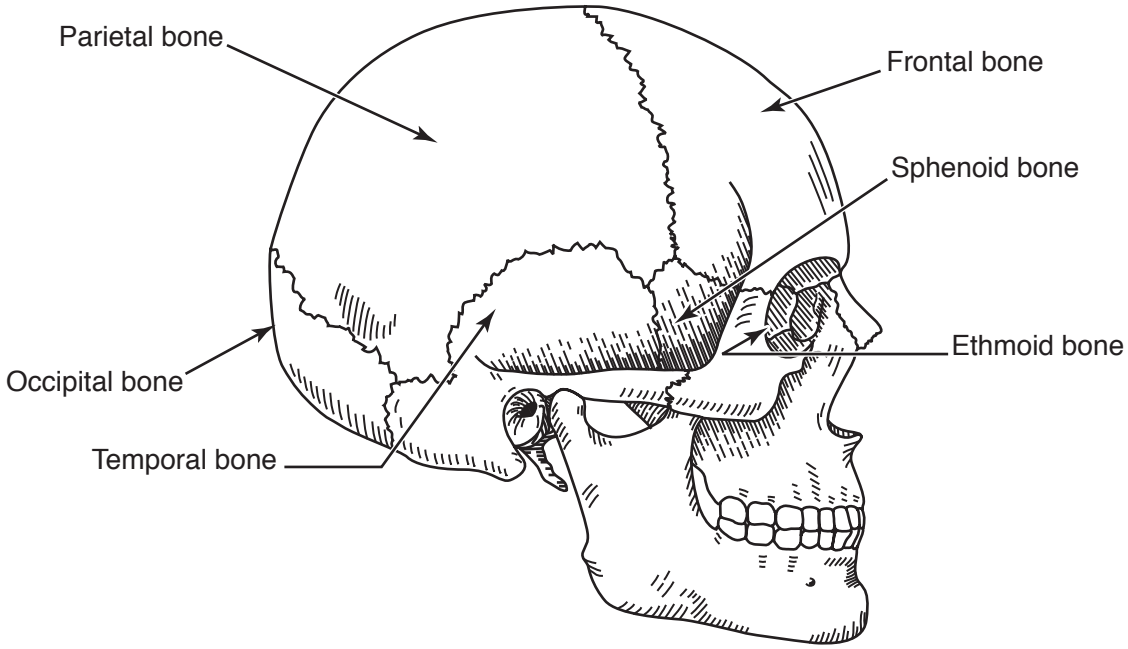
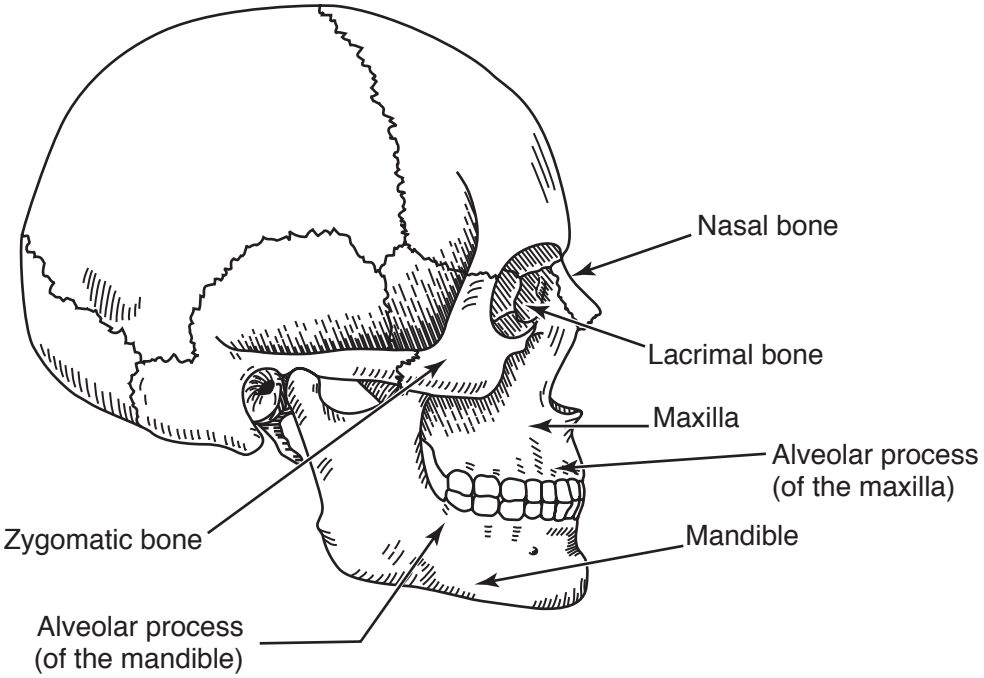


Figure 4—Major bones of the face



Objective 9

Characteristics of the hyoid bone

Key term:

- **Larynx** (laŕ-in{k}s)—The organ of voice that is part of the air passage

a. The hyoid (hí-oid) bone is considered to be part of the axial skeleton.

b. The hyoid bone is a single, U-shaped bone in the neck between the mandible and the upper part of the **larynx**.

c. The hyoid bone is the only bone in the body that does not articulate with another bone.

d. The hyoid bone is suspended by ligaments on processes from the temporal bone in the cranium.

e. The hyoid bone provides an attachment for the tongue.

Objective 10

Descriptions of regions and major bones and structures of the vertebral column

a. Regions of the vertebral column (see Figure 5)

- **Cervical** (suhŕ-vi-kuhl) **region**—The region consisting of the first seven segments of the vertebral column
- **Thoracic** (thuh-rá-sik) **region**—The region consisting of 12 segments of the upper-back portion of the vertebral column

  ✔ **Note:** The vertebrae of the thoracic region are separated by discs, and the vertebrae become thicker and heavier in descending order.

- **Lumbar** (luhḿ-bar) **region**—The region consisting of the five largest segments of the movable part of the vertebral column
- **Sacral** (sá-kruhl) **region**—The region consisting of five segments of the vertebral column that fuse in the adult to form the sacrum
- **Coccygeal** (kak-sí-je-uhl) **region**—The region consisting of four segments of the vertebral column that fuse to form the adult coccyx.

b. Major bones and structures of the vertebral column (see Figure 5)

- **Atlas**—The first cervical vertebra that articulates with the occipital bone and the axis

  ✔ **Note:** The atlas supports the skull and allows flexion, extension, and rotation of the head.

- **Axis**—The second cervical vertebra about which the atlas rotates, allowing the head to be turned, extended, and flexed

  ✔ **Note:** The axis allows side-to-side rotation of the head.

- **Vertebral body**—The weight-supporting, solid central portion of a vertebra

- **Intervertebral disc**—One of the fibrous discs found between adjacent vertebrae, except for the axis and the atlas

  ✔ **Note:** The discs vary in size, shape, thickness, and number, depending on the location in the back and on the particular vertebrae they separate.

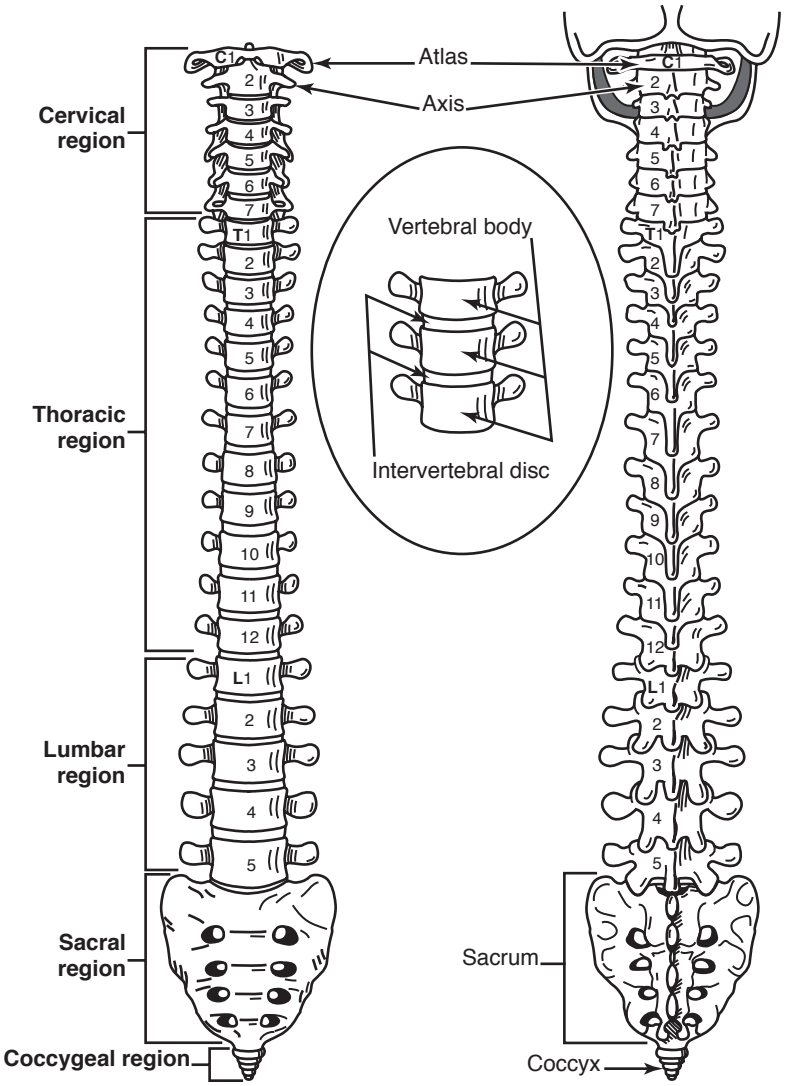
- **Sacrum** (sa´-krum)—The large, triangular bone at the dorsal part of the pelvis, inserted like a wedge between the two hip bones

- **Coccyx** (kak´-siks)—The beaklike bone joined to the sacrum by a disc of fibrocartilage at the base of the vertebral column

Objective 11

Regions and the major bones and structures of the vertebral column

Figure 5



Objective 12

Characteristics of the ribs and sternum

a. **Ribs** (see Figure 6-a)

- All ribs attach to the thoracic region of the vertebral column.
- There are 12 rib pairs.
- The upper 7 rib pairs attach directly to the sternum; these are known as the *true ribs*.

- The lower 5 rib pairs (rib pairs 8 through 12) are referred to as the *false ribs*.
- Rib pairs 11 and 12 are not attached to the sternum and are called the *floating ribs*.
- Rib pairs 8, 9, and 10 attach to the costal cartilage of the seventh rib.

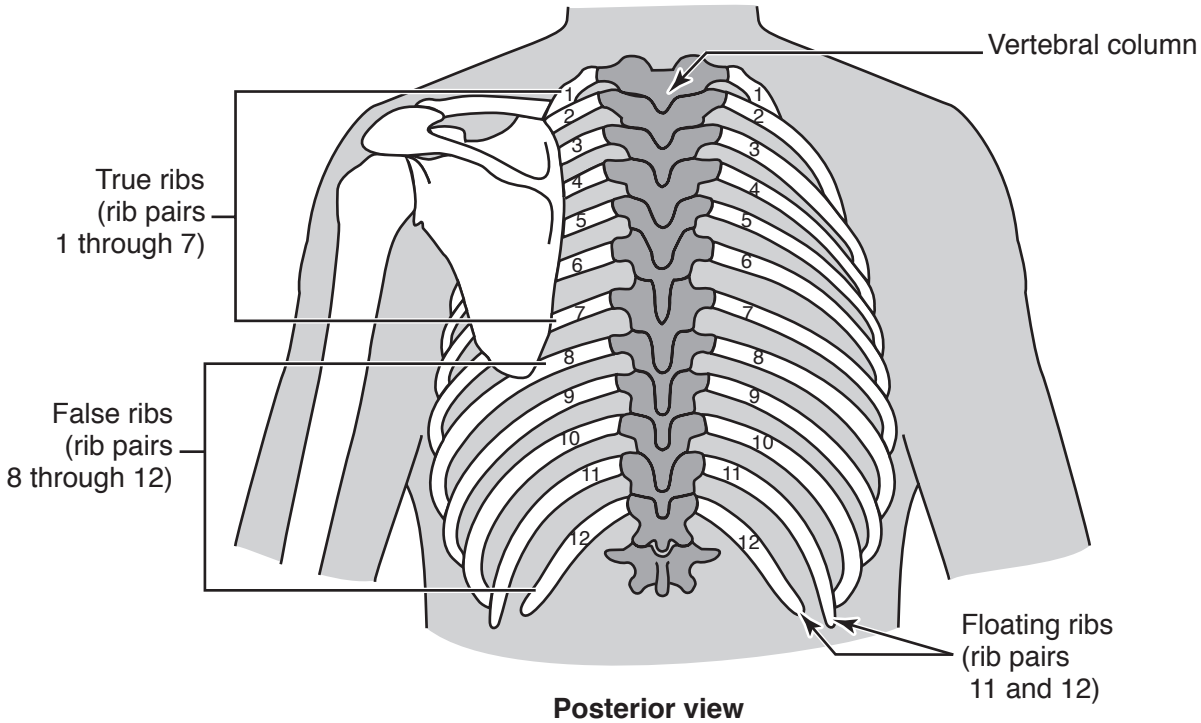
b. **Sternum** (see Figure 6-b)

- The top section of the sternum is called the manubrium (muh-nú-bre-uhm), and it provides the attachment for rib pair 1.
- The middle (body) section of the sternum is called the *gladiolus* (gla-de-ó-luhs), and it provides the attachment for rib pairs 2 through 7.
- The lowest section of the sternum is called the *xiphoid* (zí-foid) *process*.

Objective 13

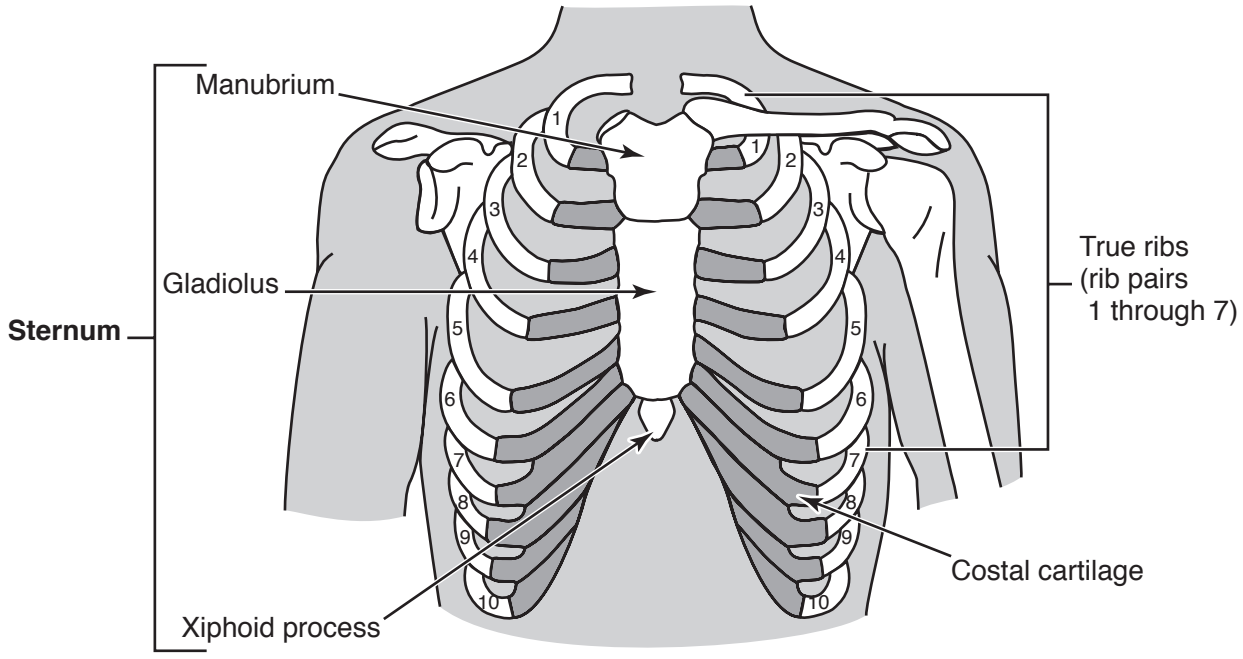
Major bones and structures of the ribs and sternum

Figure 6a—Posterior view



Posterior view

Figure 6b—Anterior view



Anterior view

Module Contents

Student Components

Student Guide

Student Workbook

* Assignment Sheets

* Assignment Sheets are located in the Student Workbook.

Prerequisites:
Modules 1–4

Learning Activities Sheet

Student Name _____

Directions

Place a checkmark in the appropriate box as you complete each of the steps below.

❑ 1. **Take** Pretest provided by your instructor.

❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.

❑ 3. **Read** Module Objective Sheet.

❑ 4. **Study** Information Sheet, Objectives 1 through 8.

❑ 5. **Research** Online resources to learn more about the muscular system. Your instructor will list several Web sites on the blanks below. Visit at least two of the following Internet sites.

- _____
- _____
- _____
- _____
- _____

❑ 6. **Do** Assignment Sheet 1, "Complete the Crossword Puzzle of Terms (Objectives 1–8)."

❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 8. If the evaluation is not satisfactory, repeat Steps 4, 6, and 7.

❑ 8. **Study** Information Sheet, Objective 9.

❑ 9. **Do** Assignment Sheet 2, "Complete the Crossword Puzzle of Terms (Objective 9)."

Learning Activities Sheet

❑ 10.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 11. If the evaluation is not satisfactory, repeat Steps 8, 9, and 10.
❑ 11.	**Study**	Information Sheet, Objectives 10 through 12.
❑ 12.	**Do**	Assignment Sheet 3, "Complete the Crossword Puzzle of Terms (Objectives 10–12)."
❑ 13.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 14. If the evaluation is not satisfactory, repeat Steps 11, 12, and 13.
❑ 14.	**Do**	Assignment Sheet 4, "Locate and Identify Major Muscles of the Head, Face, and Neck."
❑ 15.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 16. If the evaluation is not satisfactory, repeat Steps 11, 14, and 15.
❑ 16.	**Study**	Information Sheet, Objectives 13 through 16.
❑ 17.	**Do**	Assignment Sheet 5, "Complete the Crossword Puzzle of Terms (Objectives 13–16)."
❑ 18.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 19. If the evaluation is not satisfactory, repeat Steps 16, 17, and 18.
❑ 19.	**Study**	Information Sheet, Objectives 17 and 18.
❑ 20.	**Do**	Assignment Sheet 6, "Complete the Crossword Puzzle of Terms (Objectives 17–18)."
❑ 21.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 22. If the evaluation is not satisfactory, repeat Steps 19, 20, and 21.
❑ 22.	**Do**	Assignment Sheet 7, "Analyze Cosmetology Scenarios."

❑ 23.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 24. If the evaluation is not satisfactory, repeat Steps 4, 8, 11, 16, 19, 22, and 23.
❑ 24.	**Do**	Assignment Sheet 8, "Complete Module 7 Review."
❑ 25.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 26. If the evaluation is not satisfactory, repeat Steps 4, 8, 11, 16, 19, 24, and 25.
❑ 26.	**Take**	Written Test provided by your instructor.
❑ 27.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 28. If the evaluation is not satisfactory, follow your instructor's recommendations concerning a review of the above learning activities.
❑ 28.	**Check**	With your instructor for any additional assignments to be completed.
❑ 29.	**Do**	Additional assignments listed below.
❑ 30.	**Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test and assignment sheets. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

_____

_____

_____

Module Objective Sheet

Module Objective

After completing this module, you should be able to identify and distinguish among major muscle structures and major muscles. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test.

Specific Objectives

After completing this module, you should be able to:

1. Define the term muscular system.
2. State functions of the muscular system.
3. Distinguish among the major classifications of muscle tissue.
4. Match the major structures of skeletal muscles with their definitions.
5. Label the major structures of skeletal muscles.
6. Complete statements that describe the characteristics of the bone/muscle attachments of skeletal muscles.
7. Complete statements that describe how skeletal muscles function.
8. Match terms that describe the functional characteristics of muscle tissue with their definitions.
9. Match types of muscles with the type of action they accomplish.
10. Match major muscle groups with their functions.
11. Match the major muscles of the head, face, and neck with their functions.
12. Label the major muscles of the head, face, and neck.
13. Match the major muscles of the torso with their functions.
14. Label major muscles of the torso.
15. Match the major muscles of the arms with their functions.
16. Label major muscles of the arms.
17. Match the major muscles of the legs with their functions.
18. Label major muscles of the legs.

Module Objective Sheet

19. Complete the crossword puzzle of terms (Objectives 1–8). (Assignment Sheet 1)

20. Complete the crossword puzzle of terms (Objective 9). (Assignment Sheet 2)

21. Complete the crossword puzzle of terms (Objectives 10–12). (Assignment Sheet 3)

22. Locate and identify major muscles of the head, face, and neck. (Assignment Sheet 4)

23. Complete the crossword puzzle of terms (Objectives 13–16). (Assignment Sheet 5)

24. Complete the crossword puzzle of terms (Objectives 17–18). (Assignment Sheet 6)

25. Analyze cosmetology scenarios. (Assignment Sheet 7)

26. Complete Module 7 review. (Assignment Sheet 8)

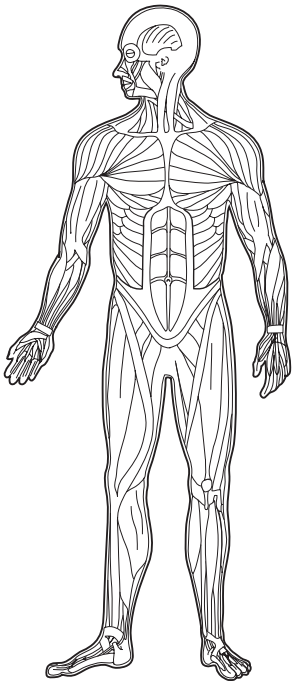
Information Sheet

Objective 1

The term *muscular system*

a. **Muscular system**—All of the muscles of the body considered as an interrelated structural group

Figure 1—Muscular system



Objective 2

Functions of the muscular system

a. Assists in body movements

✔ **Note:** A body movement may involve a complex series of actions involving numerous large muscle groups, such as walking or jogging, or it may be a small movement such as adjusting the opening of the pupil in the eye in response to changes in light level.

b. Assists in the movement of materials internal to the body

✔ **Note:** The blood is moved by the pumping of the heart's cardiac muscles. The smooth muscles of the stomach and intestines move food through the digestive tract. Even the skeletal muscles assist with materials movement as part of the power to transport lymph is produced by the action of skeletal muscles.

c. Produces heat and energy

✔ **Note:** The muscles represent the largest mass of tissue in the body; therefore, much of the body's cellular respiration takes place in muscle cells.

d. Assists in maintaining posture and balance

e. Helps to protect the internal organs

Objective 3

Major classifications of muscle tissue

✔ **Note:** There are three major classifications of muscle tissue: skeletal, visceral, and cardiac. Muscle tissues can be distinguished from one another in a number of ways and in particular whether they are voluntary or involuntary, their cellular structure, their location (which also involves their function), and the speed of their response to nerve impulses.

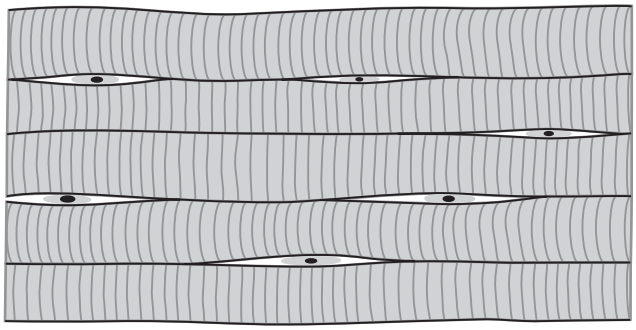
Key terms:

- **Voluntary** (vawĺ-uhn-ter-e)—Functioning under the conscious control of the organism
- **Involuntary** (in-vawĺ-uhn-ter-e)—Functioning without the conscious control of the organism
  ✔ **Note:** The terms *voluntary* and *involuntary* are a bit misleading in that most muscles exhibit both voluntary and involuntary responses.
- **Striated** (strí-at-uhd)—Consisting of narrow bands or rows
  ✔ **Note:** In the case of striated muscles, the cells are aligned in rows.
- **Viscera** (viś-uh-ruh)—The internal organs in the abdominal cavity
  Examples: liver, intestine, stomach

a. **Skeletal muscle tissue** (see Figure 2)

- Is voluntary
- Is **striated**, consisting of long, slender, striped cells
- Is attached to the skeleton and moves the skeleton's moving parts, acting in opposing groups with some muscles relaxing and some contracting
- Contracts quickly in response to stimulation of nerve impulses

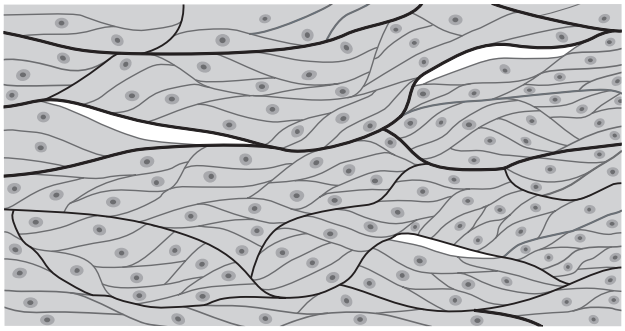
Figure 2—Skeletal muscle tissue (striated tissue)



b. **Visceral** (viś-uh-ruhl) **muscle tissue** (smooth muscle tissue) (see Figure 3)

- Is involuntary
- Is non-striated, consisting of spindle-shaped cells
- Is found in the **viscera**, especially the stomach, intestines, urinary ducts, and blood vessels
- Contracts slowly in response to stimulation to nerve impulses

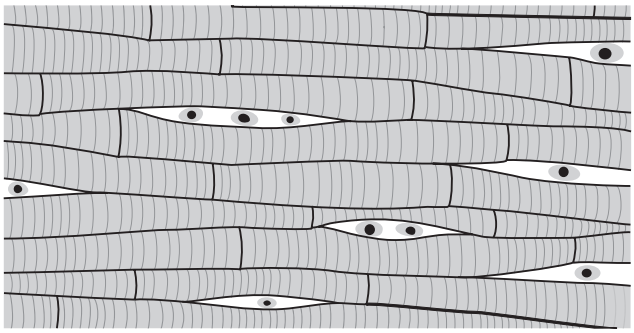
Figure 3—Visceral muscle tissue (smooth tissue)



c. **Cardiac muscle tissue** (see Figure 4)

- Is involuntary
- Is partially striated
- Is found only in the heart
- Contracts moderately fast in response to stimulation to nerve impulses

Figure 4—Cardiac muscle tissue (striated tissue)



Objective 4

Major structures of skeletal muscles and their definitions
(see Figure 5)

✔ **Note:** Generally, one end of a skeletal muscle is less movable than the other end. Usually, this end of the muscle, called the *origin*, is closer to the midline of the trunk of the body and is attached to the less-movable end of the bone. The other end of the muscle, called the *insertion*, is attached to the more-movable bone. The bulk of a skeletal muscle composes the *body* or *belly* of the muscle.

a. **Origin**—The less-movable end of a skeletal-muscle attachment that is closer to the midline of the trunk of the body and is attached to the less-movable end of the bone

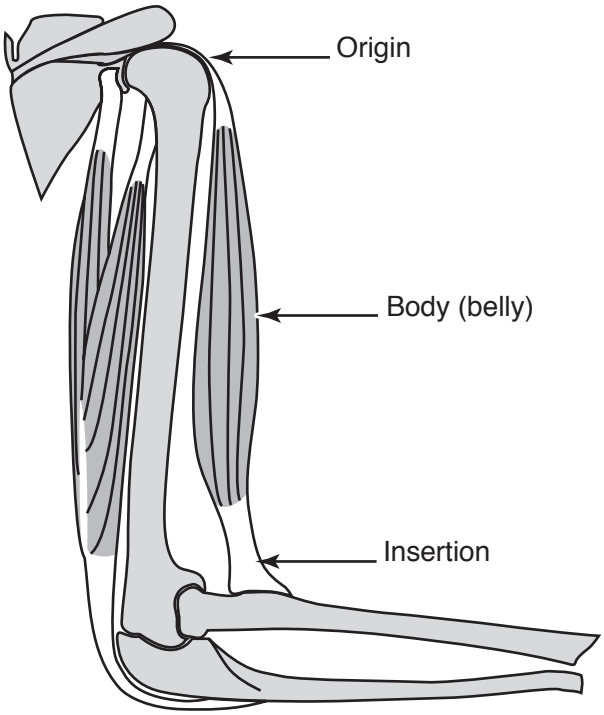
b. **Insertion**—The end of a skeletal-muscle attachment that is attached to the more-movable bone

c. **Body** (belly)—The largest or the main part of a skeletal muscle

Objective 5

Major structures of skeletal muscles

Figure 5—Major structures of skeletal muscles



Objective 6

Characteristics of the bone/muscle attachments of skeletal muscles

Key terms:

- **Epimysium** (ep-uh-miź-e-uhm)—A fibrous sheath that enfolds a skeletal muscle and extends over the origin and insertion and between bundles of muscle fibers
  - ✔ **Note:** The epimysium is sturdy in some areas but more delicate in others.
- **Periosteum** (peŕ-i-os-te-uhm)—A fibrous, vascular membrane covering the bones, except at their extremities
- **Tendon** (teń-duhn)—A structure in which the epimysium extends from the muscle as a broad, flat sheet of connective tissue that attaches to an adjacent structure; one of many white, glistening fibrous bands of tissue that attach muscle to bone
- **Aponeurosis** (aṕ-uh-nu-ro-suhs)—A structure in which the epimysium extends from the muscle as a strong, tough cord of connective tissue that is continuous with the periosteum of the bone; a strong sheet of fibrous connective tissue that serves as a tendon to attach muscles to bone or as fascia to bind muscles together

a. Skeletal muscles are enclosed in the **epimysium**, which is continuous with the fibrous structures that attach the muscles to bones and other structures.

b. Skeletal muscles are firmly attached to the structures on which they pull during contraction.

c. Skeletal muscles may be attached directly to the **periosteum** of a bone or may be attached by **tendons** or **aponeuroses**.

Objective 7

How skeletal muscles function

a. Muscles contract in response to electrical impulses, either the natural stimulus of a motor-nerve impulse or an artificial stimulus such as electrical shock.

b. Muscles that move a body part usually lie proximal to the part that they move.

c. Locomotion of the body is caused by muscles pulling on the bones.

d. Body movements result from coordinated actions in pairs of muscles.

e. The coordinated actions of a pair of muscles generally mean that one muscle contracts while the other relaxes.

f. Normal movements of body parts are the result of the coordinated motion of several pairs of muscles.

g. The energy to produce movement in muscles is released from simple sugars through metabolism.

Objective 8

Terms that describe the functional characteristics of muscle tissue

a. **Irritability** (ir-uht-uh-biĺ-uht-e)—The ability to respond to stimuli

✔ **Note:** Muscles contract in response to nerve impulses.

b. **Conductivity** (kawn-duhk-tiv´-uht-e)—The ability to transmit impulses

c. **Extensibility** (ik-sten-suh-biĺ-uht-e)—The ability to stretch (lengthen) and remain stretched (hold)

d. **Elasticity** (i-las-tiś-uht-e)—The ability to return to a former length when the stretching force is removed

e. **Contractility** (kawn-trak-tiĺ-uht-e)—The ability to contract or shorten

f. **Tone** (toń)—The slight tension that is present in muscles even when they are at rest so that they can respond more easily and quickly when needed

✔ **Note:** The term *tone* is often used to indicate how prepared for response the muscles appear. Thus, someone with good muscle tone does not necessarily have well developed muscles but does have muscles that are not flabby and do show firm, full shape.

Objective 9

Types of muscles as classified by their actions

✔ **Note:** Muscle types are generally referred to by the type of action they accomplish. For example, muscles that perform abduction are called *abductors*.

a. **Abductor** (ab-duhḱ-tuhr)—Performs abduction, moving away from a part or a midline (see Figure 6)

b. **Adductor** (uh-duhḱ-ter)—Performs adduction, moving toward a part or toward a midline (see Figure 7)

Figure 6—Abduction of the arm

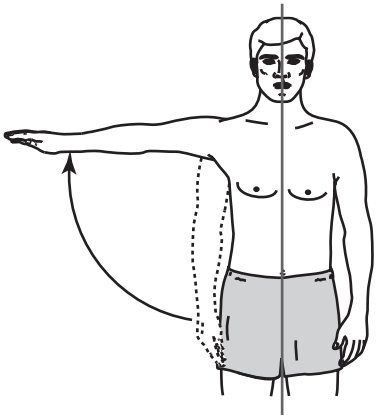
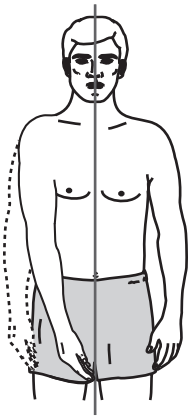


Figure 7—Adduction of the arm



c. **Levator** (li-vat´-uhr)—Performs elevation, lifting a part

d. **Depressor** (di-preś-uhr)—Performs depression, lowering a part

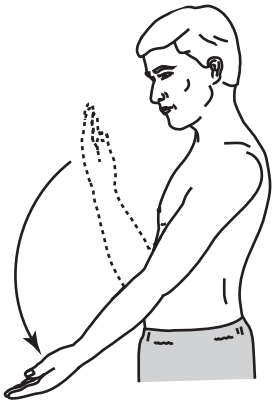
e. **Flexor** (fleḱ-suhr)—Performs flexion, bending a part at a joint (see Figure 8 and Figure 9)

Figure 8—Flexion of the arm at the elbow

Figure 9—Plantar flexion

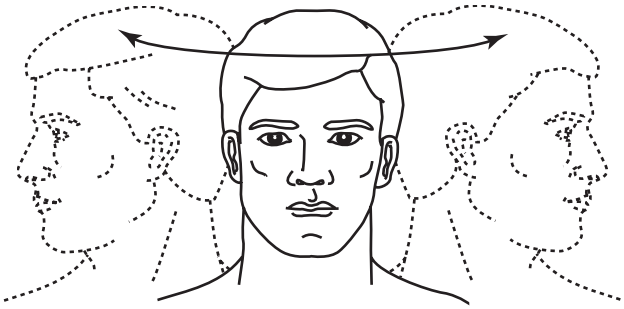
f. **Extensor** (ik-steń-suhr)—Performs extension, straightening a part at a joint (see Figure 10)

Figure 10—Extension of the arm at the elbow



g. **Rotator** (ró-tat-uhr)—Performs medial rotation—revolving a part on its axis (see Figure 11)—or lateral rotation—moving a part so that its distal point travels in a circle

Figure 11—Medial rotation of the head



h. **Protractor** (pro-traḱ-tuhr)—Performs protraction, moving a part forward

i. **Retractor** (ri-traḱ-tuhr)—Performs retraction, moving a part back

j. **Invertor** (in-vuhrt´-uhr)—Performs inversion, turning a part upside down or inside out

k. **Evertor** (i-vuhrt´-uhr)—Performs eversion, turning or rotating a part outward

l. **Supinator** (su-puh-nat´-uhr)—Performs supination, turning a part upward (see Figure 12)

m. **Pronator** (pro-nat´-uhr)—Performs pronation, turning a part downward (see Figure 13)

Figure 12—Supination of the hand

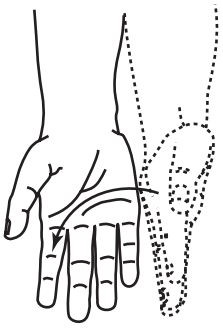
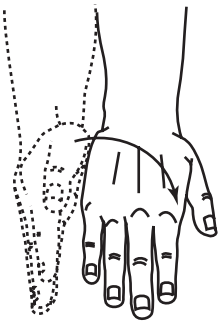


Figure 13—Pronation of the hand



n. **Dorsiflexor** (doŕ-si-flek-suhr)—Performs dorsiflexion, moving a part toward the back (see Figure 14)

Figure 14—Dorsiflexion of the foot

o. **Sphincter** (sfiṅk-tuhr)—Performs constriction, closing a body opening

p. **Tensor** (teṅ-suhr)—Performs tension, making a part more rigid

Objective 10

Functions of the major muscle groups

a. **Head and face muscles**—Control talking, chewing, swallowing, facial expressions, and blinking

b. **Neck muscles**—Move the head from side to side, from front to back, and in rotation

c. **Back muscles**—Allow the body to bend, turn, and stand erect

d. **Chest muscles**—Assist in respiration and movements of the neck, arms, and trunk

e. **Abdominal muscles**—Support the internal organs, assist in respiration, and assist in eliminating waste from the large intestine and bladder

f. **Perineal** (per-uh-né-uhl) **muscles**—Assist in defecation and urination and form the floor of the pelvic cavity

Objective 11

Functions of the major muscles of the head, face, and neck
(see Figure 15)

✔ **Note:** Most of the names of the muscles are actually descriptive of their location, shape, associated body part, orientation on the body, and function.

Key terms:

- **Hyperextend** (hi-puhr-ik-stend´)—To extend to its fullest range of motion or beyond
- **Occiput** (awḱ-suh-puht)—The back of the head
- **Clavicle** (klav´-i-kuhl)—The collarbone
- **Scapula** (skaṕ-yuh-luh)—The shoulder blade
- **Sternum** (stuhŕ-nuhm)—The breastbone
- **Mastoid** (maś-toid) **process**—The process of the temporal bone behind the ear
- **Mandible** (mań-duh-buhl)—The lower jawbone

a. **Frontalis** (fruhn-taĺ-is)—Wrinkles the forehead horizontally

b. **Temporalis** (tem-puh-raĺ-is)—Closes the mandible

c. **Orbicularis oculi** (or-biḱ-yuh-luhr-is awḱ-yuh-li)—Closes the eyelids

d. **Orbicularis oris** (oŕ-is)—Draws the lips together as in kissing

e. **Buccinator** (buḱ-sin-a-tuhr)—Moves the lips for blowing, whistling, and smiling

f. **Mentalis** (men-ta´lis)—Raises and wrinkles skin of chin, elevating lower lip

g. **Masseter** (muh-set´-uhr)—Closes the jaws as in chewing

h. **Trapezius** (truh-pé-ze-us)—Moves the shoulders by raising, assists in moving the head to one side or the other, **hyperextends** the head when the **occiput** acts as insertion, and helps hold the head erect

✔ **Note:** The trapezius is trapezoidal, with the narrow end attached to the **clavicle** and **scapula** and wide end spreading from the occiput along the vertebral column, over the scapula, and to the thoracic vertebrae. Thus, the trapezius is part of the neck, shoulders, and back.

i. **Sternocleidomastoid** (stuhr-no-klí-do-mas-toid)—Rotates the head from side to side, flexes the upper vertebral column and head as in bowing the head, and helps hold the head erect

✔ **Note:** There is a sternocleidomastoid muscle along each side of the neck, extending from the **sternum** to the **mastoid process** of the temporal bone in the skull.

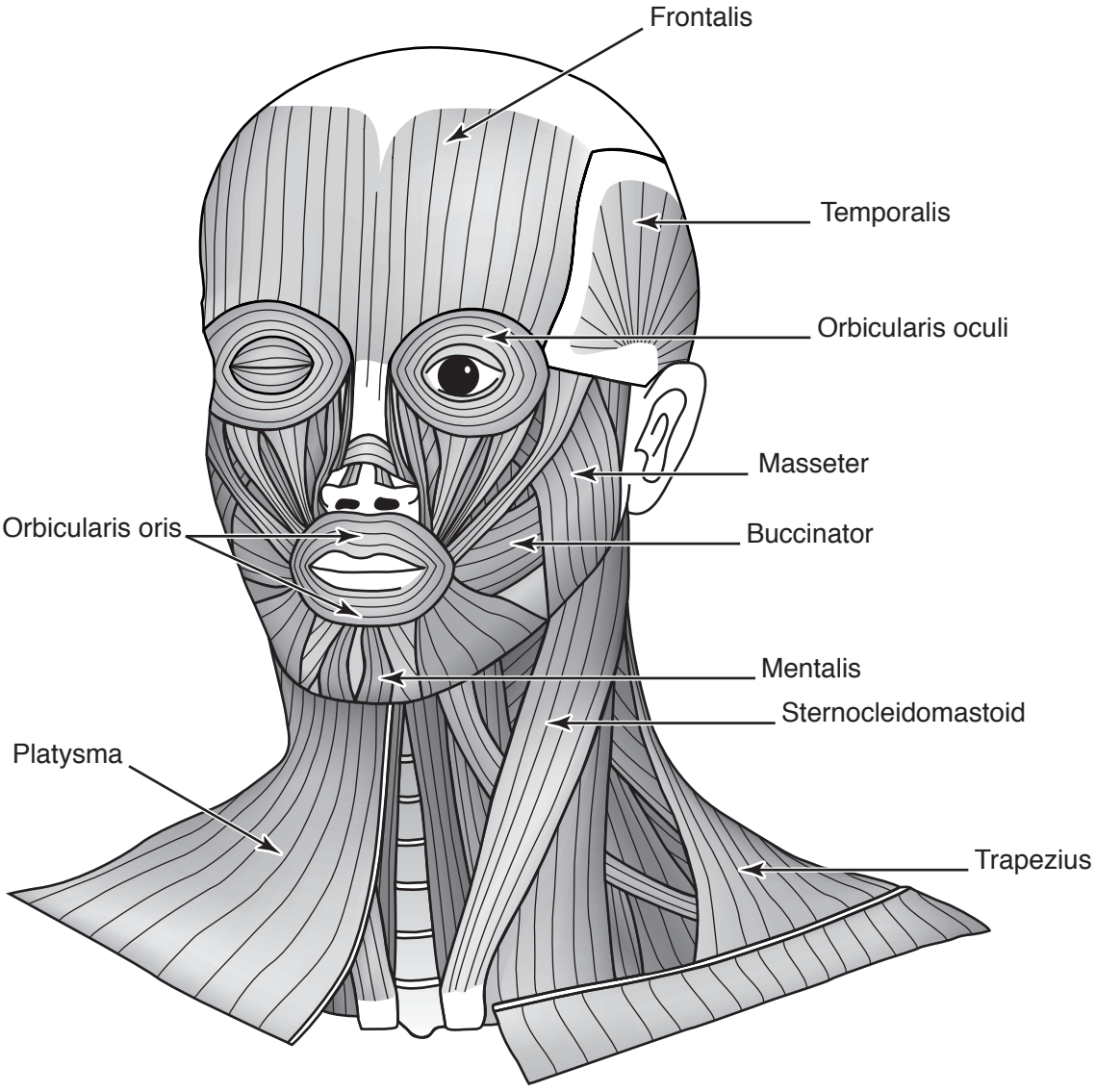
j. **Platysma** (pluh-tiź-muh)—Acts to wrinkle the skin in the neck and depresses the **mandible**

Objective 12

Major muscles of the head, face, and neck

✔ **Note:** Knowing the location and function of the muscles in the head, face, and neck will help you give your clients beneficial, satisfying facial services.

Figure 15—Major muscles of the head, face, and neck



Objective 13

Functions of the major muscles of the torso

a. **Deltoid** (deĺ-toid)—Moves the upper arm at the point of the shoulder

b. **Pectoralis** (peḱ-tuh-ra-lis) **major**—Flexes the upper arm, adducts the upper arm anteriorly, and draws the arm across the chest

c. **Serratus** (suh-rá-tuhs) **anterior**—Rotates the scapula and raises the shoulder, as in full flexion and abduction of the arm

d. **Intercostals** (in-tuhr-koś-tuhls)—Elevate and depress the ribs

e. **Latissimus dorsi** (la-tiś-i-muhs doŕ-si)—Brings the arms down forcefully

f. **Diaphragm** (dí-uh-fram)—Contracts and relaxes to cause inhalation and exhalation

g. **External oblique**—Compresses the abdomen and rotates the trunk laterally

h. **Internal oblique**—Compresses the abdomen and rotates the trunk laterally

i. **Transversus abdominis** (trans-vuŕ-suhs ab-dawḿ-uhn-is)—Compresses the abdomen and rotates the trunk laterally

j. **Rectus** (reḱ-tuhs) **abdominis**—Compresses the abdomen and rotates the trunk laterally and flexes the trunk

k. **Levator ani** (li-vat´-uhr á-ni)—Forms the floor of the pelvic cavity and supports the organs

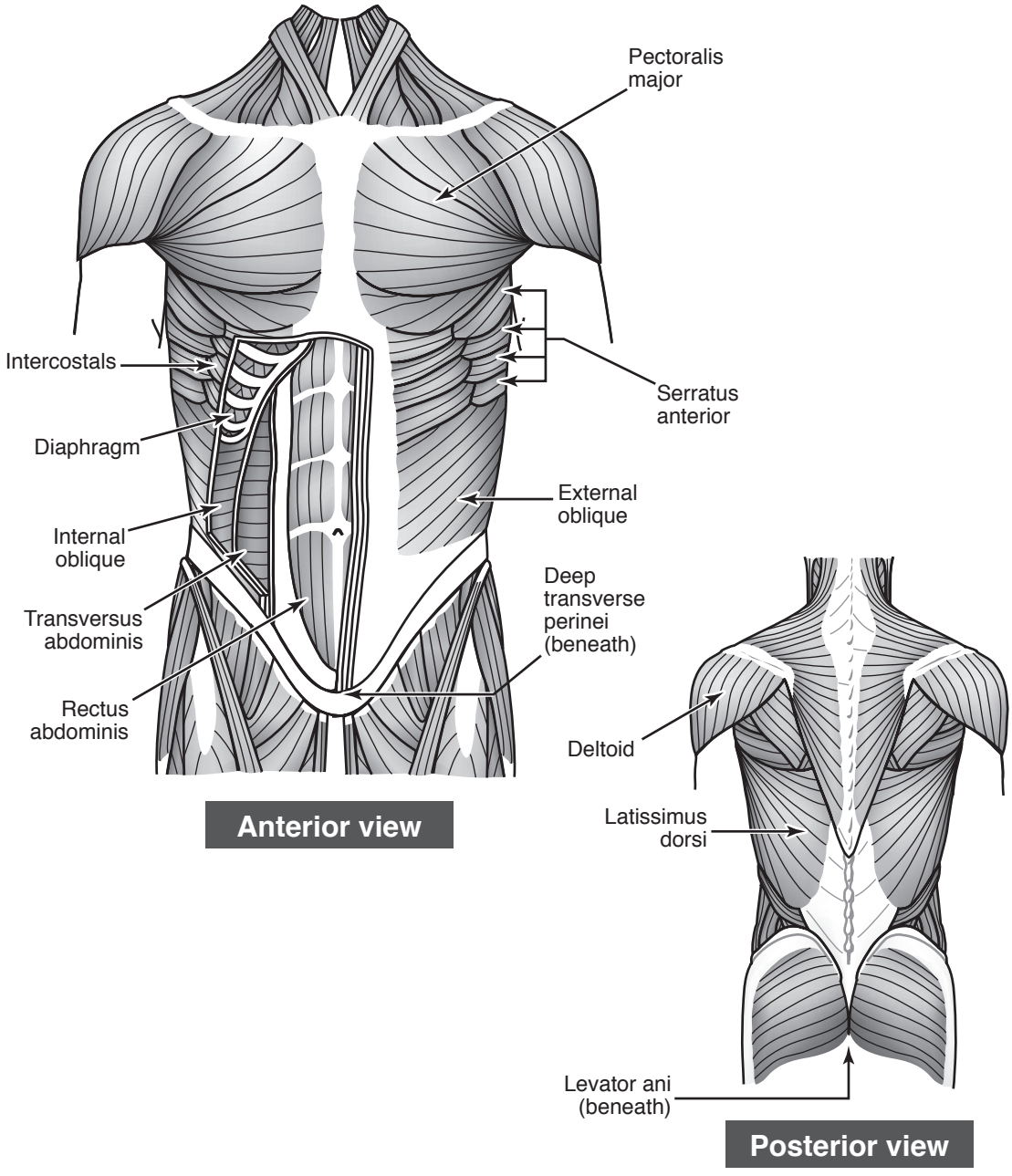
l. **Deep transverse perinei** (per-uh-né-i)—Forms the floor of the pelvic cavity

Information Sheet

Objective 14

Major muscles of the torso

Figure 16—Major muscles of the torso



Objective 15

Functions of the major muscles of the arms

a. **Biceps brachii** (bí-seps brá-ke-i)—Flexes the supinated forearm

✔ **Note:** One of the ways in which muscle names refer to the shapes of muscles is by describing how they are divided into sections. Thus, biceps have two sections, triceps have three sections, quadriceps have four sections, etc.

b. **Triceps** (trí-seps) **brachii**—Extends the lower arm

c. **Brachialis** (brá-ke-al-is)—Flexes the pronated forearm

d. **Brachioradialis** (brá-ke-o-ra-de-al-is)—Flexes the forearm

e. **Carpi** (kawŕ-pi) **muscles**—Control hand movements

f. **Digitorum** (dij´-uh-tor-um) **muscles**—Control finger movements

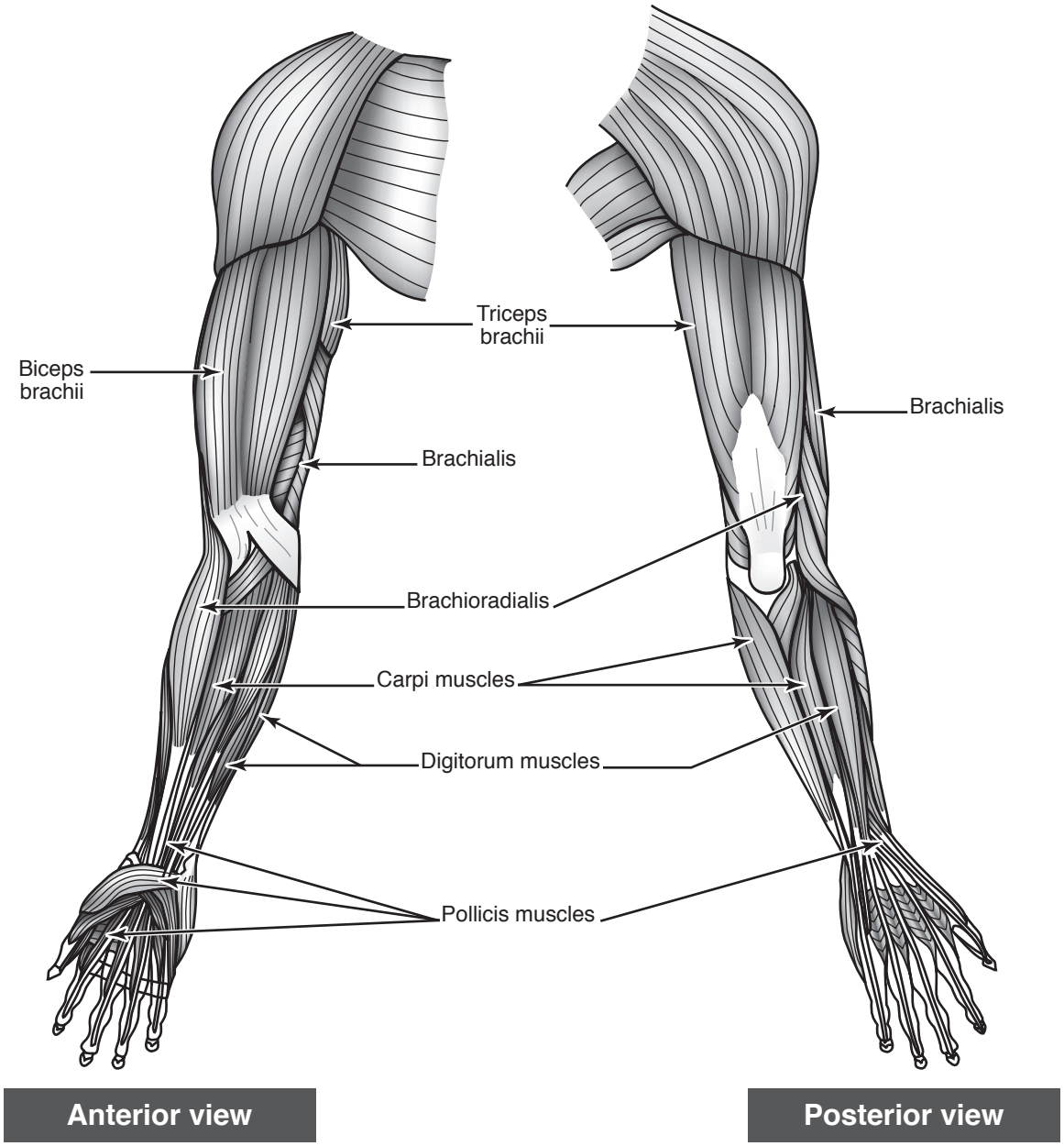
g. **Pollicis** (pawĺ-uh-cis) **muscles**—Control thumb movements

Information Sheet

Objective 16

Major muscles of the arms

Figure 17—Major muscles of the arms



Objective 17

Functions of the major muscles of the legs (see Figure 18)

✔ **Note:** The muscles of the upper leg extend to the hips for attachment. Thus, the muscles of the hips and buttocks are included.

a. **Gluteus** (glut´-e-uhs) **maximus**—Helps maintain an erect posture and extends and rotates the thigh

b. **Gluteus medius**—Abducts the thigh, rotates the thigh outward, and stabilizes the pelvis on the femur

c. **Gluteus minimus**—Abducts the thigh, rotates the thigh outward, stabilizes the pelvis on the femur, and extends the thigh

d. **Sartorius** (sawŕ-tor-e-uhs)—Adducts and flexes the leg

e. **Quadriceps femoris** (kwad´-ruh-seps feḿ-uh-ris)—Extends the leg

f. **Adductor**—Presses the thighs together

g. **Hamstring**—Flexes the lower leg

h. **Gastrocnemius** (gas-tró-kne-me-uhs)—Extends the foot

i. **Tibialis** (tib-e-á-lis) **anterior**—Flexes the foot and inverts the ankle

j. **Peroneus** (per-uh-né-uhs) **longus**—Everts the ankle

k. **Soleus** (só-le-uhs)—Inverts the ankle

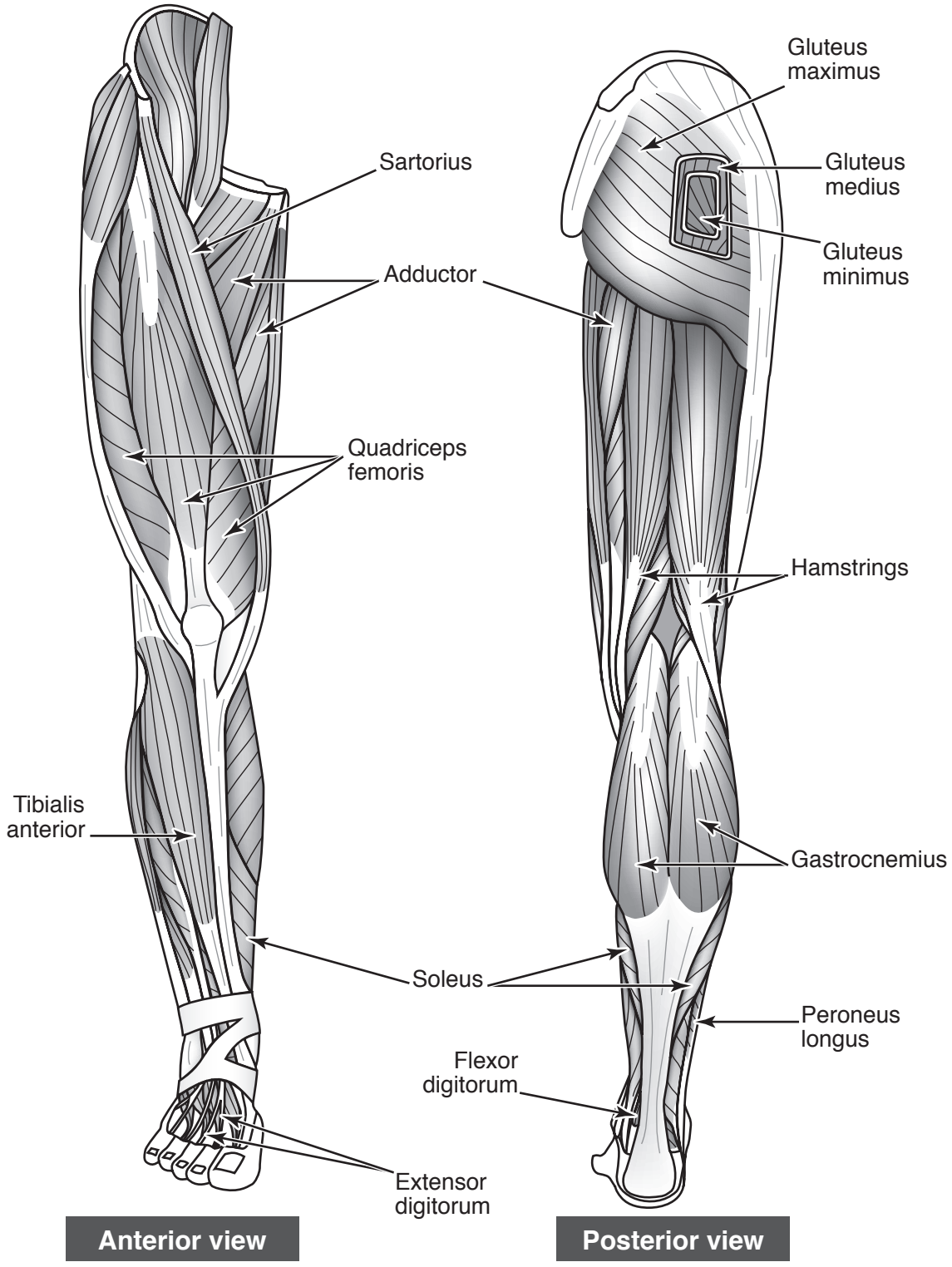
l. **Flexor digitorum** (dij´-uh-tor-uhm)—Flexes the toes

m. **Extensor digitorum**—Extends the toes

Information Sheet

Objective 18 | **Major muscles of the legs**

Figure 18—Major muscles of the legs



Module Contents

Student Components

Student Guide

Student Workbook

* Assignment Sheets

* Assignment Sheets are located in the Student Workbook.

Prerequisites:
Modules 1–4

Learning Activities Sheet

Student Name _____

Directions

Place a checkmark in the appropriate box as you complete each of the steps below.

❑ 1. **Take** Pretest provided by your instructor.

❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.

❑ 3. **Read** Module Objective Sheet.

❑ 4. **Study** Information Sheet, Objectives 1 through 5.

❑ 5. **Research** Online resources to learn more about the nervous system. Your instructor will list several Web sites on the blanks below. Visit at least two of the following Internet sites.

- _____
- _____
- _____
- _____
- _____

❑ 6. **Do** Assignment Sheet 1, "Complete the Crossword Puzzle of Terms (Objectives 1–5)."

❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 8. If the evaluation is not satisfactory, repeat Steps 4, 6, and 7.

❑ 8. **Study** Information Sheet, Objectives 6 through 13.

❑ 9. **Do** Assignment Sheet 2, "Complete the Crossword Puzzle of Terms (Objectives 6–13)."

Learning Activities Sheet

❑ 10.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 11. If the evaluation is not satisfactory, repeat Steps 8, 9, and 10.
❑ 11.	**Study**	Information Sheet, Objective 14.
❑ 12.	**Do**	Assignment Sheet 3, "Complete the Crossword Puzzle of Terms (Objective 14)."
❑ 13.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 14. If the evaluation is not satisfactory, repeat Steps 11, 12, and 13.
❑ 14.	**Do**	Assignment Sheet 4, "Participate in a Face Off."
❑ 15.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 16. If the evaluation is not satisfactory, repeat Steps 4, 8, 11, 14, and 15.
❑ 16.	**Do**	Assignment Sheet 5, "Analyze Cosmetology Scenarios."
❑ 17.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 18. If the evaluation is not satisfactory, repeat Steps 4, 8, 11, 16, and 17.
❑ 18.	**Do**	Assignment Sheet 6, "Complete Module 8 Review."
❑ 19.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 20. If the evaluation is not satisfactory, repeat Steps 4, 8, 11, 18, and 19.
❑ 20.	**Take**	Written Test provided by your instructor.
❑ 21.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 22. If the evaluation is not satisfactory, follow your instructor's recommendations concerning a review of the above learning activities.

❑	22. **Check**	With your instructor for any additional assignments to be completed.
❑	23. **Do**	Additional assignments listed below.
❑	24. **Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test and assignment sheets. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

_____

_____

_____

***Permission to duplicate this form is granted.**

Module Objective Sheet

Module Objective

After completing this module, you should be able to describe and identify the major structures of the nervous system. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test.

Specific Objectives

After completing this module, you should be able to:

1. Define the term *nervous system*.
2. State the functions of the nervous system.
3. Distinguish between the major subsystems of the nervous system.
4. Describe the major subsystems of the peripheral nervous system.
5. Distinguish between the major subsystems of the autonomic nervous system.
6. Define the term *nerve tissue*.
7. Describe the basic types of nerve tissue.
8. Distinguish among the major structures of a neuron.
9. Label the major structures of a neuron.
10. Match types of neurons with their descriptions.
11. Complete statements that describe a reflex arc.
12. List the major structures within the spinal canal.
13. Complete statements that describe the structure and function of the spinal cord.
14. Match nerves of the head, face, and neck with their functions.
15. Complete the crossword puzzle of terms (Objectives 1–5). (Assignment Sheet 1)
16. Complete the crossword puzzle of terms (Objectives 6–13). (Assignment Sheet 2)
17. Complete the crossword puzzle of terms (Objective 14). (Assignment Sheet 3)

18. Participate in a "face off." (Assignment Sheet 4).
19. Analyze cosmetology scenarios. (Assignment Sheet 5)
20. Complete Module 8 review. (Assignment Sheet 6)

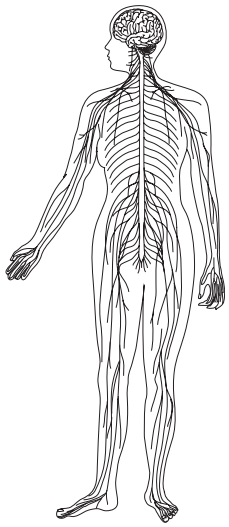
Information Sheet

Objective 1

The term *nervous system*

a. **Nervous** (nuhŕ-vuhs) **system**—The extensive intricate network of structures that activates, coordinates, and controls all of the functions of the body

Figure 1—Nervous system



Information Sheet

Objective 2

Functions of the nervous system

Key terms:

- **Stimulus**—A change in an organism's external environment or internal conditions that cause a response in one or more of the organism's systems
  - ✔ **Note:** Changes in the external environment include factors such as temperature, light levels, noises, odors, conditions that cause pain, etc. Changes in the internal environment include conditions such as being short of breath, needing an increased flow of blood, pain in the joints and internal organs, hunger, thirst, infection, and many other factors.
- **Sensory organ**—An organ with the primary purpose of monitoring conditions in the environment and within the body in order to provide the brain with information that may require a response
  - ✔ **Note:** Sensory organs include the eyes, ears, taste buds, nerve endings in the skin that sense touch and other conditions, and receptors in the nasal passages that detect odors. Sensory organs are specialized extensions of the nervous system.
- **Brain**—The portion of the central nervous system contained within the cranium and containing specialized cells that coordinate and regulate the functions of the central nervous system
- **Motor organ**—An organ with the primary function of moving materials within the body parts of the body itself
  - ✔ **Note:** The skeletal system and muscular system are primarily responsible for moving the parts of the body. The circulatory system moves blood and the materials it carries, the digestive system moves food and nutrients, the respiratory system moves gases and water vapor, and so on with the other systems of the body that are composed of motor organs.

a. Receives internal and external **stimuli** through the **sensory organs**

b. Transmits messages to and from the **brain**

c. Interprets the transmitted messages, stores any needed information, and coordinates any required responses

   ✔ **Note:** The brain is part of the nervous system and performs the functions related to processing messages, storing memories, and initiating responses in the body, both voluntary and involuntary.

d. Responds to internal and external stimuli through the **motor organs**

Objective 3

Major subsystems of the nervous system (see Figure 2)

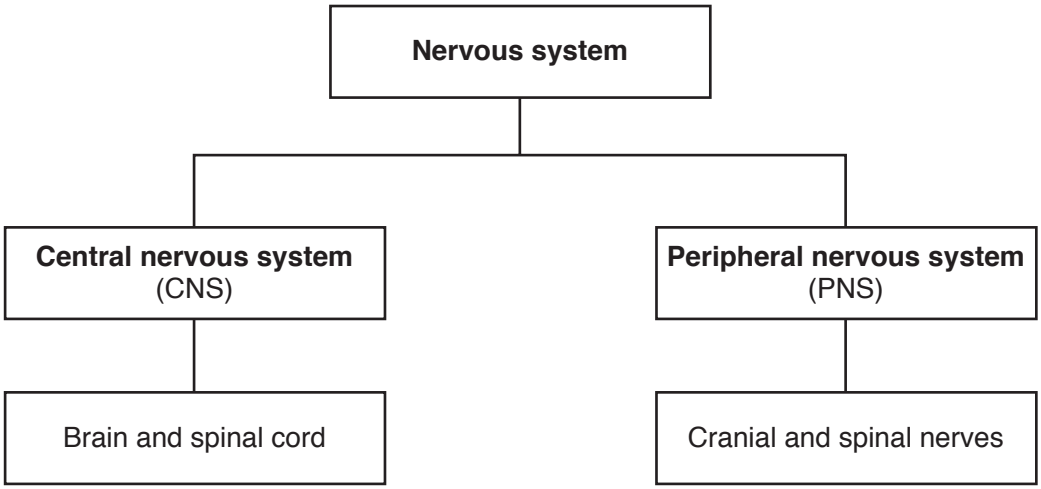
Key terms:

- **Spinal cord**—The cord of nerve tissue that extends from the brain lengthwise along the back in the **spinal canal** and gives off pairs of spinal nerves, carries impulses to and from the brain, and serves as a center for initiating and coordinating reflex acts
- **Spinal canal**—The row of aligned holes in the vertebrae through which the spinal cord passes

a. **Central nervous system** (CNS)—The part of the nervous system that consists of the brain and **spinal cord**, to which sensory impulses are transmitted and from which motor impulses pass out; the part of the nervous system that coordinates the activity of the entire nervous system

b. **Peripheral nervous system** (PNS)—The part of the nervous system that is outside the central nervous system and consists of 12 pairs of cranial nerves and 31 pairs of spinal nerves that link the various parts of the body to the central nervous system

Figure 2—Major subsystems of the nervous system



Objective 4

Major subsystems of the peripheral nervous system (PNS)
(see Figure 3)

Key terms:

- **Somatic** (só-ma-tik)—Of, relating to, or affecting the body
- **Autonomic** (o-tuh-naẃ-mik)—Acting or occurring involuntarily

a. **Somatic nervous system** (SNS)—The part of the peripheral nervous system that connects the central nervous system to the skin and the skeletal muscles via the cranial and spinal nerves and initiates voluntary responses

b. **Autonomic nervous system** (ANS)—The part of the peripheral nervous system that connects the central nervous system to the visceral organs via the cranial and spinal nerves and initiates involuntary responses

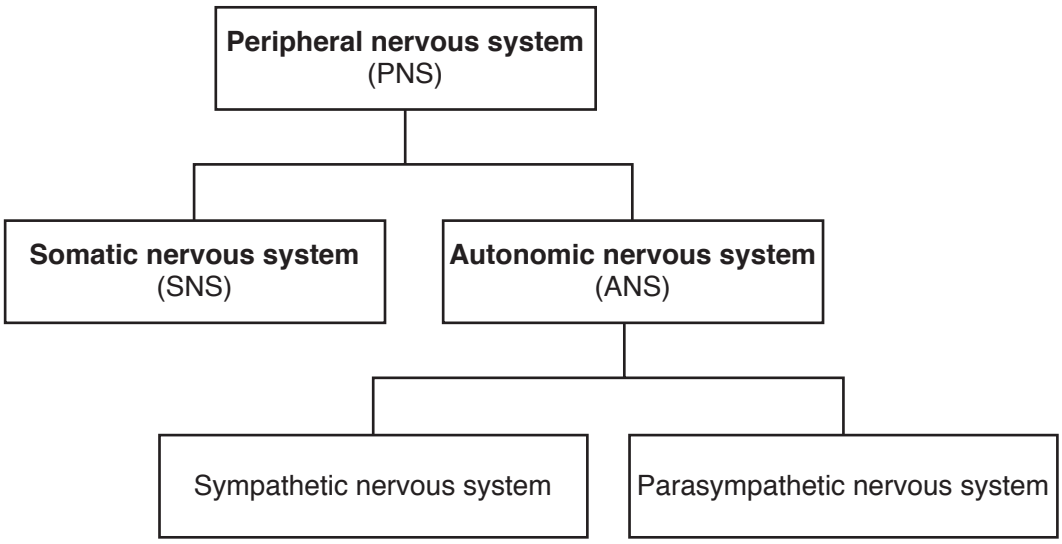
Objective 5

Major subsystems of the autonomic nervous system (ANS)
(see Figure 3)

a. **Sympathetic** (sim-puh-thé-tik) **nervous system**—The part of the autonomic nervous system that prepares the body to deal with emergencies through the expenditures of energy

b. **Parasympathetic** (par-uh-sim-puh-thé-tik) **nervous system**—The part of the autonomic nervous system that restores homeostatic balance and conserves energy

Figure 3—Major subsystems of the peripheral nervous system



Objective 6

The term *nerve tissue*

a. **Nerve tissue**—Tissue consisting of one or more bundles of impulse-carrying fibers that connect the brain and the spinal cord with other parts of the body

Objective 7

Basic types of nerve tissue

a. **Neurons** (n{y}ú-rawns)—The basic nerve-tissue cells that are capable of transmitting nerve impulses (see Figure 4)

b. **Neuroglia** (n{y}u-ró-gle-uh)—The basic nerve-tissue cells that support neurons and play a role when there is injury or infection in the nervous system (see Figure 5)

Figure 4—Neuron (sensory neuron)

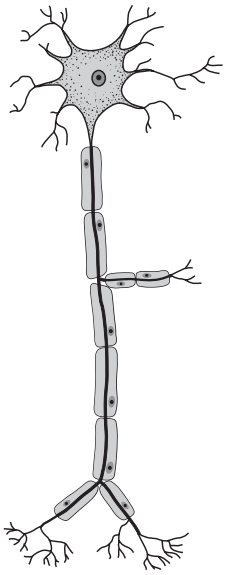
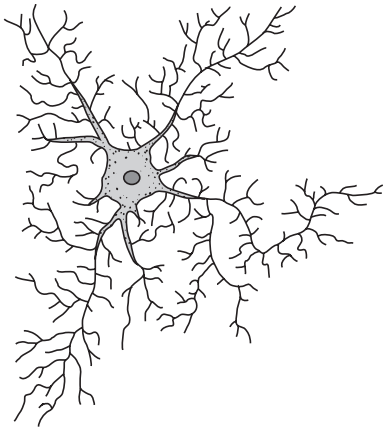


Figure 5—Neuroglia



Objective 8

Functions of the major structures of a neuron (see Figure 6)

✔ **Note:** Neurons consist of a cell body and two extensions: axons (aḱ-sawns) and dendrites (deń-drits). A neuron will have one axon but may have several dendrites. Basically, neurons are relay stations. Nerve impulses or signals—which are essentially electrical current—enter one end of the neuron (the dendrites), are transported through the cell body, and exit the other end of the neuron (the axon). The impulse then passes through the space that separates the axon from a dendrite of another neuron and continues its journey, somewhat like a spark passing across the gap of a spark plug.

a. **Cell body**—Acts as a sending and receiving center, performs metabolic and reproductive functions for the cell, and stores energy

✔ **Note:** The cell body of a neuron is like most cells within the body. It carries on routine cell functions such as metabolism and mitosis. It stores energy for use by the cell when additional energy is needed. The cell body of the neuron also assists with the specialized functions of a nerve cell by relaying impulses from the dendrites to the axon.

b. **Dendrite**—Carries impulses to the cell body

c. **Axon**—Carries impulses from the cell body

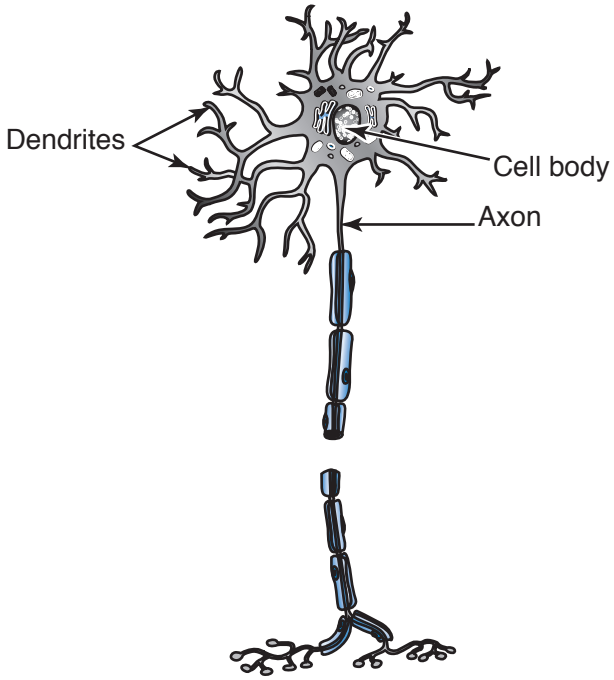
Information Sheet

Objective 9

Major structures of a neuron (see Figure 6)

✔ **Note:** The artwork in Figure 6 shows a typical motor neuron.

Figure 6—Major structures of a neuron



Objective 10

Types of neurons

✔ **Note:** It may already be apparent to you that there is a problem if nerve impulses travel only one way through a neuron because signals have to go to and come from the brain. If the skin receptors tell the brain that the environment is too hot, the brain must be able to send signals back to the body to address the stimulus, by sweating for example. In fact, there are parallel paths of nerves—those that transport messages to the brain from the sensory organs and those that carry messages from the brain to the motor organs.

Key term:

- **Thalamus** (thá-luh-muhs)—One of a pair of large oval organs in the brain

a. **Sensory neurons**

- Are also called *afferent* (af´-uh-ruhnt) or *receptor neurons*
- Receive messages from all parts of the body and transmit them to the central nervous system (brain and spinal cord)
- Are controlled by the **thalamus**

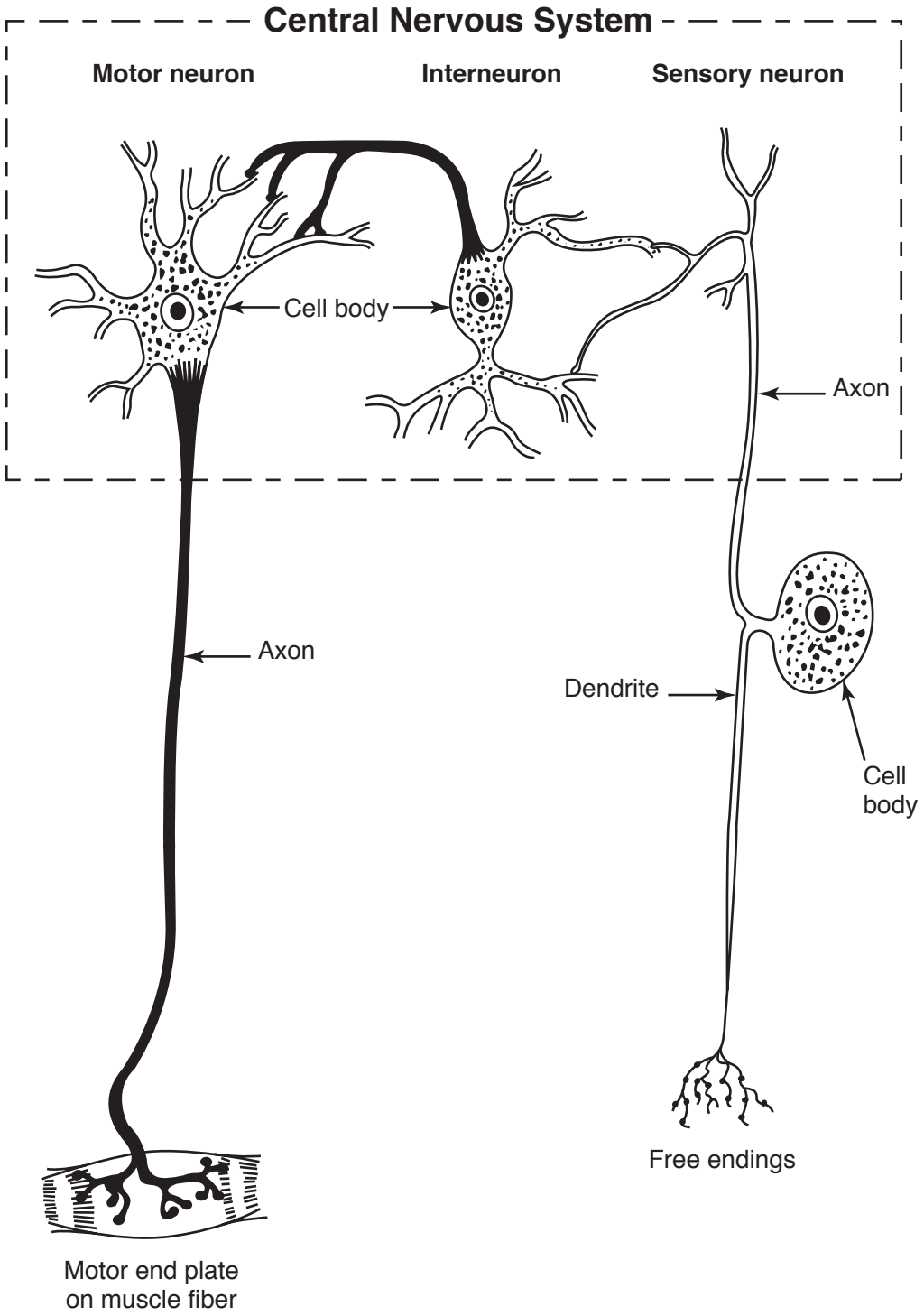
b. **Interneurons**

- Are also called *central neurons* or *internuncial* (in-tuhr-nuhń-se-uhl) *neurons* or *connecting neurons*
- Conduct messages or impulses from sensory to motor neurons
- Are found only in the central nervous system (brain and spinal cord)

c. **Motor neurons**

- Are also called *efferent* (ef´-uh-ruhnt) *neurons*
- Transmit messages from the central nervous system to all parts of the body
- Are located in the muscles and glands
- Are controlled by the frontal lobe of the brain

Figure 7—Types of neurons



Objective 11

A reflex arc

Key term:

- **Gray matter**—Nerve tissue that consists of motor neurons and interneurons

a. A reflex is an involuntary response to a stimulus, such as blinking the eyes when something approaches them, salivating at the sight of appetizing food, and jerking of the knee when a certain spot is tapped.

b. Many reflexes do not involve action on part of the brain; instead, the affector/effector circuit is completed by a loop in the spinal cord called a *reflex arc*.

c. A reflex arc consists of an affector that provides a signal through a sensory neuron into a spinal nerve and into the spinal cord.

d. The impulse passes through an interneuron in the **gray matter** of the spinal cord to a motor neuron that connects to an effector.

Objective 12

Major structures within the spinal canal

✔ **Note:** The spinal canal is a row of aligned holes in the vertebrae through which the spinal cord passes. The spinal canal provides excellent protection to this vital extension of the brain. In addition to the shielding provided by the bones of the vertebral column, the spinal cord is surrounded by a network of blood vessels and is suspended in a special fluid produced in the brain and called *cerebrospinal fluid*. The spinal canal itself is lined with special membranes called the *meninges* (muh-niń-jez) that also extend into the cranial cavity. Further protection is provided by deposits of adipose tissue.

Key term:

- **Meninx** (mé-nin{k}s)—Any one of the three membranes that envelop the brain and the spinal cord

a. **Spinal cord**

b. **Cerebrospinal fluid**

c. **Meninges**

d. **Adipose tissue**

e. **Blood vessels**

Information Sheet

Objective 13

Structure and function of the spinal cord

a. The spinal cord is a small cord about 18 inches (47 centimeters) long in an adult.

b. The spinal cord lies within the spinal canal and is surrounded by the vertebrae.

c. The spinal cord acts as the conduction pathway for impulses between the peripheral nerves to and from the brain.

d. The spinal cord extends from the medulla of the brain to the first lumbar vertebra or top of the second lumbar vertebra.

Objective 14

Functions of the nerves of the head, face, and neck

✔ **Note:** Knowing the location and function of the nerves of the head, face, and neck (cranial nerves) will assist you in performing comfortable and relaxing shampoos, facials, and massages on your clients.

Key terms:

- **Cornea**—The transparent part of the coat of the eyeball that covers the iris and pupil and admits light to the interior
- **Conjunctiva**—The mucous membrane that lines the inner surface of the eyelids and continues over the forepart of the eyeball
- **Pancreas**—A large gland that secretes digestive enzymes and the hormones insulin and glucagon

a. **Olfactory** (awl-fak´-tre)—Nerve pair I; support the sense of smell

b. **Optic** (awp´-tik)—Nerve pair II; support the sense of sight

c. **Oculomotor** (aw-kyuh-luh-mo´-tuhr)—Nerve pair III; control four muscles of the eye

d. **Trochlear** (traw´-kle-uhr)—Nerve pair IV; control some of the eye muscles

e. **Trigeminal** (tri-je´-muh-nuhl)—Nerve pair V; control the muscles of the **cornea** and **conjunctiva**, the upper portion of the face, the ear, the lower lip, the teeth, the gums, and the muscles for chewing

f. **Abducens** (ab-du´-senz)—Nerve pair VI; control lateral eye movement

g. **Facial** (fa´-shuhl)—Nerve pair VII; supply the face muscles, the middle ear, and the taste sensors

h. **Auditory** (o´-duh-tor-e)—Nerve pair VIII; support the sense of hearing and balance

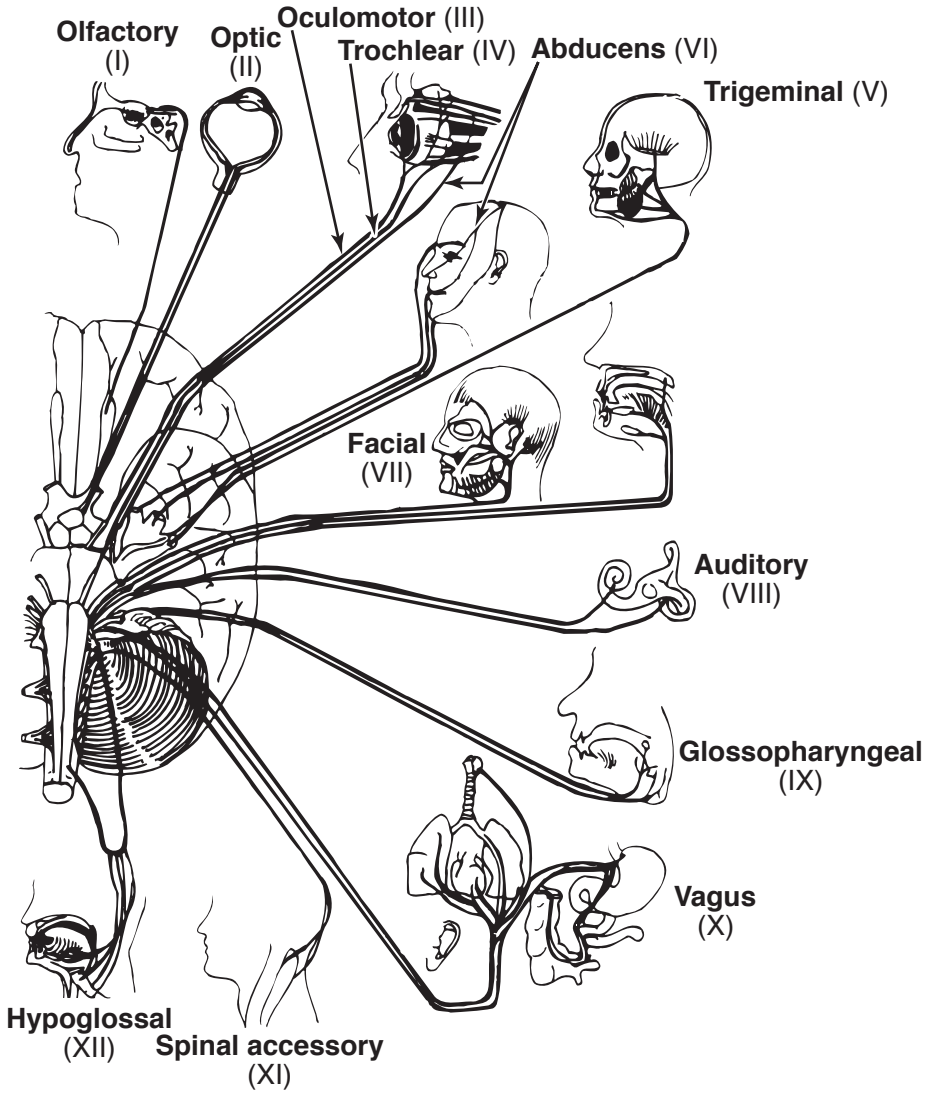
i. **Glossopharyngeal**—Nerve pair IX; support the sense of taste and control swallowing

j. **Vagus** (va´-guhs)—Nerve pair X; control swallowing, hunger, speech, breathing, heart rate, and glands in the stomach and **pancreas**

k. **Spinal accessory**—Nerve pair XI; control the muscles of the neck and upper back; carry impulses to the neck and shoulder muscles

i. **Hypoglossal** (hi-puh-glaw´-suhl)—Nerve pair XII; control the tongue muscles

Figure 8—Nerves of the head, face, and neck
(Cranial nerves of the peripheral nervous system)



✔ **Note**: The brain is shown in relation to the cranial nerves.

Module Contents

Student Components

Student Guide

Student Workbook

* Assignment Sheets

* Assignment Sheets are located in the Student Workbook.

Prerequisites:
Modules 1–4

Learning Activities Sheet

Student Name _____

Directions

Place a checkmark in the appropriate box as you complete each of the steps below.

❑ 1. **Take** Pretest provided by your instructor.

❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.

❑ 3. **Read** Module Objective Sheet.

❑ 4. **Study** Information Sheet, Objectives 1 through 7.

❑ 5. **Research** Online resources to learn more about the circulatory system. Your instructor will list several Web sites on the blanks below. Visit at least two of the following Internet sites.

- _____
- _____
- _____
- _____
- _____

❑ 6. **Do** Assignment Sheet 1, "Complete the Crossword Puzzle of Terms (Objectives 1–7)."

❑ 7. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 8. If the evaluation is not satisfactory, repeat Steps 4, 6, and 7.

❑ 8. **Study** Information Sheet, Objectives 8 through 15.

❑ 9. **Study** Information Sheet, Objectives 16 through 24.

Learning Activities Sheet

	❑	10. **Do**	Assignment Sheet 2, "Complete the Crossword Puzzle of Terms (Objectives 8–24)."
	❑	11. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 12. If the evaluation is not satisfactory, repeat Steps 8, 9, 10, and 11.
	❑	12. **Do**	Assignment Sheet 3, "Construct a Model of the Human Heart."
	❑	13. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 14. If the evaluation is not satisfactory, repeat Steps 12 and 13.
	❑	14. **Do**	Assignment Sheet 4, "Research the Route of a Blood Cell Through the Circulatory System."
	❑	15. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 16. If the evaluation is not satisfactory, repeat Steps 14 and 15.
	❑	16. **Do**	Assignment Sheet 5, "Analyze Cosmetology Scenarios."
	❑	17. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 18. If the evaluation is not satisfactory, repeat Steps 4, 8, 9, 16, and 17.
	❑	18. **Do**	Assignment Sheet 6, "Complete Module 9 Review."
	❑	19. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 20. If the evaluation is not satisfactory, repeat Steps 4, 8, 9, 18, and 19.
	❑	20. **Take**	Written Test provided by your instructor.

❑ 21. **Stop** Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 22. If the evaluation is not satisfactory, follow your instructor's recommendations concerning a review of the above learning activities.

❑ 22. **Check** With your instructor for any additional assignments to be completed.

❑ 23. **Do** Additional assignments listed below.

_____

_____

_____

❑ 24. **Stop** Have your instructor evaluate your performance on this module by compiling your scores on the Written Test and assignment sheets. If the evaluation is satisfactory, proceed to the next module. If the evaluation is not satisfactory, ask your instructor for further instructions.

***Permission to duplicate this form is granted.**

Module Objective Sheet

Module Objective

After completing this module, you should be able to identify major structures of the heart, and describe structures and characteristics of the various organs and parts that make up the circulatory system. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test.

Specific Objectives

After completing this module, you should be able to:

1. Define the term *circulatory system*.
2. Select from a list the functions of the circulatory system.
3. List the subsystems of the circulatory system.
4. Match the major organs of the circulatory system with their definitions.
5. Distinguish among the major components of blood.
6. Complete statements that describe the normal physical characteristics of blood.
7. List the major components of blood plasma.
8. Define the term *cardiovascular system*.
9. Complete statements that describe the size and position of the heart.
10. List the major structures of the heart.
11. Select true statements concerning characteristics of the chambers of the heart.
12. Select true statements that describe the characteristics of the major veins of the heart.
13. Complete statements that describe the characteristics of the major arteries of the heart.
14. Select true statements concerning characteristics of the major valves of the heart.
15. Label the major structures of the heart.
16. Define the term *vascular system*.

Module Objective Sheet

17. Select from a list the major structures of the vascular system.
18. Match major arteries that extend from the aortic arch with their descriptions.
19. Label the major arteries of the systemic circulation system.
20. Complete statements that describe the characteristics of capillaries.
21. Complete statements that describe the characteristics of veins.
22. Define the term *pulse point*.
23. Define the term *blood pressure*.
24. Define the term *lymphatic system*.
25. Complete the crossword puzzle of terms (Objectives 1–7). (Assignment Sheet 1)
26. Complete the crossword puzzle of terms (Objectives 8–24). (Assignment Sheet 2)
27. Construct a model of the human heart. (Assignment Sheet 3)
28. Research the route of a blood cell through the circulatory system. (Assigment Sheet 4)
29. Analyze cosmetology scenarios. (Assignment Sheet 5)
30. Complete Module 9 review. (Assignment Sheet 6)

Information Sheet

Objective 1

The term *circulatory system*

a. **Circulatory system**—The network of channels through which the nutrient fluids of the body circulate (see Figures 1-a and 1-b on the next page)

Objective 2

Functions of the circulatory system

a. Transports various substances to and from body cells, including oxygen, carbon dioxide, food, water, chemicals, hormones, and waste products

b. Protects the body against invading organisms

c. Helps regulate body temperature

d. Maintains homeostasis

e. Transports waste products to excretory organs

Objective 3

Subsystems of the circulatory system

✔ **Note:** The circulatory system consists of two distinct subsystems. One allows the circulation of **blood** and the other supports the circulation of **lymph**.

Key terms:

- **Blood** (bluhd´)—The liquid pumped by the heart through the arteries, veins, and capillaries, carrying nourishment and oxygen to and bringing away waste products from all parts of the body
  ✔ **Note:** You will study the terms arteries, veins, and capillaries in Objective 4.
- **Lymph** (lim{p}f´)—The pale fluid that bathes the tissues, passes into lymphatic vessels and ducts, and is discharged into the blood

a. **Blood circulatory system** (see Figure 1-a on the next page)

b. **Lymphatic system** (see Figure 1-b on the next page)

Figure 1-a
Circulatory system—blood

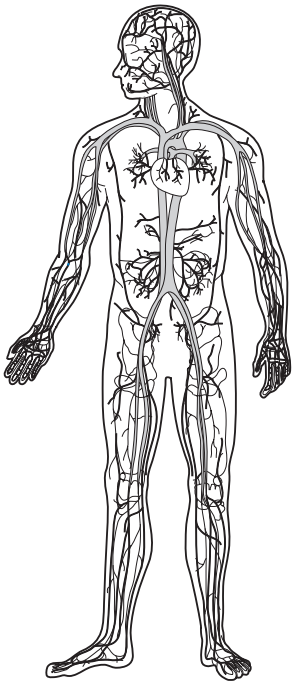
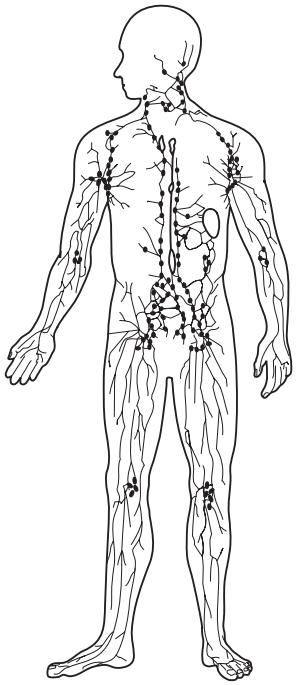


Figure 1-b
Circulatory system—lymphatic



Objective 4

Major organs of the circulatory system

Key terms:

- **Lymphocyte** (liḿ-fuh-sit)—One of two types of white blood cells—a T cell or a B cell—that performs various functions related to recognizing, marking, and remembering pathogens based on their antigens
- **Monocyte** (mawń-uh-sit)—A type of white blood cell that enlarges to form a macrophage in order to perform more-rapid digestion of bacteria or other foreign bodies
- **Plasma** (plaź-muh)—The fluid part of blood and lymph
- **Leukocyte** (lú-kuh-sit)—Another term for white blood cell

a. **Arteries** (awŕ-tuh-res)—The tubular, branching, muscular- and elastic-walled blood vessels that carry blood from the heart through the body

✔ **Note:** Collectively, arteries, veins, and capillaries are called *blood vessels*.

b. **Heart** (hawrt´)—The hollow, muscular organ that by its rhythmic contraction acts as a force pump maintaining the circulation of the blood

c. **Veins** (vanź)—The many blood vessels that convey blood from the capillaries to the heart

d. **Capillaries** (ká-puh-ler-es)—The smallest blood vessels forming networks throughout the body

e. **Arterioles** (awr-tiŕ-e-ols)—The small terminal twigs of an artery that end in capillaries

f. **Venules** (veń-yu{uh}ls)—Small veins and especially the minute veins connecting capillaries with larger veins

g. **Lymphatic vessels**—Fine, transparent, valved channels that carry lymph and tissue fluid, are distributed through most tissues, and are characterized by a beaded appearance

h. **Lymph nodes**—Small, oval structures that filter lymph, fight infection, and form **lymphocytes**, **monocytes**, and **plasma** cells

i. **Spleen** (spleń)—A soft, highly vascular organ located between the stomach and the diaphragm and considered a part of the lymphatic system; it produces **leukocytes**, monocytes, lymphocytes, and plasma cells, stores blood cells, and filters out bacteria and wornout red blood cells

Objective 5

Major components of blood

✔ **Note:** Blood is composed of a liquid called *plasma* and a solid portion that consists of three types of blood cells.

Key terms:

- **Heparin** (hé-puh-ruhn)—A chemical that prevents blood from clotting
- **Clotting**—The process of blood becoming solid

a. **Blood plasma**—The liquid part of blood that serves as a source of nutrition and a means of removing waste products from the cells of the body

b. **Erythrocytes** (i-rith´-ruh-sitz)—Red blood cells (RBCs) that transport oxygen and carbon dioxide in support of respiration

c. **Leukocytes** (lú-kuh-sitz)—White blood cells (WBCs) that ingest and digest foreign particles in blood, form antibodies, and release **heparin**

d. **Thrombocytes** (thrawḿ-buh-sitz)—Blood platelets, the tiny protoplasmic discs of the blood that assist in blood **clotting**

Information Sheet

Objective 6

The normal physical characteristics of blood

✔ **Note:** Blood is an important component of life processes. As such, the chemical and physical characteristics of blood are vitally important. If these characteristics vary too much from normal parameters, then the blood will not be able to perform its functions. For example, if the pH of the blood is too high or low, the cells will not be able to carry adequate amounts of oxygen or sufficient nutrients.

a. The color of unoxygenated blood in the veins is purple or deep red.

b. The color of oxygenated blood in the arteries is bright red.

c. Blood tastes slightly metallic and salty.

d. Blood is slightly alkaline, with a normal pH of 7.35 to 7.45.

e. There are approximately 6 quarts (5000 to 5500 cubic centimeters) of blood in the body of an adult.

✔ **Note:** The above amount is equivalent to 5 to 5.5 liters.

f. The composition of blood is 78 percent water and 22 percent solids or 55 percent plasma and 45 percent cells.

Objective 7

Major components of blood plasma

a. **Water**

✔ **Note:** Blood plasma is approximately 90 percent water.

b. **Electrolytes**

c. **The nutrients glucose, amino acids, and fat**

d. **Metabolic wastes**

Examples: Urea, uric acid, creatinine, and lactic acid

e. **Respiratory gases**

f. **Regulatory substances, including hormones and enzymes**

g. **Antibodies**

Objective 8

The term *cardiovascular system*

Key terms:

- **Cardiac**—Of or pertaining to the heart
- **Vascular**—Of or pertaining to the blood vessels

a. **Cardiovascular system**—The network of anatomical structures, including the heart and the blood vessels, that pump blood throughout the body

Objective 9

Size and position of the heart

Key terms:

- **Mediastinum** (me-de-uh-stí-nuhm)—A portion of the thoracic cavity in the middle of the thorax, between the pleural sacs containing the two lungs
- **Apex** (á-peks)—The lower border of the heart
- **Base**—The upper border of the heart

a. The heart is a hollow, muscular organ that is about the size and shape of a person's fist and weighs 9 to 13 ounces (250 to 350 grams).

b. The heart is suspended in the thoracic cavity by vessels and lies in the **mediastinum** with approximately two-thirds of its mass to the left of the midline of the body.

c. The heart rests obliquely in the body with the right side anterior to the left side; it rests on the diaphragm with the **apex** pointing left and is positioned with the **base** below the second rib.

d. The heart lies in a fibrous, loose-fitting sac called the pericardium (per-uh-kawŕde-uhm) (see Figure 2), which consists of the serous pericardium and the fibrous pericardium.

e. The serous pericardium consists of a parietal layer, which lines the inside of the fibrous pericardium, and a visceral layer, which adheres to the surface of the heart.

f. Between the two layers of the pericardium is the pericardial space, which contains the pericardial fluid that lubricates the opposing surfaces of the space and allows the heart to move easily during contraction.

Information Sheet

Objective 10

Major structures of the heart

a. **Septum** (seṕ-tuhm)

✔ **Note:** The septum is the partition or wall that divides the heart into right and left halves (see Figure 2). The right half of the heart contains venous blood and the left half contains arterial blood.

b. **Chambers**

✔ **Note:** A chamber is a hollow but not necessarily empty space or cavity in an organ.

c. **Veins**

✔ **Note:** Veins convey blood to the heart.

d. **Arteries**

✔ **Note:** Arteries carry blood from the heart.

e. **Valves**

✔ **Note:** A valve is a structure in a vessel that prevents the backflow of blood. There are four major valves in the heart.

Objective 11

Characteristics of the chambers of the heart

a. The heart is divided into four chambers: (1) the right atrium (á-tre-uhm), (2) the right ventricle (veń-tri-kuhl), (3) the left atrium, and (4) the left ventricle (see Figure 2).

b. The two upper chambers—the atria—collect blood; the right atrium receives deoxygenated blood and the left atrium receives oxygenated blood.

c. The two lower chambers—the ventricles—pump blood from the heart; the right ventricle pumps deoxygenated blood to the lungs and the left ventricle pumps oxygenated blood to the body.

✔ **Note:** The right side of the heart provides for the oxygenation of blood (pulmonary circulation), and the left side of the heart is responsible for transportation of blood to the body (systemic circulation).

d. Because they do the pumping, the ventricles consist of thicker muscle tissue than the atria, and the left ventricle, which pumps blood to the body, is approximately three times thicker than the right ventricle.

Objective 12

Characteristics of the major veins of the heart

a. Deoxygenated blood returns to the heart from the body by the way of two large veins—the superior vena cava and the inferior vena cava (see Figure 2).

b. The superior vena cava carries blood from the upper part of the body.

c. The inferior vena cava carries blood from the lower part of the body.

d. The superior and inferior venae cavae deposit deoxygenated blood into the right atrium (see Figure 2).

e. The right and left pulmonary veins carry oxygenated blood back to the heart from the lungs.

f. The pulmonary veins deposit oxygenated blood in the left atrium (see Figure 2).

Objective 13

Characteristics of the major arteries of the heart

a. When the heart contracts, blood leaves the right ventricle of the heart through the left pulmonary artery and the right pulmonary artery and travels to the lungs (see Figure 2).

b. When the heart contracts, oxygenated blood leaves the left ventricle through the aorta (see Figure 2), the largest artery of the body.

c. The aorta branches into smaller arteries that carry blood to all the parts of the body.

Objective 14

Characteristics of the major valves of the heart (see Figure 2)

Key term:

- **Semilunar** (se-me-lú-nuhr)—Half-moon shaped

a. There are four major valves in the heart: (1) the tricuspid valve, (2) the bicuspid valve, (3) the pulmonary valve, and (4) the aortic valve.

b. The tricuspid valve is located between the right atrium and the right ventricle and consists of three main cusps (flaps).

c. The bicuspid valve, which is also called the *mitral* (mí-truhl) *valve*, is located between the left atrium and the left ventricle and consists of two cusps.

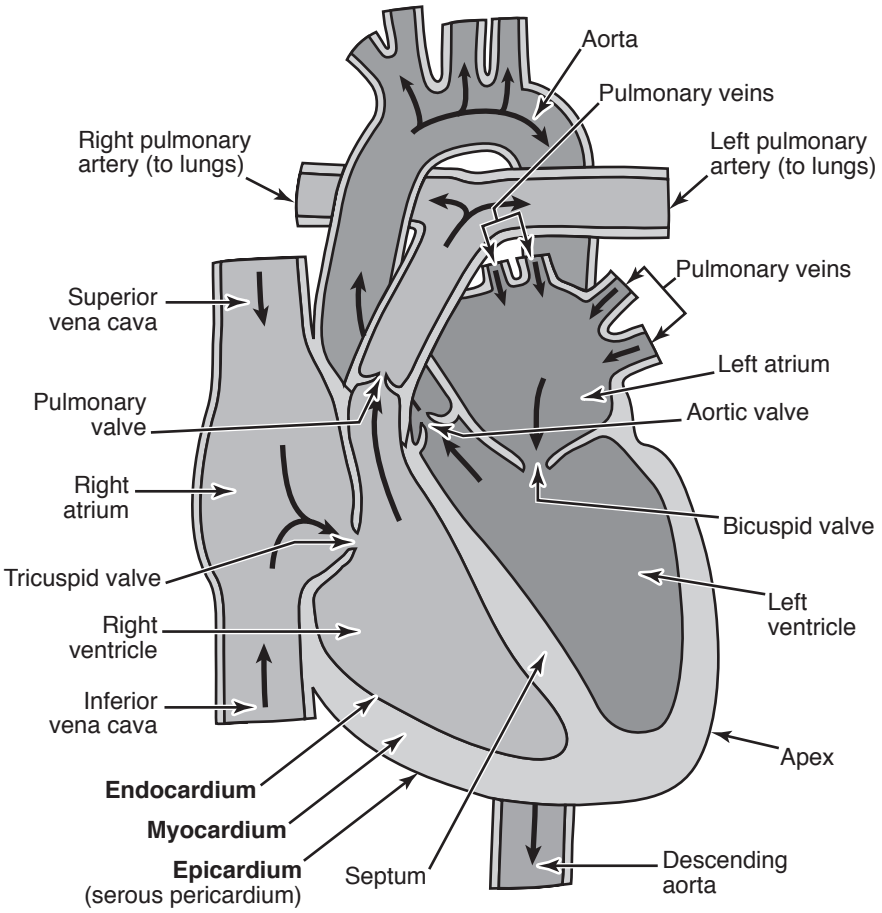
d. The pulmonary valve, which is also called the *pulmonary* ***semilunar*** *valve*, is located in the pulmonary artery and consists of three semilunar cusps that prevent blood from flowing back into the right ventricle from the pulmonary artery.

e. The aortic valve, which is also called the *aortic semilunar valve*, is located between the left ventricle and the aorta and consists of three semilunar cusps that prevent blood from flowing back into the left ventricle from the aorta.

Objective 15

Major structures of the heart

Figure 2—Major structures of the heart



Objective 16

The term *vascular system*

a. **Vascular system**—The portion of the cardiovascular system that deals with the blood vessels that allow for the circulation of blood throughout the body

✔ **Note:** The term *blood vessels* is used when referring collectively to arteries, veins, and capillaries.

Objective 17

Major structures of the vascular system

✔ **Note:** Structures are defined in Objective 4.

a. Arteries

b. Arterioles

c. Capillaries

d. Venules

e. Veins

Objective 18

Major arteries that extend from the aortic arch (see Figure 3)

Key terms:

- **Axillary** (aḱ-suh-ler-e)—Pertaining to the armpit
- **Brachial** (brá-ke-uhl)—Pertaining to the arm
- **Radial** (rá-de-uhl)—Pertaining to the radius, the bone of the forearm
- **Ulnar** (uhĺ-nuhr)—Pertaining to the ulna, the bone on the little-finger side of the forearm

a. **Right subclavian artery**—The main artery from the aortic arch that supplies the right arm and the surrounding area

b. **Left subclavian artery**—The main artery from the aortic arch that supplies the left arm and the surrounding area

c. **Right carotid artery (right common carotid artery)**—The main artery from the aortic arch that supplies the right side of the head, neck, and brain

d. **Left carotid artery (left common carotid artery)**—The main artery from the aortic arch that supplies the left side of the head, neck, and brain

e. **Axillary artery**—One of a pair of the continuations of the subclavian arteries that supplies various chest muscles and arm muscles

f. **Brachial artery**—The principal artery of the upper arm that is the continuation of the axillary artery

g. **Radial artery**—An artery of the forearm starting at the bifurcation of the brachial artery and passing in 12 branches supplying the forearm, wrist and hand

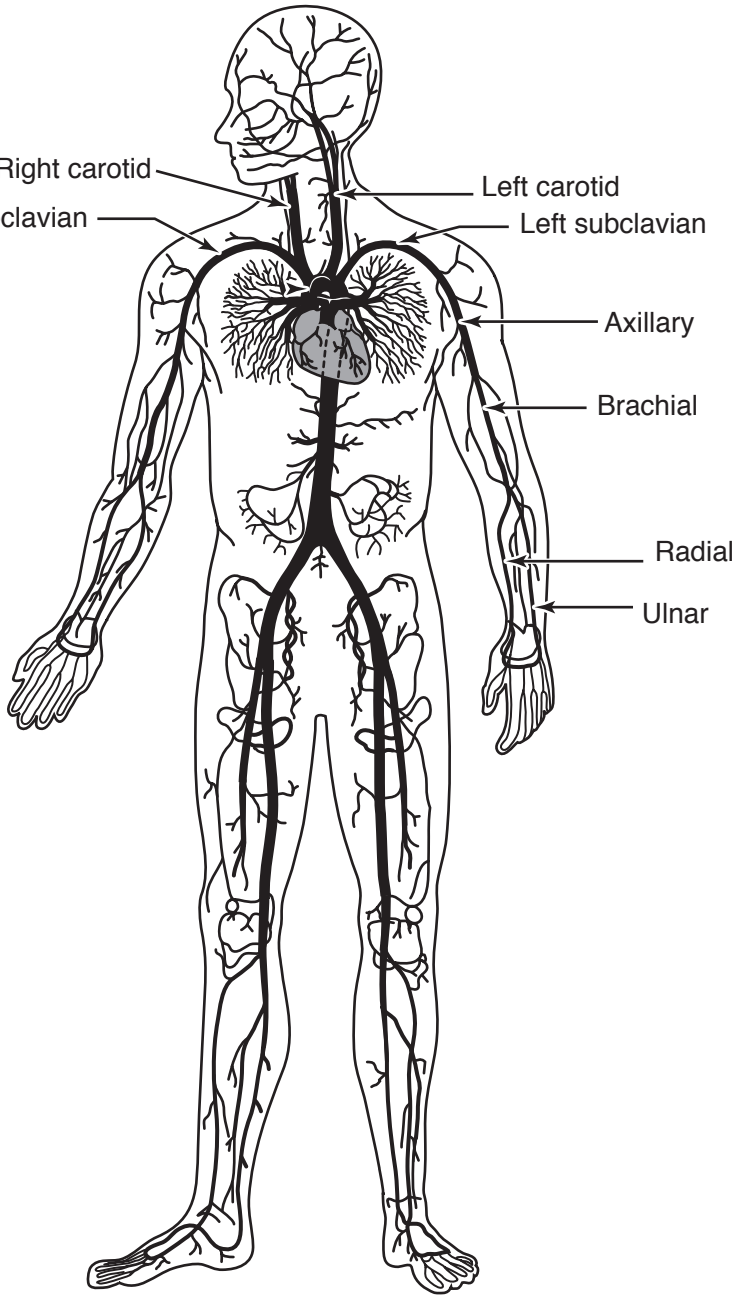
h. **Ulnar artery**—A large artery branching from the brachial artery and supplying muscles in the forearm, wrist, and hand; it has nine branches: four in the forearm, two in the wrist, and three in the hand

Information Sheet

Objective 19

Major arteries of the systemic circulation system

Figure 3—Major arteries of the systemic circulation system



Objective 20

Characteristics of capillaries

a. Capillaries connect arterioles and venules.

b. Capillaries are minute vessels with walls that are only one cell layer thick.

c. Nutrients and oxygen move from the capillaries through the capillary walls and into the cells of the body by osmosis.

d. Wastes move from the cells of the body through the capillary walls and into the capillaries by osmosis.

Objective 21

Characteristics of veins

a. Most veins carry deoxygenated blood to the vena cava of the heart; the pulmonary veins are an exception, as they carry oxygenated blood from the lungs to the heart.

b. Veins branch into venules and venules branch into capillaries.

c. The middle layer of muscle tissue in a vein is not very well developed or very flexible.

d. The wall of a vein is relatively thin, causing a vein to collapse when cut.

e. Many veins contain valves that prevent the backflow of blood.

f. Many veins share their names with the corresponding arteries.

Objective 22

The term *pulse point*

a. **Pulse point**—Any one of the sites on the surface of the body where arterial pulsations can be easily felt

b. One of the indicators of health is the rate of the heartbeat. The heartbeat can be monitored at one of these points conveniently without interference from clothing and the heavy structure of the chest.

Example: A normal pulse rate is between 60 to 80 beats per minute. The rate will vary with exercise, health, age, and other factors.

Information Sheet

Objective 23

The term *blood pressure*

a. **Blood pressure**—The pressure exerted by the circulating volume of blood on the walls of the arteries, the veins, and the chambers of the heart

✔ **Note:** Blood pressure is created by the contraction of the ventricles in the heart. Two points are taken in measuring blood pressure: the systole (siś-tuh-le) and the diastole (dí-as-tuh-le). The systole is the contraction of the myocardium, which in ventricular contraction, causes blood to be pumped into the arteries. The diastole is the dilation of the cavities of the heart during which they fill with blood.

b. Blood pressure measurements are always given stating the systole first and the diastole second.

Example: 120 over 70 or 120/70 (typical for a healthy young adult)

Objective 24

The term *lymphatic system*

Key term:

- **Interstitial** (in-tuhr-stí-shuhl)—Situated within but not restricted to or characteristic of a particular organ or tissue

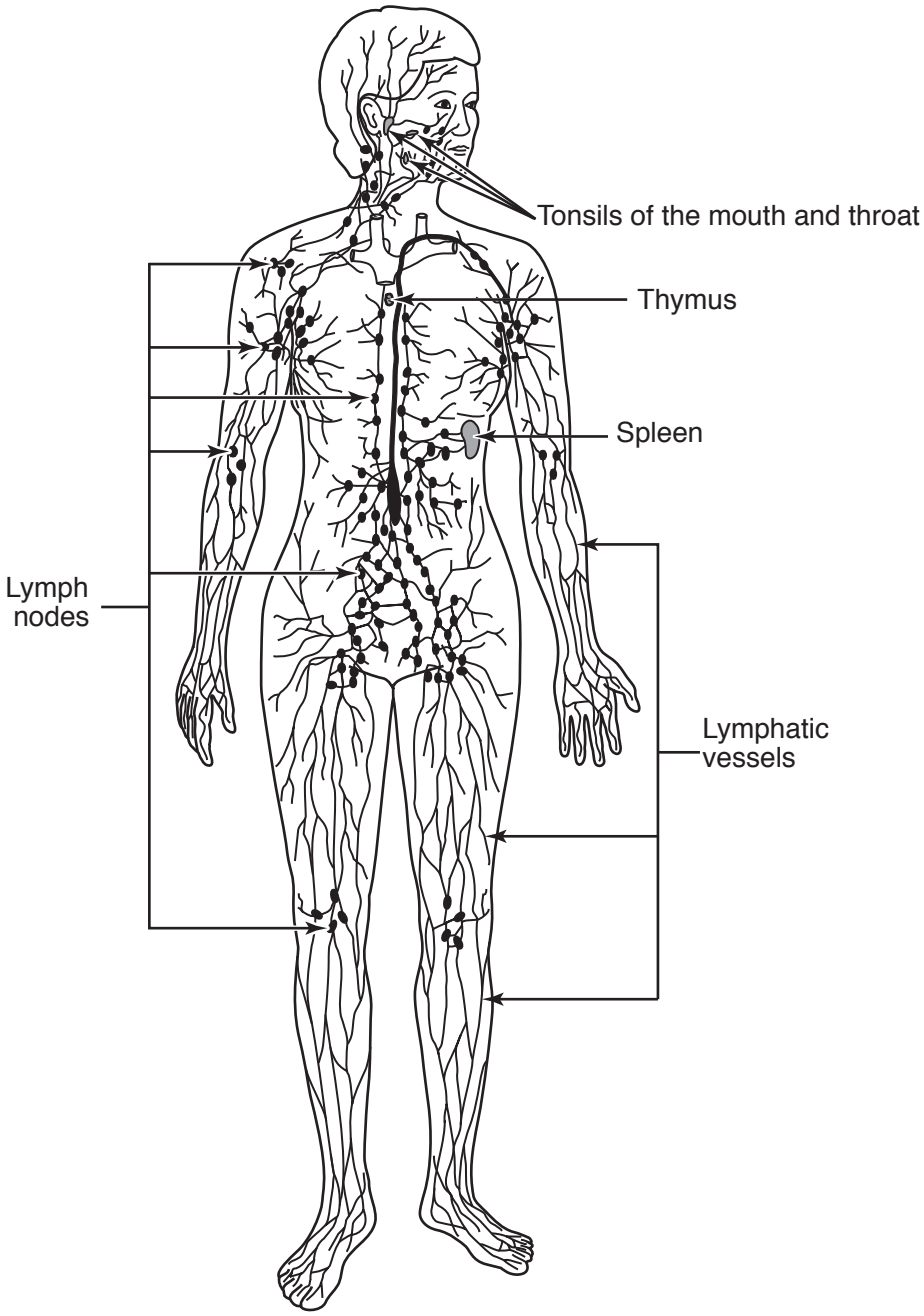
a. **Lymphatic** (lim-fá-tik) system—The vast, complex network of capillaries, thin vessels, valves, ducts, nodes, and organs that helps to protect and maintain the internal fluid environment of the entire body by producing, filtering, and conveying lymph and by producing various blood cells

✔ **Note:** The lymphatic system consists of the lymphatic vessels, the fluid that flows through them, specialized structures called *nodes*, and organs that include the spleen and the thymus. The lymphatic vessels are distributed throughout the body so that specific areas of the vessel network drain interstitial fluid from adjacent areas of the body.

b. The lymphatic system is closely related to the circulation of blood in the body and is in reality an extension of the circulatory system with complementary functions. The flow of blood and the flow of lymph interact with each other.

c. One function of the lymphatic system is to absorb excess interstitial fluid and return it to the veins, thus maintaining fluid balance within the body.

Figure 4—Major structures of the lymphatic system



Module Contents

Student Components

Student Guide

Student Workbook

* Assignment Sheets

* Assignment Sheets are located in the Student Workbook.

Prerequisites: Modules 1–4

Learning Activities Sheet

Student Name _____

Directions

Place a checkmark in the appropriate box as you complete each of the steps below.

❑ 1. **Take** Pretest provided by your instructor.

❑ 2. **Stop** Have your instructor evaluate your performance. Follow your instructor's recommendations concerning the following learning activities.

❑ 3. **Read** Module Objective Sheet.

❑ 4. **Study** Information Sheet, Objectives 1 through 3.

❑ 5. **Research** Online resources to learn more about the respiratory system. Your instructor will list several Web sites on the blanks below. Visit at least two of the following Internet sites.

- _____
- _____
- _____
- _____
- _____

❑ 6. **Study** Information Sheet, Objectives 4 through 8.

❑ 7. **Research** Online resources to learn more about the digestive system. Your instructor will list several Web sites on the blanks below. Visit at least three of the following Internet sites.

- _____
- _____
- _____
- _____
- _____

Learning Activities Sheet

❑	8.	**Study**	Information Sheet, Objectives 9 through 11.
❑	9.	**Research**	Online resources to learn more about the urinary system. Your instructor will list several Web sites on the blanks below. Visit at least three of the following Internet sites. • _____ • _____ • _____ • _____ • _____
❑	10.	**Do**	Assignment Sheet 1, "Complete the Crossword Puzzle of Terms (Objectives 1–11)."
❑	11.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 12. If the evaluation is not satisfactory, repeat Steps 4, 6, 8, 10, and 11.
❑	12.	**Do**	Assignment Sheet 2, "Participate in a Face Off."
❑	13.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 14. If the evaluation is not satisfactory, repeat Steps 4, 6, 8, 12, and 13.
❑	14.	**Do**	Assignment Sheet 3, "Analyze Cosmetology Scenarios."
❑	15.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 16. If the evaluation is not satisfactory, repeat Steps 4, 6, 8, 14, and 15.
❑	16.	**Do**	Assignment Sheet 4, “Complete Module 10 Review.”
❑	17.	**Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 18. If the evaluation is not satisfactory, repeat Steps 4, 6, 8, 16, and 17.
❑	18.	**Take**	Written Test provided by your instructor.

❑	19. **Stop**	Have your instructor evaluate your performance. If the evaluation is satisfactory, continue to Step 20. If the evaluation is not satisfactory, follow your instructor's recommendations concerning a review of the above learning activities.
❑	20. **Check**	With your instructor for any additional assignments to be completed.
❑	21. **Do**	Additional assignments listed below.
		_____
		_____
		_____
❑	22. **Stop**	Have your instructor evaluate your performance on this module by compiling your scores on the Written Test and assignment sheets. Ask your instructor for further instructions.

***Permission to duplicate this form is granted.**

Module Objective Sheet

Module Objective

After completing this module, you should be able to define and describe major organs of the respiratory, digestive, and urinary systems. You should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 85 percent on the Written Test.

Specific Objectives

After completing this module, you should be able to:

1. Define the term *respiratory system*.
2. Complete statements that describe the characteristics of pulmonary ventilation.
3. Match major organs and structures of the respiratory system with their descriptions.
4. Define the term *digestive system*.
5. State functions of the digestive system.
6. Define the term *accessory glands*.
7. Match major organs and structures of the digestive system with their descriptions.
8. Select from a list the functions of the liver.
9. Define the term *urinary system*.
10. Select from a list the functions of the urinary system.
11. Match major organs and structures of the urinary system with their descriptions.
12. Complete the crossword puzzle of terms (Objectives 1–11). (Assignment Sheet 1)
13. Participate in a "Face Off." (Assignment Sheet 2)
14. Analyze cosmetology scenarios. (Assignment Sheet 3)
15. Complete Module 10 review. (Assignment Sheet 4)

Information Sheet

Objective 1

The term *respiratory system*

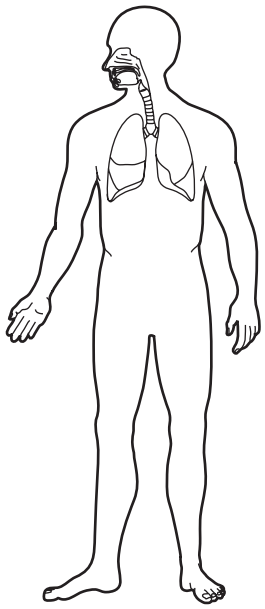
Key terms:

- **Pulmonary ventilation**—The process of inhaling and exhaling air through the lungs; breathing
  ✔ **Note:** Pulmonary ventilation is also called *external respiration*.
- **Cellular respiration**—The process of oxygen carried by the blood passing into the cells and being used by the cells, which leads to the production of carbon dioxide that is then carried away by the blood
  ✔ **Note:** Cellular respiration is also called *internal respiration*.

a. **Respiratory system**—The complex of organs and structures that performs the **pulmonary ventilation** of the body and **cellular respiration** (see Figure 1)

✔ **Note:** During the process of converting nutrients to energy, oxygen is required to fuel the chemical reaction and carbon dioxide is produced as a by-product of the reactions. The bloodstream carries the required oxygen to the cells and removes the carbon dioxide and other wastes. The source of oxygen is the air around us, which is approximately 21 percent oxygen at sea level. However, getting the oxygen out of the air and into the bloodstream is a specialized process performed by the respiratory system.

Figure 1—Respiratory system



Information Sheet

Objective 2

Characteristics of pulmonary ventilation

✔ **Note:** Pulmonary ventilation (breathing) is a mechanical process. The lungs are alternately expanded by movement of the diaphragm, which creates low pressure in the lungs and allows air to be drawn in. To breathe out, the diaphragm relaxes, allowing the lungs to compress, thus forcing air out of the lungs.

Key terms:

- **Medulla oblongata** (muh-duh´-luh aw-blon-gaẃ-tuh)—One of the three parts of the brainstem that contains the cardiac, vasomotor, and the respiratory centers of the brain
- **Pons** (pawnź)—A broad mass of nerve fibers conspicuous on the ventral surface of the brainstem
- **Brainstem**—The part of the brain composed of the mesencephalon, pons, and medulla oblongata and connecting the spinal cord with the forebrain and cerebrum

a. The mechanical portion of pulmonary ventilation (external respiration) is referred to as *breathing*.

b. There are two stages to breathing: inhalation and exhalation (inspiration and expiration).

c. Breathing is controlled by the **medulla oblongata** and the **pons** of the **brainstem**.

✔ **Note:** Breathing can be consciously controlled by the central cortex. As we hold our breath or speak or shout, the volume of air exhaled is consciously regulated. However, if we try to hold our breath too long or speak too rapidly or too long, the medulla will force the respiratory system to breathe.

d. The major regulator of respiration is the carbon-dioxide level in the blood; high concentrations of carbon dioxide increase the rate of respiration, while decreased concentrations of carbon dioxide slow the rate of respiration.

✔ **Note:** Breathing rates vary with a number of factors, both internal and external. The rate of breathing usually increases with exercise, during times of excitement, when the oxygen level is low (as in higher altitudes), and with different diseases.

Objective 3

Major organs and structures of the respiratory system (see Figure 2)

✔ **Note:** The principal organs of the respiratory system are the lungs. However, a number of auxiliary structures are required to support respiration, including pathways to carry air to and from the lungs and muscles to pump the lungs.

Key term:

- **Saccular** (sá-kyuh-luhr)—Resembling a sac

a. **Nose**—The structure that protrudes from the anterior portion of the skull and serves as part of the passageway for air to and from the lungs

b. **Pharynx** (faŕ-in{k}s)—The throat; the muscular, tubular structure that extends from the base of the skull to the esophagus and serves as a passageway for both the respiratory and digestive tracts

c. **Larynx** (laŕ-in{k}s)—The organ of voice that is part of the air passageway connecting the pharynx with the trachea

d. **Trachea** (trá-ke-uh)—The windpipe; the nearly cylindrical tube in the neck that extends from the lower end of the larynx to the point where it divides into the two bronchi of the lungs

e. **Bronchi** (brawń-ke)—The large air passages in the lungs through which pass inspired air and exhaled waste gases

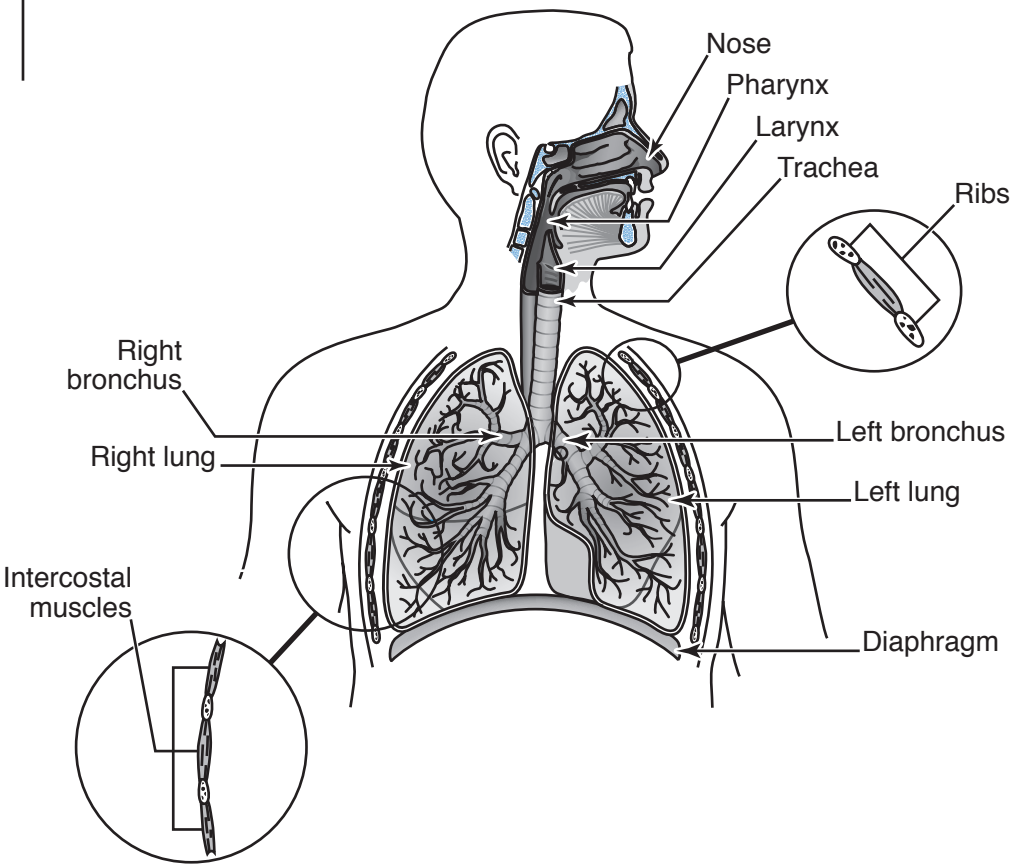
f. **Lungs**—The two light, spongy, highly elastic, **saccular** organs located in the thoracic cavity and constituting the main components of the respiratory system for inspiring air and exhaling carbon dioxide

g. **Diaphragm** (dí-uh-fram)—The dome-shaped partition of muscle and connective tissue that separates the thoracic and the abdominal cavities and aids respiration by moving up and down

h. **Intercostal** (iń-tuhr-kaws-tuhl) **muscles**—The muscles between the ribs

Information Sheet

Figure 2—Major organs and structures of the respiratory system

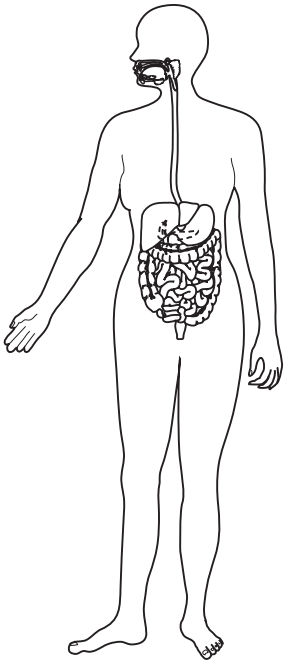


Objective 4

The term *digestive system* (Figure 3)

a. **Digestive system**—The organs, structures, and accessory glands of the digestive tube of the body through which food passes

Figure 3—Digestive system



Objective 5

Functions of the digestive system

Key term:

- **Organic** (or-gá-nik)—Related to those chemicals that contain carbon and are commonly found as the building blocks of living things
  - ✔ **Note:** Chemicals can generally be classed as organic or inorganic. All organic chemicals contain carbon and generally oxygen and hydrogen. They are formed as part of the life processes of plants and animals. All other chemicals are referred to as inorganic.

a. To convert the complex **organic**-compound molecules of ingested food into simple organic and inorganic compounds that are capable of being transported by the circulatory and lymphatic systems and being used by cells to produce energy

b. To convert nutrients into energy at the cellular level

c. To convert excess nutrients into fat for later use

d. To eliminate from the body the by-products of digestion that are not used by the cells or stored

Information Sheet

Objective 6

The term *accessory glands*

a. **Accessory glands**—The glands of the digestive system that secrete the digestive enzymes that are used by the digestive system to break down food substances in preparation for absorption into the bloodstream before carrying the waste to the intestines for excretion

Objective 7

Major organs and structures of the digestive system (see Figure 4)

Key terms:

- **Alimentary tract**—The digestive tube; the muscular tube that extends from the mouth to the anus
  ✔ **Note:** The alimentary tract is also called the *digestive tract.*
- **Bile**—The bitter, yellow-green secretion of the liver that is stored in the gallbladder

a. **Mouth**—The nearly oval oral cavity at the anterior end of the **alimentary tract**

b. **Pharynx**—The throat; the tubular structure that extends from the base of the skull to the esophagus and serves as a passageway for the respiratory and alimentary tracts

c. **Esophagus**—The muscular canal, about ten inches long, that extends from the pharynx to the stomach and is the narrowest part of the alimentary tract

d. **Liver**—The liver is shaped like an irregular hemisphere and located beneath the diaphragm in the right upper quadrant of the abdominal cavity

✔ **Note:** The liver is the largest gland of the body weighing approximately 3 to 4 pounds (7.2 kilograms).

e. **Stomach**—The major organ of digestion that receives partially processed food and drink funneled from the esophagus and then moves nutritional bulk into the small intestine

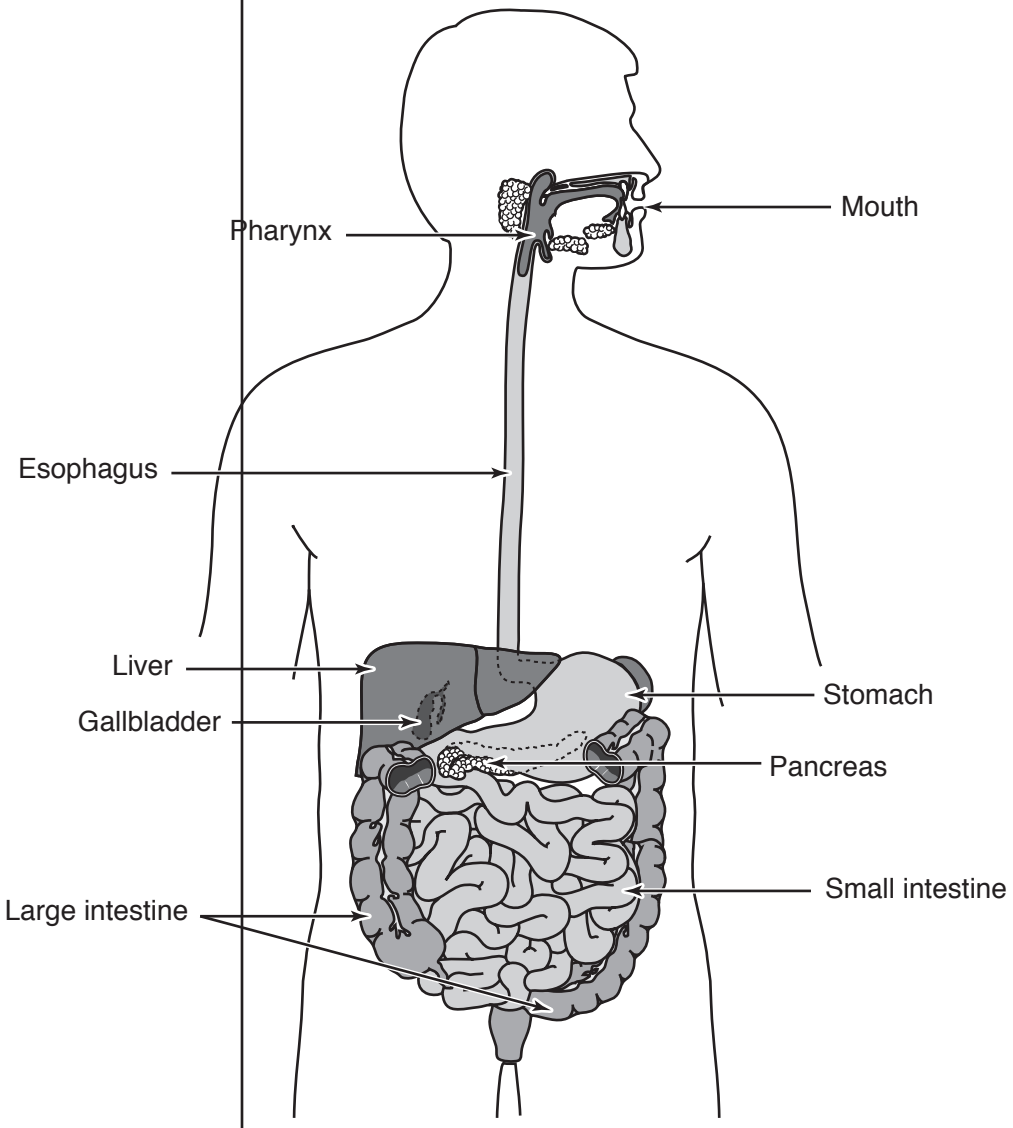
f. **Gallbladder**—The pear-shaped gland located on the surface of the liver and serving as a reservoir for **bile**

g. **Pancreas**—The fish-shaped gland that lies posterior and slightly inferior to the stomach and secretes various substances

h. **Small intestine**—The longest portion of the alimentary tract that extends from the stomach to the large intestine; most digestion and nutrient absorption occurs in the small intestine

i. **Large intestine**—The portion of the alimentary tract that extends from the small intestine to the anus; its functions are to absorb water, minerals, and vitamins and eliminate waste

Figure 4—Major organs and structures of the digestive system



Objective 8

Functions of the liver

a. Produces bile, which is stored in the gallbladder and is released when needed for the digestive process

b. Changes proteins into urea for elimination

c. Regulates blood volume

d. Manufactures antibodies

e. Removes bacteria and foreign substances from the bloodstream by phagocytosis

f. Produces body heat

g. Detoxifies harmful substances, such as drugs and poisons, before they make their way to the heart

h. Manufactures cholesterol

✔ **Note:** Cholesterol (kuh-leś-tuh-rol) is a steroid synthesized by the liver and used in the walls of cells.

Objective 9

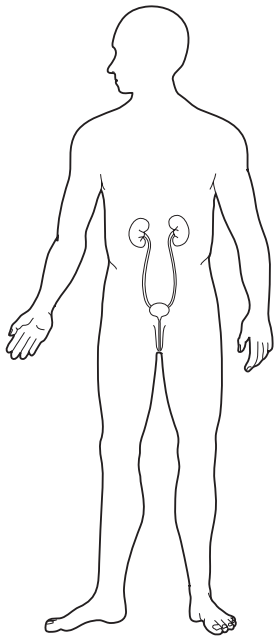
The term *urinary system*

Key term:

- **Urine** (yuŕ-uhn)—The waste material that is secreted by the kidneys

a. **Urinary** (yuŕ-uh-ner-e) **system**—All of the organs involved in the secretion and elimination of urine (see Figure 5)

Figure 5—Urinary system



Objective 10

Functions of the urinary system

a. Filters the blood by removing various toxins, metabolic waste products, and some water

b. Manufactures and excretes urine

c. Assists in regulation of water, electrolyte, and acid-base balance of the body

d. Influences blood pressure

Objective 11

Major organs and structures of the urinary system (see Figure 6)

a. **Kidney** (kid´-ne)—One of a pair of bean-shaped urinary organs in the dorsal part of the abdomen, one on each side of the vertebral column

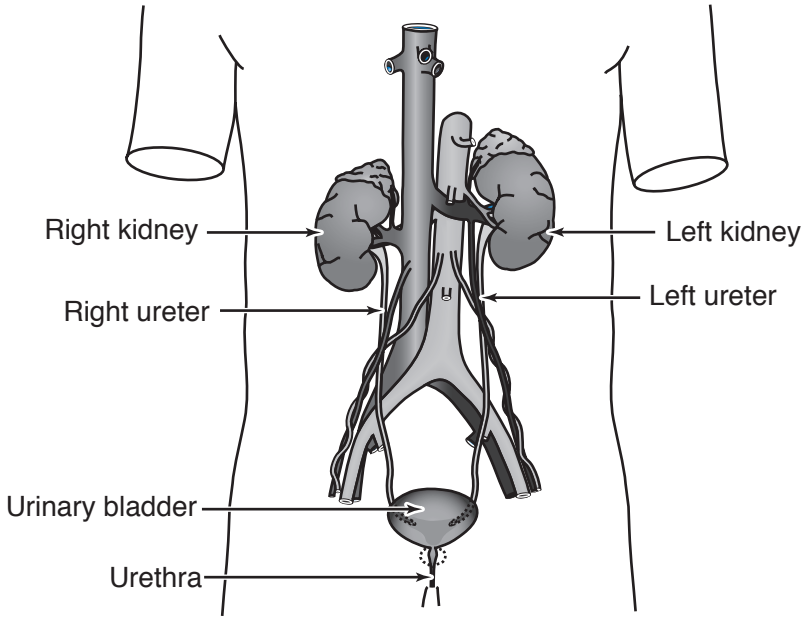
b. **Ureter** (yuŕ-uh-tuhr)—One of a pair of thick-walled tubes that carries urine from the kidney into the urinary bladder

c. **Urinary bladder**—The muscular membranous sac in the pelvis that stores urine for discharge through the urethra

d. **Urethra** (yu-ré-thruh)—The small, tubular structure that drains urine from the bladder

✔ **Note:** The structure of the urethra is different in the male and female. For simplicity, the drawing below shows the male structure of the urethra.

Figure 6—Major organs and structures of the urinary system



Glossary of Key Terms

Accessory glands—The glands of the digestive system that secrete the digestive enzymes that are used by the digestive system to break down food substances in preparation for absorption into the bloodstream before carrying the waste to the intestines for excretion

Acid—A substance that releases a hydrogen ion when dissolved

Alimentary tract—The digestive tube; the muscular tube that extends from the mouth to the anus
✔ **Note:** The alimentary tract is also called the digestive tract

Allergy—A condition of being highly sensitive to foreign substances that enter the body often because the person's immune system does not respond to the antigen of the substance

Alopecia—Baldness

Anatomy—The scientific study of the structure of an organism that describes the size, shape, construction, and relative positions of the organs in the body

Antibiotic—A special medication that slows or stops the growth of certain microorganisms

Antiseptic—A chemical used to destroy or reduce the growth of pathogens on a person

Apex—The lower border of the heart

Aponeurosis—A structure in which the epimysium extends from the muscle as a strong, tough cord of connective tissue that is continuous with the periosteum of the bone; a strong sheet of fibrous connective tissue that serves as a tendon to attach muscles to bone or as fascia to bind muscles together

Areola—A small space or a cavity within a tissue

Areolar tissue—A kind of connective tissue having little tensile strength and consisting of loosely woven fibers and areolae

Arrector pili muscle—Bundles of involuntary muscle fiber that contract against the follicle when the skin is cold or during certain emotional states, causing the hair shaft to stand upright

Asymptomatic—Being without symptoms

Atlas—The first vertebra of the neck

Glossary

Atom—The smallest division of an element that exhibits all the properties and characteristics of the element

Atomic number—The number of protons, or positive charges, in the nucleus of an atom of a particular element

Autonomic—Acting or occurring involuntarily

Auxiliary appendage—A formation of specialized cells within the skin that performs a particular function

Axillary—Pertaining to the armpit

Basale—The Latin term for "base layer"

Base—A substance that releases a hydroxide ion when dissolved; the upper border of the heart

Bile—The bitter, yellow-green secretion of the liver that is stored in the gallbladder

Biochemistry—The study of chemistry as it relates to life

Blood—The liquid pumped by the heart through the arteries, veins, and capillaries, carrying nourishment and oxygen to and bringing away waste products from all parts of the body

Blood pressure—The pressure exerted by the circulating volume of blood on the walls of the arteries, the veins, and the chambers of the heart

Bond—The mechanism by which atoms link to one another to form molecules involving the loss of, gaining of, or sharing of electrons in the outer shell

Brachial—Pertaining to the arm

Brain—The portion of the central nervous system contained within the cranium and containing specialized cells that coordinate and regulate the functions of the central nervous system

Brainstem—The part of the brain composed of the mesencephalon, pons, and medulla oblongata and connecting the spinal cord with the forebrain and cerebrum

Cardiac—Striated, involuntary muscle tissue that composes the walls of the heart; of or pertaining to the heart

Cardiovascular system—The network of anatomical structures, including the heart and the blood vessels, that pump blood throughout the body

Carpals—The wrist bones

Carrier—An organism capable of spreading disease

Catalyst—A substance that affects the rate of change in a chemical reaction without being changed chemically

Cellular respiration—The process of oxygen carried by the blood passing into the cells and being used by the cells, which leads to the production of carbon dioxide that is then carried away by the blood
✔ **Note:** Cellular respiration is also called *internal respiration*.

Centrifuge—A device that is used to separate the components of a solution or liquid mixture by spinning the substance

Cerumen—Earwax, a secretion of the ceruminous glands in the ear canal

Chemical reaction—A process in which one or more chemicals that are exposed to other chemicals or sources of energy such as heat change their chemical composition to produce other chemicals and often other forms of energy

Circulatory system—The network of channels through which the nutrient fluids of the body circulate

Clavicle—The collarbone

Clotting—The process of blood becoming solid

Colitis—An inflammatory condition of the large intestine characterized by severe diarrhea, bleeding, and ulceration of the mucosa of the intestine

Compound—A substance that consists of atoms of two or more different elements bonded together as molecules; to separate its components into other compounds and elements requires a chemical reaction

Concentration—The ratio of the components of a solution or mixture

Conjunctiva—The mucous membrane that lines the inner surface of the eyelids and continues over the forepart of the eyeball

Contagious—Communicable, such as a disease that may be transmitted by direct or indirect contact

Cornea—The transparent part of the coat of the eyeball that covers the iris and pupil and admits light to the interior

Corneum—The Latin term for "horn"

Cranial bones—The bones of the skull, particularly the bones that enclose the brain

Cranium—The bony part of the skull that holds the brain

Cuticle—The thin edge of cornified epithelium at the base of a nail

Cyst—A capsule that forms around microorganisms before they enter dormant periods

Digestive system—The organs, structures, and accessory glands of the digestive tube of the body through which food passes

Disease—A specific illness or disorder characterized by a recognizable set of signs and symptoms and attributable to heredity, infection, diet, or environment

Disinfectant—A chemical used to destroy or reduce the growth of pathogens on objects

Electron—A negatively charged elementary particle of an atom

Element—One of more than 100 primary, simple substances that cannot be broken down by chemical means into any other substance

Energy—The capacity to do work
✔ **Note:** The definition presented here is the classic scientific definition of the term energy. Work can be understood as a force that can bring about change in matter or other types of energy.

Epimysium—A fibrous sheath that enfolds a skeletal muscle and extends over the origin and insertion and between bundles of muscle fibers

Epithelium—The covering of the internal organs of the body, also the lining of the vessels, body cavities, glands, and organs

Exoskeleton—A characteristic of some organisms in which the outer tissue of parts of the body are hardened to the point that they support attached softer tissues

Follicle—A tube that extends from the dermis through the epidermis and to the surface of the skin

Gas—A state of matter in which the substance will take on the shape of any container in which it is placed and will expand to fill the container

Germinativum—The Latin term for "germination"
✔ **Note:** Germination is the process of seeds developing and growing. The term *germinativum* is a reference to the fact that cells are continually developing in this layer to provide cells for the outer layers of the epidermis.

Gland—Any of the various structures within the body that produce specific chemicals to help with the functions of the body

Gray matter—Nerve tissue that consists of motor neurons and interneurons

Heparin—A chemical that prevents blood from clotting

Homeostasis—The state of the body in which conditions remain relatively stable despite changes in the environment

Hormone—A substance containing amino acid that originates in an organ or gland, moves through the blood to another part of the body, and stimulates activity in that region by chemical reaction

Host—The organism that provides the resources required to sustain a parasitic relationship; an organism that serves as a permanent or temporary home for another organism

Hydroxyl—An ion consisting of one hydrogen atom and one oxygen atom

Hyperextend—To extend to its fullest range of motion or beyond

Ilium—The flat portion of the hip

Illness—The period of time during which a host exhibits symptoms of a disease

Immunity—The state of being protected from the effects of a pathogen, generally due to having received a vaccination or because of the body's production of antibodies from a previous exposure to the organism

Immunology—The study of the ways in which the body resists infection

Infection—An invasion of a body by organism and the reaction of the body to the presence of those organisms and to the toxins they produce

Integument—The structures that cover the exposed surfaces of the body

Interstitial—Situated within but not restricted to or characteristic of a particular organ or tissue

Invertebrate—An organism that does not have an internal skeleton and, specifically, a spinal column

Involuntary—Muscles that work automatically, functioning without the conscious control of the organism

Ion—An atom or group of atoms with either a positive or a negative electrical charge

Keratin—A fibrous, sulfur-containing protein that is the primary component of the epidermis, hair, nails, and enamel of the teeth

Lacrimal—Of or pertaining to tears

Larynx—The organ of voice that is part of the air passage

Lesion—A separation in tissue

Leukocyte—Another term for white blood cell

Liquid—A state of matter in which the substance will take on the shape of a container but will not expand to fill a container with greater volume than the substance

Lubricate—To improve the ease of movement between two objects by applying a substance that reduces friction

Lucidum—The Latin term for "clear"

Lunula—The Latin term meaning “little moon”; the crescent-shaped white area at the base of a nail

Lymph—The pale fluid that bathes the tissues, passes into lymphatic vessels and ducts, and is discharged into the blood

Lymphatic—The vast, complex network of capillaries, thin vessels, valves, ducts, nodes, and organs that helps to protect and maintain the internal fluid environment of the entire body by producing, filtering, and conveying lymph and by producing various blood cells

Lymphocyte—One of two types of white blood cells—a T cell or a B cell—that performs various functions related to recognizing, marking, and remembering pathogens based on their antigens

Mandible—The lower jawbone

Mastoid process—The process of the temporal bone behind the ear

Matter—That portion of the universe that has shape and substance

Mediastinum—A portion of the thoracic cavity in the middle of the thorax, between the pleural sacs containing the two lungs

Medulla oblongata—One of the three parts of the brainstem that contains the cardiac, vasomotor, and the respiratory centers of the brain

Melanin—A protein that absorbs ultraviolet light to give coloration to body structures; also referred to as a *pigment*

Meninx—Any one of the three membranes that envelop the brain and the spinal cord

Metabolism—The processes that lead to chemical reaction in the body

Microbiology—The study of extremely small life

Mixture—A substance that consists of two or more combined components that do not interact chemically; to separate its components requires either a mechanical method or the application of energy

Molecule—A structure consisting of two or more atoms

Monocyte—A type of white blood cell that enlarges to form a macrophage in order to perform more-rapid phagocytosis

Motor organ—An organ with the primary function of moving materials within the body parts of the body itself

Muscular system—All of the muscles of the body considered as an interrelated structural group

Nail—A horny, translucent cover protecting the tip of each finger and toe and the underlying tissue associated within

Nerve tissue—Tissue consisting of one or more bundles of impulse-carrying fibers that connect the brain and the spinal cord with other parts of the body

Nervous system—The extensive intricate network of structures that activates, coordinates, and controls all of the functions of the body

Neutron—An elementary particle that is a fundamental component of the nucleus of atoms; it has no electric charge

Nucleus—The structure in the center of an atom consisting of protons and neutrons and about which electrons orbit

Occiput—The back of the head

Onychosis—Technical term applied to any deformity or disease of the nail

Orbit—One of a pair of bony, conical cavities in the skull that accommodate the eyeballs and associated structures

Organ—A structure consisting of two or more tissues that performs a specific function for the body

Organic—Related to those chemicals that contain carbon and are commonly found as the building blocks of living things

Organic compound—A compound that contains carbon and hydrogen

Organism—A living person, animal, or plant

Pancreas—A large gland that secretes digestive enzymes and the hormones insulin and glucagon

Papilla—A protrusion that extends into the epidermal area

Patella—The kneecap

Pathogen—An organism that is capable of producing disease in another organism

Periosteum—A fibrous, vascular membrane covering the bones, except at their extremities

Permeability—The characteristic of a material to allow other substances to pass through it

Physiology—The scientific study of the functions of an organism that describes how the organs work independently and in relation to the whole organism

Plasma—The fluid part of blood and lymph

Pons—A broad mass of nerve fibers conspicuous on the ventral surface of the brainstem

Proton—A positively charged particle that is a fundamental component of the nucleus of atoms

Protoplasm—The complex mass of proteins and other organic and inorganic materials that is capable of exhibiting the characteristics of life

Pulmonary ventilation—The process of inhaling and exhaling air through the lungs; breathing
✔ **Note:** Pulmonary ventilation is also called *external respiration*.

Pulse point—Any one of the sites on the surface of the body where arterial pulsations can be easily felt

Pus—An accumulation of white blood cells, pathogens, dead or damaged cells, and other substances associated with an infection

Radial—Pertaining to the radius, the bone of the forearm

Respiration—The physical and chemical processes by which an organism supplies its cells and tissues with oxygen and removes carbon dioxide

Respiratory system—The complex of organs and structures that performs the pulmonary ventilation of the body and cellular respiration

Rib—Any of the paired, curved, bony, or partly cartilaginous rods that stiffen the walls of the body

Saccular—Resembling a sac

Salt—A class of chemicals that have a positive ion other than hydrogen and a negative ion that is not a hydroxyl

Scapula—A shoulder blade

Sebaceous gland—The gland that is connected to the dermal shaft that surrounds the root of a hair

Sebum—The oily secretion of the sebaceous glands of the skin; composed of keratin, fat, and cellular debris

Semilunar—Half-moon shaped

Sensitive—Containing nerve endings and, therefore, can feel sensation

Sensory organ—An organ with the primary purpose of monitoring conditions in the environment and within the body in order to provide the brain with information that may require a response

✔ **Note:** Sensory organs include the eyes, ears, taste buds, nerve endings in the skin that sense touch and other conditions, and receptors in the nasal passages that detect odors.

Sesamoid—Any one of numerous small, round, bony masses embedded in certain tendons that may be subjected to compression and tension

Sheath—A covering, especially a loose-fitting one

Shell—The set of electron orbits in an atom that have the same energy level

Skeletal—Striated, voluntary muscle tissue attached to bones

Skeletal system—All of the bones and cartilage of the body that collectively provide the supporting framework for the muscles and organs

Solid—A state of matter in which the substance has a definite shape that is maintained unless acted upon by a force that is capable of changing that shape

Solution—A substance that consists of one or more components dissolved in a liquid; to separate its components, the energy of the substance must change so that the energy balance between the components prevents the liquid from being able to hold the dissolved material

Somatic—Of, relating to, or affecting the body

Spinal canal—The row of aligned holes in the vertebrae through which the spinal cord passes

Spinal cord—The cord of nerve tissue that extends from the brain lengthwise along the back in the spinal canal and gives off pairs of spinal nerves, carries impulses to and from the brain, and serves as a center for initiating and coordinating reflex acts

Spore—The dormant form of a bacterium or the reproductive form of a fungus

Sputum—Substance expelled from the respiratory tract that may contain mucus, pus, cellular materials, blood, and other materials

Sterilize—To destroy all of the pathogens on an object or in a substance

Sternum—The breastbone

Stimulus—A change in an organism's external environment or internal conditions that cause a response in one or more of the organism's systems

Stratum—The Latin term for "layer"

Striated—Lined with grooves

Structure—A part of the body, such as the heart, a bone, a gland, a cell, or a limb

Subcutaneous—Beneath the skin

Susceptibility—The degree to which a person is likely to contract a disease

Sweat gland—A small structure located in the deep layers of the dermis with a duct that exits through a pore in the epidermis; the gland consists of a coiled tube surrounded by capillaries

Symptom—A condition that occurs in association with a disease and that can be evidence of the presence of the disease

System—A group of organs and related structures that work together to perform a common function

✔ **Note:** The functioning of the body is supported by a number of systems that perform specific purposes. Each system consists of one or more organs and additional structures that connect these organs and tie them to other systems.

Tarsals—The ankle bones that form the heel and the proximal or posterior half of the foot

Tendon—A structure in which the epimysium extends from the muscle as a broad, flat sheet of connective tissue that attaches to an adjacent structure; one of many white, glistening fibrous bands of tissue that attach muscle to bone

Thalamus—One of a pair of large oval organs in the brain

Tissue—A collection of cells that share a similar structure and are organized to perform a specific function

Toxin—A substance that is harmful to cells

Ulnar—Pertaining to the ulna, the bone on the little-finger side of the forearm

Unicellular—Consisting of one cell

Urinary system—All of the organs involved in the secretion and elimination of urine

Urine—The waste material that is secreted by the kidneys

Vaccination—The administration of a medication that increases the body's resistance to a specific pathogen

Vaccine—A suspension of diluted or killed microorganisms administered by injection or ingestion in order to stimulate the production of antibodies to promote an active immunity to that pathogen

Vascular—Containing blood or lymph vessels; of or pertaining to the blood vessels

Vascular system—The portion of the cardiovascular system that deals with the blood vessels that allow for the circulation of blood throughout the body

Vectors of disease—The conditions that tend to promote the spread of a disease, such as when the bite of an arthropod allows pathogens to enter a person's bloodstream

Vertebra—One of the bony or cartilaginous segments composing the spinal column

Viscera—The internal organs in the abdominal cavity

Visceral—Smooth, involuntary muscle tissue that lines the walls of hollow organs

Vital organ—An organ that must function properly in order for the life of the organism to continue

Voluntary—Muscles that are consciously controlled by the will of a person