



GENERAL ANATOMY & PHYSIOLOGY

LEARNING OBJECTIVES

After completing this chapter, you will be able to:

LO1

Define and explain the importance of anatomy and physiology to the cosmetology profession.

LO2

Describe cells, their structure, and their reproduction.

LO3

Define tissue and identify the four types of tissues found in the body.

LO4

Name the 11 main body systems and explain their basic functions.

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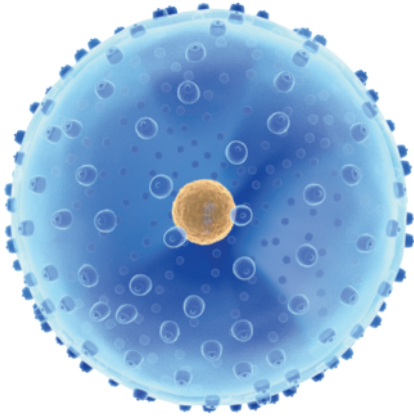
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Cosmetologists are licensed to touch and perform services on clients in ways that are not permitted in many other occupations. This is a very important responsibility and, as a cosmetologist, you should consider it an honor to be able to aid others in achieving a greater sense of well-being. How can you do this? You can begin by having a solid understanding of the anatomy and physiology of the human body.

why study ANATOMY AND PHYSIOLOGY?

Cosmetologists should study and have a thorough understanding of anatomy and physiology because:

- > Understanding how the human body functions as an integrated whole is a key component to understanding how a client's hair, skin, and nails may react to various treatments and services.
- > You will need to be able to recognize the difference between what is considered normal and what is considered abnormal for the body in order to determine whether specific treatments and services are appropriate and what should be referred to a physician.
- > Understanding the bone and muscle structure of the human body will help you use the proper application of services and products for scalp manipulations and facials.

After reading the next few sections, you will be able to:

LO 1 Define and explain the importance of anatomy and physiology to the cosmetology profession.

Why Anatomy and Physiology Are Important to You

While you should have an overall knowledge of human anatomy, cosmetology is primarily limited to the skin, muscles, nerves, circulatory system, and bones of the head, face, neck, shoulders, arms, hands, lower legs, and feet. Understanding the anatomy of these areas will help you develop techniques that can be used during scalp massage, facials, manicures, pedicures, and as part of a ritual at the shampoo station. In addition, knowing the bones of the skull and facial structure is important

to designing flattering hairstyles that gracefully drape the head and for skillfully applying cosmetics. This chapter will provide you with the definitions and “map” of the human body as a point of reference to be used when you discuss specific services later in the text.

Anatomy (ah-NAT-ah-mee) is the study of the human body structures that can be seen with the naked eye and how the body parts are organized; it is the science of the structure of organisms or of their parts.

Physiology (fiz-ih-OL-oh-jee) is the study of the functions and activities performed by the body’s structures. The ending **-ology** (AHL-O-jee) means *study of*.

After reading the next few sections, you will be able to:

LO2 Describe cells, their structure, and their reproduction.

Describe Cells

Cells are the basic units of all living things—from bacteria to plants to animals, including human beings. Without cells, life does not exist. As a basic functional unit, the cell is responsible for carrying on all life processes.

Basic Structure of the Cell

The cells of all living things are composed of a substance called **protoplasm** (PROH-toh-plaz-um), a colorless jelly-like substance found inside cells in which food elements such as proteins, fats, carbohydrates, mineral salts, and water are present. You can visualize the protoplasm of a cell as being similar to raw egg white. In addition to protoplasm, most cells also include a nucleus, cytoplasm, and the cell membrane (figure 6-1).

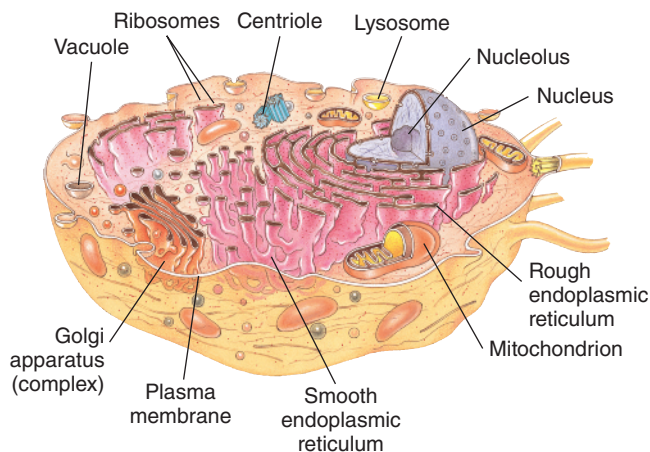
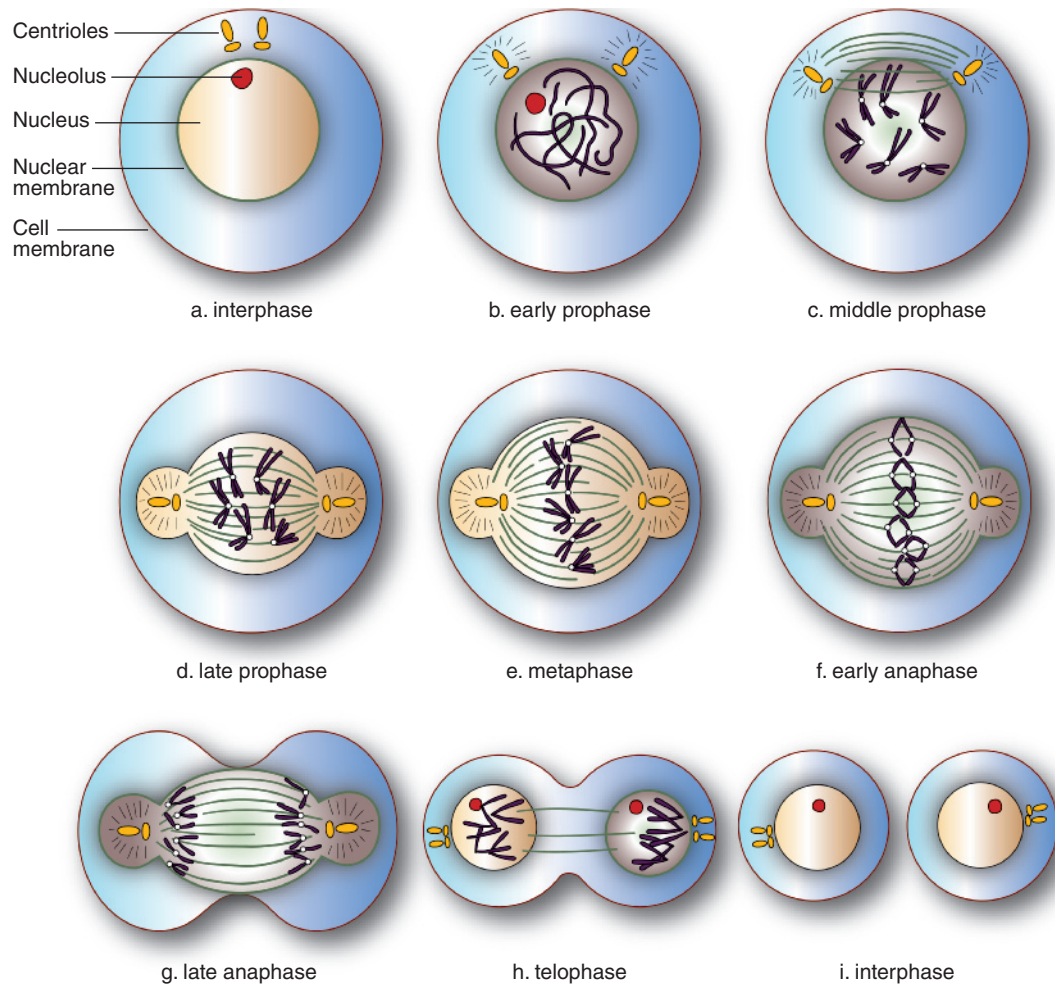


figure 6-1
Basic structure of the cell

figure 6-2
Phases of mitosis



The **nucleus** (NOO-klee-us) is the dense, active protoplasm found in the center of the cell; it plays an important part in cell reproduction and metabolism. You can visualize the nucleus as the yolk in the middle of a raw egg.

The **cytoplasm** (sy-toh-PLAZ-um) is the watery fluid that surrounds the nucleus of the cell and is needed for growth, reproduction, and self-repair. It is the protoplasm of the cell.

The **cell membrane** (SELL MEM-brayn) is the cell part that encloses the protoplasm and permits soluble substances to enter and leave the cell.

Cell Reproduction and Division

Cells have the ability to reproduce, thus providing new cells for the growth and replacement of worn or injured ones. **Mitosis** (my-TOH-sis) is the usual process of cell reproduction of human tissues that occurs when the cell divides into two identical cells called daughter cells (**figure 6-2**). As long as conditions are favorable, the cell will grow and reproduce. Favorable conditions include an adequate supply of food, oxygen, and water; suitable temperatures; and the ability to eliminate waste products.

After reading the next few sections, you will be able to:

- LO 3** Define tissue and identify the four types of tissues found in the body.

Define Tissues

Tissue (TISH-oo) is a collection of similar cells that perform a particular function. Each kind of tissue has a specific function and can be recognized by its characteristic appearance. Body tissues are composed of large amounts of water, along with various other substances. There are four types of tissue in the body:

- **Connective tissue** is fibrous tissue that binds together, protects, and supports the various parts of the body. Examples of connective tissue are bone, cartilage, ligaments, tendons, blood, lymph, and **adipose tissue** (ADD-ih-pohz TISH-oo), a technical term for fat. Adipose tissue gives smoothness and contour to the body while protecting internal organs and insulating the body.
- **Epithelial tissue** (ep-ih-THÉE-lee-ul TISH-oo) is a protective covering on body surfaces, such as skin, mucous membranes, the tissue inside the mouth, the lining of the heart, digestive and respiratory organs, and the glands.
- **Muscle tissue** contracts and moves various parts of the body.
- **Nerve tissue** (NURV TISH-oo) carries messages to and from the brain and controls and coordinates all bodily functions. Nerve tissue is composed of special cells known as neurons that make up the nerves, brain, and spinal cord.

After reading the next few sections, you will be able to:

- LO 4** Name the 11 main body systems and explain their basic functions.

Name the Organs and Body Systems

Organs are structures composed of specialized tissues designed to perform specific functions in plants and animals. During development of a fetus, tissues are “assigned” to specific functions in the body and they develop specifically for those functions. For example, lung tissue would not work as a part of the brain as it is designed to serve a specific function in the lungs. **Body systems** are groups of body organs acting together to perform one or more functions (figure 6-3). Table 6-1 outlines

figure 6-3
Life is built from the atom up.

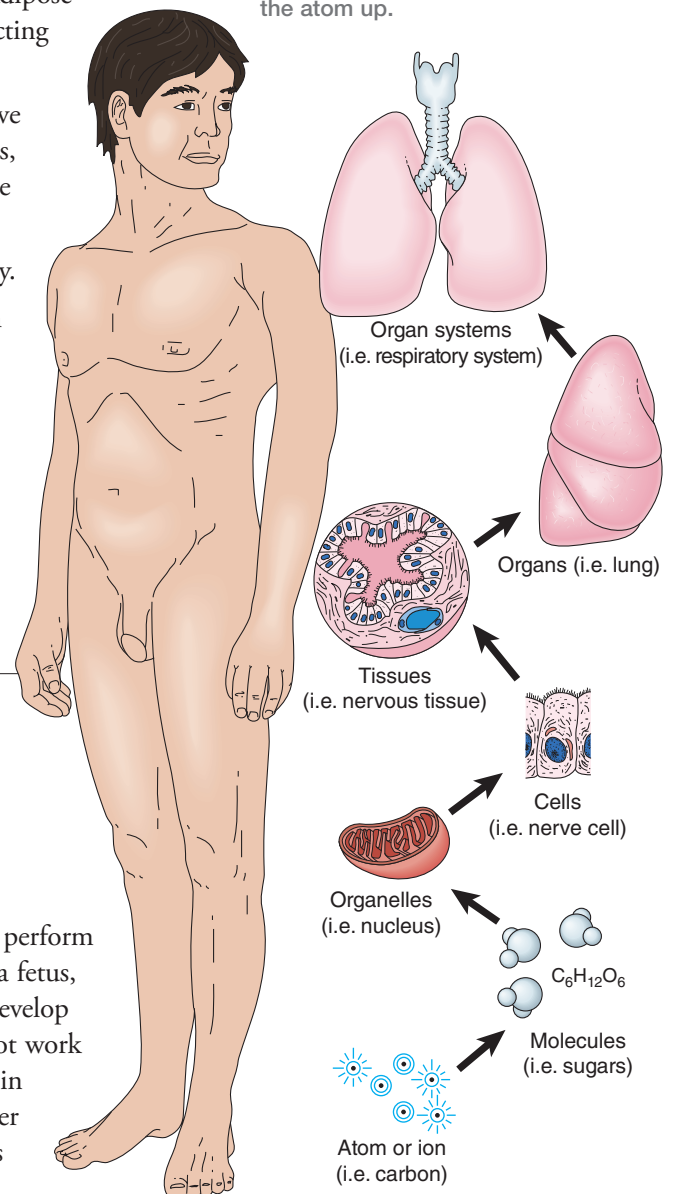


table 6-1

THE ELEVEN BODY SYSTEMS, THEIR FUNCTIONS, AND MAJOR ORGANS

Body Systems	Function	Major Organs
Circulatory	Controls movement of blood throughout the body	Heart, blood vessels
Digestive (gastrointestinal)	Breaks down food into nutrients or waste for nutrition or excretion	Stomach, intestines, salivary and gastric glands
Endocrine	Controls hormone levels within the body that determine growth, development, sexual function, and health of entire body	Endocrine glands, hormones
Excretory	Eliminates waste from the body reducing build up of toxins	Kidneys, liver, skin, large intestines, lungs
Integumentary	Provides protective covering and regulates body temperature	Skin, oil/sweat glands, hair, nails
Immune (lymphatic)	Protects the body from disease by developing immunities and destroying pathogens and toxins	Lymph, lymph nodes, thymus gland, spleen
Muscular	Covers, shapes and hold the skeletal in place. Muscles contract to allow for movement of body structures.	Muscles, connective tissues
Nervous	Coordinates all other body systems allowing them to work efficiently and react to the environment	Brain, spinal cord, nerves, eyes
Reproductive	Produces offspring and allows for transfer of genetic material. Differentiates between the sexes	Female: ovaries, uterus, vagina Male: testes, prostate, penis
Respiratory	Makes blood and oxygen available to body structures through respiration; eliminates carbon dioxide	Lungs, air passages
Skeletal	Forms the physical foundation of the body: 206 bones that are connected by moveable and immovable joints	Bones, joints

the body systems, indicating the functions of each system and the major organs that are associated with that system.

As a summary, understand that the basic structure and function is the *cell*. Cells are organized into layers or groups called *tissues*. Groups of tissues form complex structures that perform certain functions called *organs*. Organs are arranged in *body systems*. Body systems are arranged to form an *organism*, for example the human body.

Review the Skeletal System

The **skeletal system** forms the physical foundation of the body and is composed of 206 bones that vary in size and shape and are connected by movable and immovable joints.

Except for the tissue that forms the major part of the teeth, bone is the hardest tissue in the body. It is composed of connective tissue consisting of about one-third organic matter, such as cells and blood; and two-thirds minerals, mainly calcium carbonate and calcium phosphate.

The primary functions of the skeletal system are to:

- Give shape and support to the body.
- Protect various internal structures and organs.
- Serve as attachments for muscles and act as levers to produce body movement.
- Help produce both white and red blood cells (one of the functions of bone marrow).
- Store most of the body's calcium supply, as well as phosphorus, magnesium, and sodium.

A **joint** (JOYNT) is the connection between two or more bones of the skeleton. There are two types of joints: movable, such as elbows, knees, and hips; and immovable, such as the joints found in the pelvis and skull, which allow little or no movement. There are exceptions to this such as childbirth, where special hormones allow for flexibility of the pelvic joints.

Bones of the Skull

The **skull** is the skeleton of the head and is divided into two parts:

- **Cranium** (KRAY-nee-um). An oval, bony case that protects the brain.
- **Facial skeleton**. The framework of the face that is composed of 14 bones (figure 6-4).

Bones of the Cranium

The following are the cranium's eight bones:

- **Occipital bone** (ahk-SIP-ih-tul BOHN). Hindmost bone of the skull, below the parietal bones; forms the back of the skull above the nape.
- **Parietal bones** (puh-RY-uh-tul BOHNS). Bones that form the sides and top of the cranium. There are two parietal bones.
- **Frontal bone** (FRUNT-ul BOHN). Bone that forms the forehead.
- **Temporal bones** (TEM-puh-rul BOHNS). Bones that form the sides of the head in the ear region. There are two temporal bones.

? **DID YOU KNOW?**
People often complain of joint pain; however, the pain is usually caused by inflammation of the tissue surrounding the joint and not by the joint itself. You have over 230 moveable and semi-moveable joints in your body.

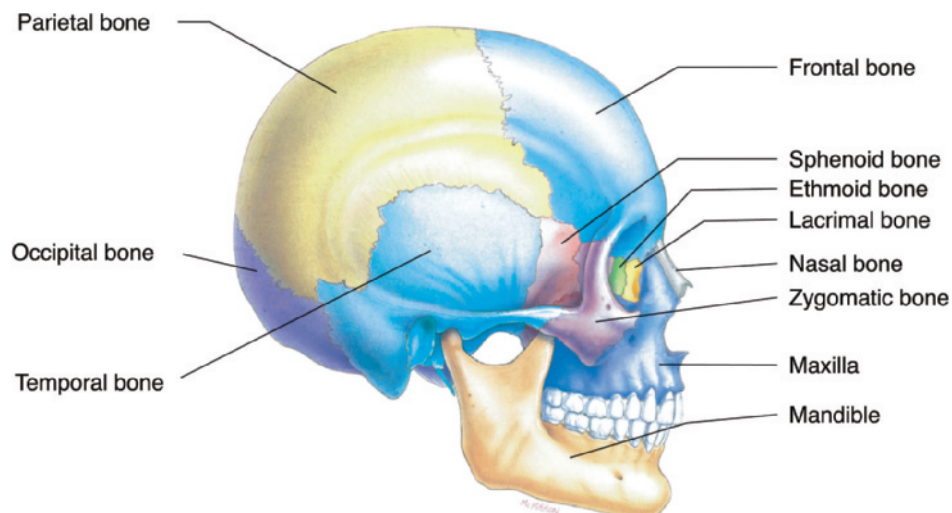


figure 6-4
Bones of the cranium and the face

- **Ethmoid bone** (ETH-moyd BOHN). Light spongy bone between the eye sockets; forms part of the nasal cavities.
- **Sphenoid bone** (SFEEN-oyd BOHN). Bone that joins all of the bones of the cranium together.

The ethmoid and sphenoid bones are not affected when performing services or giving a massage.

Bones of the Face

There are 14 bones of the face, but those listed below are most involved in the practice of cosmetology:

- **Nasal bones** (NAY-zul BOHNS). Bones that form the bridge of the nose. There are two nasal bones.
- **Lacrimal bones** (LAK-ruh-mul BOHNS). Small, thin bones located at the front inner wall of the orbits (eye sockets). There are two lacrimal bones.
- **Zygomatic bones** (zy-goh-MAT-ik BOHNS), also known as *malar bones* or *cheekbones*. Bones that form the prominence of the cheeks. There are two zygomatic bones.
- **Maxillae** (mak-SIL-ee) (singular: maxilla [mak-SIL-uh]). Bones of the upper jaw. There are two maxillae.
- **Mandible** (MAN-duh-bul). Lower jawbone; largest and strongest bone of the face.

DID YOU KNOW?

Painful inflammation involving the carpus area can be caused by repetitive motions, such as flexing your wrist excessively or locking it in a bent position. Keeping the wrist straight can help prevent these injuries.

Bones of the Neck

The main bones of the neck are the following:

- **Hyoid bone** (HY-oyd BOHN). U-shaped bone at the base of the tongue that supports the tongue and its muscles. It is the one and only bone of the throat.
- **Cervical vertebrae** (SUR-vih-kul VURT-uh-bray). The seven bones of the top part of the vertebral column, located in the neck region ([figure 6-5](#)).

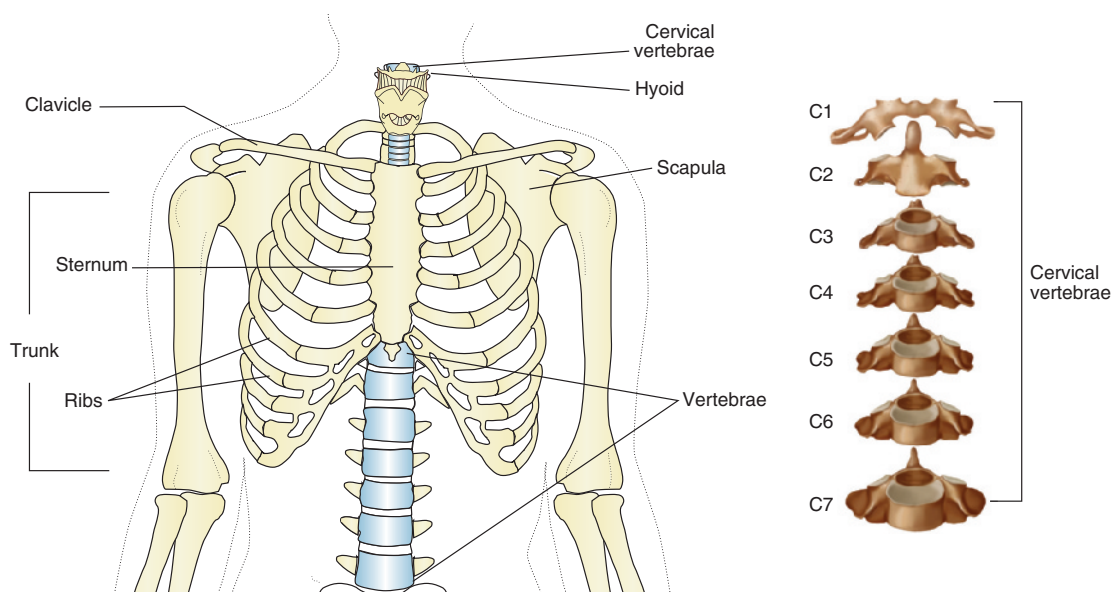


figure 6-5
Bones of the neck,
shoulders, and back

Bones of the Chest, Shoulder, and Back

The bones of the trunk, or torso, are the following:

- **Thorax** (THOR-aks), also known as *chest* or *pulmonary trunk* (PUL-muh-nayr-ee TRUNK). Consists of the sternum, ribs, and thoracic vertebrae. It is an elastic, bony cage that serves as a protective framework for the heart, lungs, and other internal organs.
- **Ribs**. Twelve pairs of bones forming the wall of the thorax.
- **Scapula** (SKAP-yuh-luh), also known as *shoulder blade*. Large, flat, triangular bone of the shoulder. There are two scapulae.
- **Sternum** (STUR-num), also known as *breastbone*. Flat bone that forms the ventral (front) support of the ribs.
- **Clavicle** (KLAV-ih-kul), also known as *collarbone*. Bone that joins the sternum and scapula.

Bones of the Arms and Hands

The important bones of the arms and hands that you should know include the following:

- **Humerus** (HYOO-muh-rus). Uppermost and largest bone in the arm, extending from the elbow to the shoulder.
- **Ulna** (UL-nuh). Inner and larger bone in the forearm (lower arm), attached to the wrist and located on the side of the little finger.
- **Radius** (RAY-dee-us). Smaller bone in the forearm (lower arm) on the same side as the thumb (figure 6-6).
- **Carpus** (KAR-pus), also known as *wrist*. Flexible joint composed of a group of eight small, irregular bones (carpals) held together by ligaments.
- **Metacarpus** (met-uh-KAR-pus). Bones of the palm of the hand; parts of the hand containing five bones between the carpus and phalanges.
- **Phalanges** (fuh-LAN-jeez) (singular: phalanx [FAY-langks]). Also known as *digits*. Bones of the fingers or toes (figure 6-7). There are three phalanges in each finger and two in the thumb.

Bones of the Leg, Ankle, and Foot

The four bones of the leg are the following:

- **Femur** (FEE-mur). Heavy, long bone that forms the leg above the knee.
- **Tibia** (TIB-ee-ah). Larger of the two bones that form the leg below the knee. The tibia may be visualized as a bump on the big-toe side of the ankle.
- **Fibula** (FIB-ya-lah). Smaller of the two bones that form the leg below the knee. The fibula may be visualized as a bump on the little-toe side of the ankle.
- **Patella** (pah-TEL-lah). Also known as *accessory bone* or *kneecap*. Forms the kneecap joint (figure 6-8).

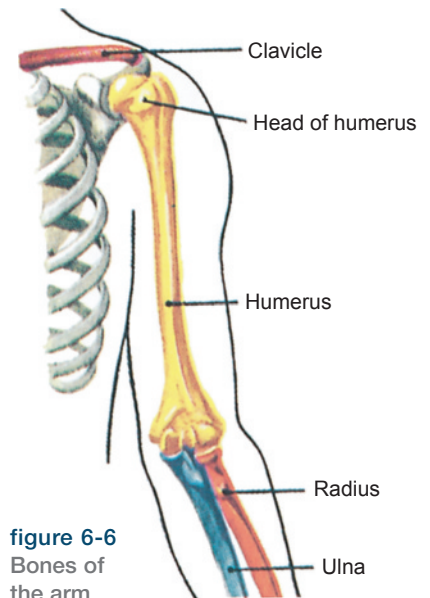


figure 6-6
Bones of
the arm

? **DID YOU KNOW?**
Fingernails provide protection for the delicate tips of the phalanges in the hand. If a phalanx is accidentally broken, the finger loses much of its fine dexterity, and it becomes more difficult to pick up very small objects such as sewing needles or coins.

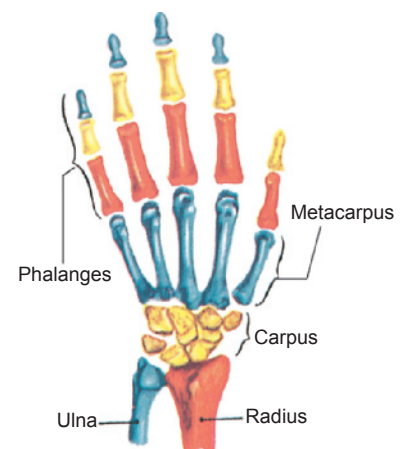
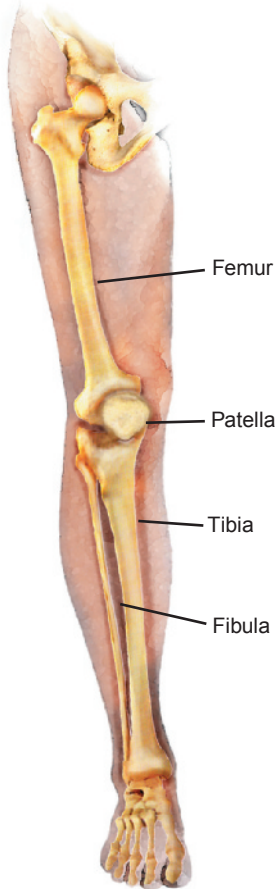


figure 6-7
Bones of the hand

figure 6-8
Bones of
the leg



The ankle joint is composed of three bones:

- Tibia. Bone that comes down from the lower leg bone.
- Fibula. Bone that comes down from the lower leg bone.
- **Talus** (TA-lus), also known as *ankle bone*. Third bone of the ankle joint.

The foot is made up of 26 bones. These can be subdivided into three general categories:

- **Tarsal** (TAHR-sul). There are seven tarsal bones—talus, calcaneus (heel), navicular, three cuneiform bones, and the cuboid.
- **Metatarsal** (met-ah-TAHR-sul). Long and slender bones, similar to the metacarpal bones of the hand. There are five metatarsal bones.
- Phalanges. Fourteen bones that compose the toes. Toe phalanges are similar to the finger phalanges. There are three phalanges in each toe, except for the big toe, which has only two (**figure 6-9**).

Review the Muscular System

The **muscular system** (MUS-kuyh-lur SIS-tum) is the body system that covers, shapes, and holds the skeletal system in place; the muscular system contracts and moves various parts of the body.

Cosmetologists must be concerned with the voluntary muscles that control movements of the arms, hands, lower legs, and feet. It is important to know where these muscles are located and what they control. These muscles can become fatigued from excessive work or injury, and your clients will benefit greatly from the massaging techniques you incorporate into your services.

Muscles are fibrous tissues that have the ability to stretch and contract according to demands of the body's movements.

A muscle has three parts (**figure 6-10**):

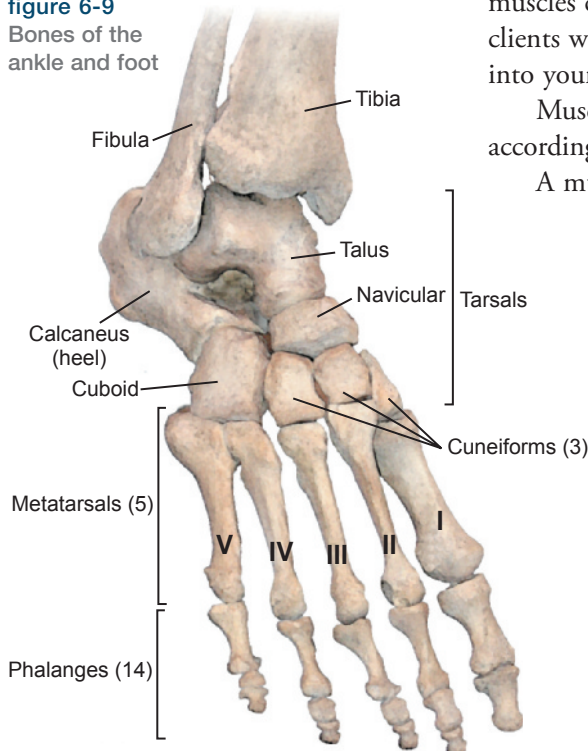
- **Origin**. The part of the muscle that does not move and is attached closest to the skeleton.
- **Belly**. The middle part of the muscle.
- **Insertion**. The part of the muscle that moves and is farthest from the skeleton.

Pressure in massage is usually directed from the insertion to the origin.

Muscular tissue can be stimulated by:

- Massage (hand, electric vibrator, or water jets).
- Electrical therapy current. (See Chapter 13, Basics of Electricity, for additional information on types of electrical therapy current.)
- Infrared light.

figure 6-9
Bones of the
ankle and foot



- Dry heat (heating lamps or heating caps).
- Moist heat (steamers or moderately warm steam towels).
- Nerve impulses (through the nervous system).
- Chemicals (certain acids and salts).

Muscles of the Scalp

The four muscles of the scalp are the following:

- **Epicranius** (ep-ih-KRAY-nee-us), also known as *occipitofrontalis* (ahk-SIP-ih-toh frun-TAY-lus). Broad muscle that covers the top of the skull and consists of the occipitalis and frontalis.
- **Occipitalis** (ahk-SIP-i-tahl-is). Back (posterior) portion of the epicranius; the muscle that draws the scalp backward.
- **Frontalis** (frun-TAY-lus). Front (anterior) portion of the epicranius; the muscle of the scalp that raises the eyebrows, draws the scalp forward, and causes wrinkles across the forehead.
- **Epicranial aponeurosis** (ep-ih-KRAY-nee-al ap-uh-noo-ROH-sus). Tendon that connects the occipitalis and frontalis muscles (**figure 6-11**).

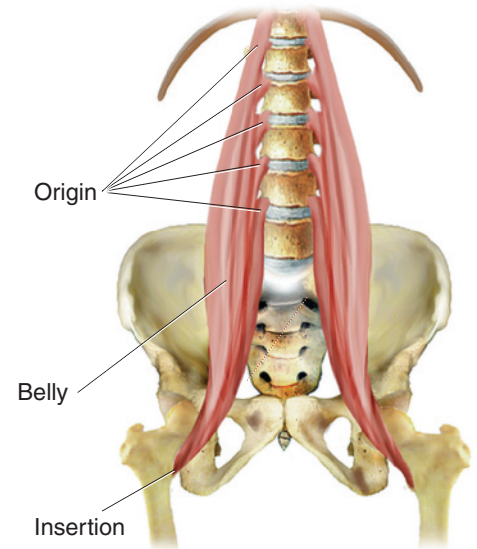


figure 6-10
Muscle origin and insertion

Muscles of the Neck

The muscles of the neck include the following:

- **Platysma muscle** (plah-TIZ-muh MUS-ul). Broad muscle extending from the chest and shoulder muscles to the side of the chin; responsible for lowering the lower jaw and lip.
- **Sternocleidomastoideus** (STUR-noh-KLEE-ih-doh-mas-TOYD-ee-us). Muscle of the neck that lowers and rotates the head.

? DID YOU KNOW?
About 40 to 50 percent of body weight is in muscles. And there are over 630 muscles that make your body move.

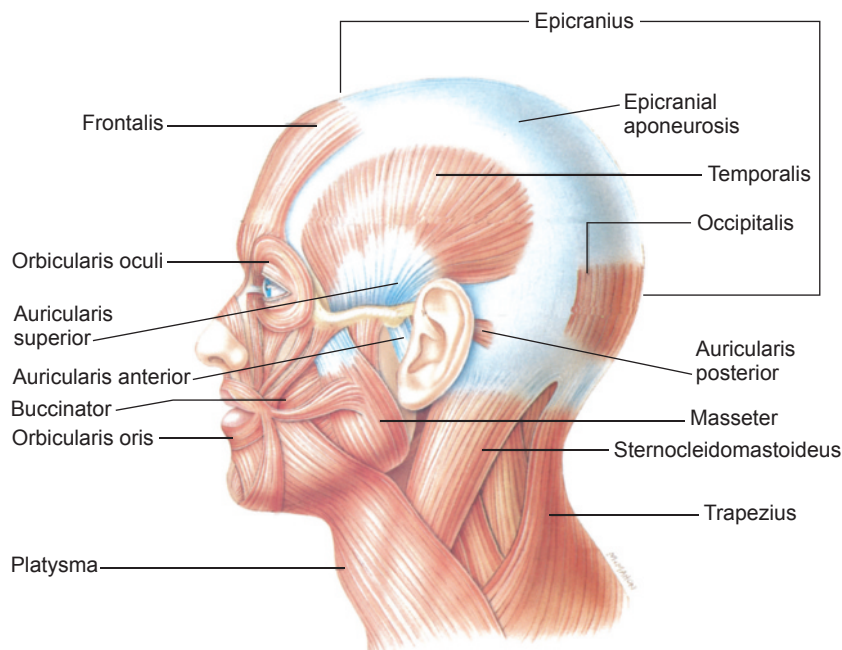


figure 6-11
Muscles of the head, face, and neck

Muscles of the Eye

The eye muscles include the following:

- **Orbicularis oculi muscle** (or-bik-yuh-LAIR-is AHK-yuh-lye MUS-ul). Ring muscle of the eye socket; enables you to close your eyes.
- **Corrugator muscle** (KOR-oo-gay-tohr MUS-ul). Muscle located beneath the frontalis and orbicularis oculi muscle that draws the eyebrow down and wrinkles the forehead vertically (**figure 6-12**).
- **Levator palpebrae superioris muscle** (lih-VAYT-ur [PAL-puh-bree] soo-peer-ee-OR-is MUS-ul). Thin muscle that controls the eyelid and can be easily damaged during makeup application.

Muscles of the Nose

The muscle of the nose that you should remember is the following:

- **Procerus muscle** (proh-SEE-rus MUS-ul). Covers the bridge of the nose, lowers the eyebrows, and causes wrinkles across the bridge of the nose.

There are other nasal muscles that contract and expand the openings of the nostrils, but they are not of major concern to cosmetologists.

Muscles of the Mouth

The important muscles of the mouth are the following:

- **Buccinator muscle** (BUK-sih-nay-tur MUS-ul). Thin, flat muscle of the cheek between the upper and lower jaw that compresses the cheeks and expels air between the lips.

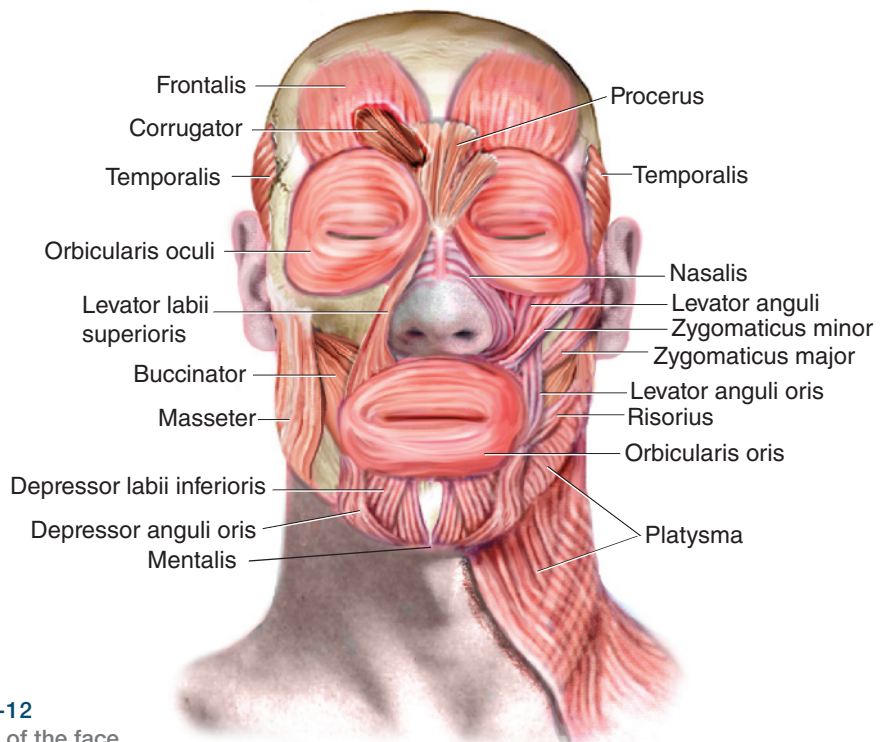


figure 6-12
Muscles of the face

- **Depressor labii inferioris muscle** (dee-PRES-ur LAY-bee-eye in-FEER-ee-or-us MUS-ul), also known as *quadratus labii inferioris muscle* (kwah-DRAY-tus LAY-bee-eye in-feer-ee-OR-is MUS-ul). Muscle surrounding the lower lip; lowers the lower lip and draws it to one side, as in expressing sarcasm.
- **Levator anguli oris muscle** (lih-VAYT-ur ANG-yoo-ly OH-ris MUS-ul), also known as *caninus muscle* (kay-NY-nus MUS-ul). Muscle that raises the angle of the mouth and draws it inward.
- **Levator labii superioris muscle** (lih-VAYT-ur LAY-bee-eye soo-peer-ee-OR-is MUS-ul), also known as *quadratus labii superioris muscle* (kwah-DRA-tus LAY-bee-eye soo-peer-ee-OR-is MUS-ul). Muscle surrounding the upper lip; elevates the upper lip and dilates the nostrils, as in expressing distaste.
- **Mentalis muscle** (men-TAY-lis MUS-ul). Muscle that elevates the lower lip and raises and wrinkles the skin of the chin.
- **Orbicularis oris muscle** (or-bik-yuh-LAIR-is OH-ris MUS-ul). Flat band of muscle around the upper and lower lips that compresses, contracts, puckers, and wrinkles the lips.
- **Risorius muscle** (rih-ZOR-ee-us MUS-ul). Muscle of the mouth that draws the corner of the mouth out and back, as in grinning.
- **Triangularis muscle** (try-ang-gyuh-LAY-rus MUS-ul). Muscle extending alongside the chin that pulls down the corners of the mouth.
- **Zygomaticus major muscles** (zy-goh-mat-ih-kus MAY-jor MUS-uls). Muscles on both sides of the face that extend from the zygomatic bone to the angle of the mouth. These muscles pull the mouth upward and backward, as when you are laughing or smiling.
- **Zygomaticus minor muscles** (zy-goh-mat-ih-kus MY-nor MUS-uls). Muscles on both sides of the face that extend from the zygomatic bone to the upper lips. These muscles pull the upper lip backward, upward, and outward, as when you are smiling (figures 6-11 and 6-12).

? **DID YOU KNOW?**
You have over 30 muscles in your face that control your expressions.

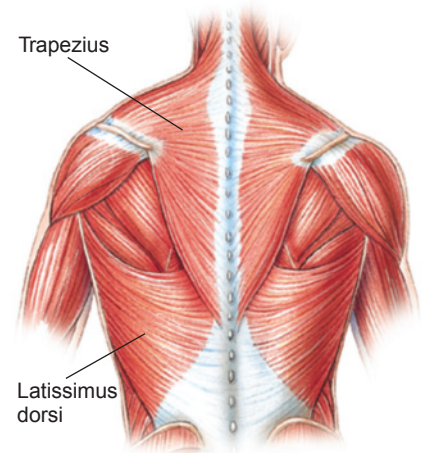


figure 6-13
Muscles of the back that attach the arms to the body

Muscles that Attach the Arms to the Body

The muscles that attach the arms to the body are the following:

- **Latissimus dorsi** (lah-TIS-ih-mus DOR-see). Large, flat, triangular muscle covering the lower back. It helps extend the arm away from the body and rotate the shoulder.
- **Pectoralis major** (pek-tor-AL-is MAY-jor) and **pectoralis minor** (pek-tor-AL-is MY-nur), located under the pectoralis major (not shown in figure 6-14). Muscles of the chest that assist the swinging movements of the arm.
- **Serratus anterior** (ser-RAT-us an-TEER-ee-or). Muscle of the chest that assists in breathing and in raising the arm.
- **Trapezius** (trah-PEE-zee-us). Muscle that covers the back of the neck and the upper and middle region of the back; rotates and controls swinging movements of the arm (figures 6-13 and 6-14).

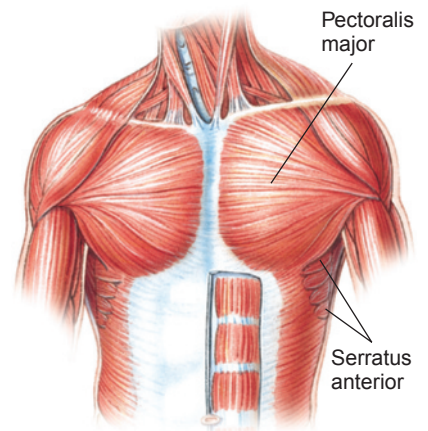


figure 6-14
Muscles of the chest that attach the arms to the body

Muscles of the Shoulder and Arm

There are three principal muscles of the shoulders and upper arms (figure 6-15):

- **Bicep** (BY-sep). Muscle that produces the contour of the front and inner side of the upper arm; lifts the forearm and flexes the elbow.
- **Deltoid** (DEL-toyd). Large, triangular muscle covering the shoulder joint that allows the arm to extend outward and to the side of the body.
- **Tricep** (TRY-sep). Large muscle that covers the entire back of the upper arm and extends the forearm.

The forearm is made up of a series of muscles and strong tendons (figure 6-15). As a cosmetologist, you will be concerned with the following muscles of the forearm:

- **Extensors** (ik-STEN-surs). Muscles that straighten the wrist, hand, and fingers to form a straight line.
- **Flexor** (FLEK-sur). Extensor muscle of the wrist involved in flexing the wrist.
- **Pronator** (proh-NAY-tohr). Muscle that turns the hand inward so that the palm faces downward.
- **Supinator** (SOO-puh-nayt-ur). Muscle of the forearm that rotates the radius outward and the palm upward.

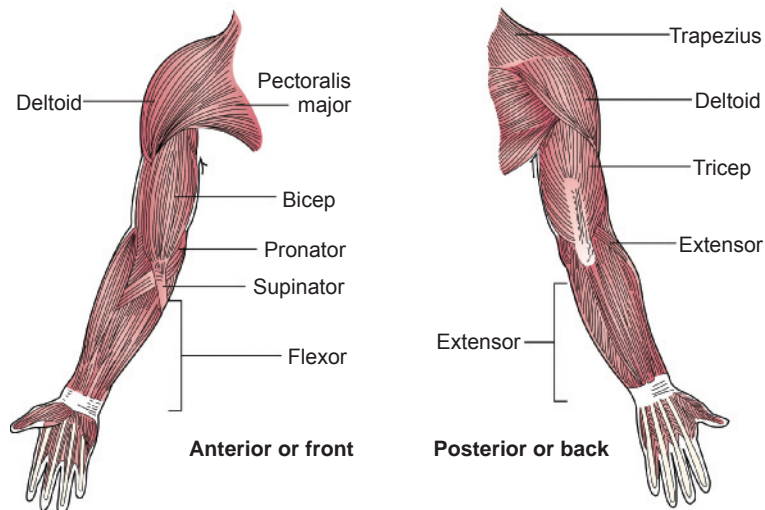


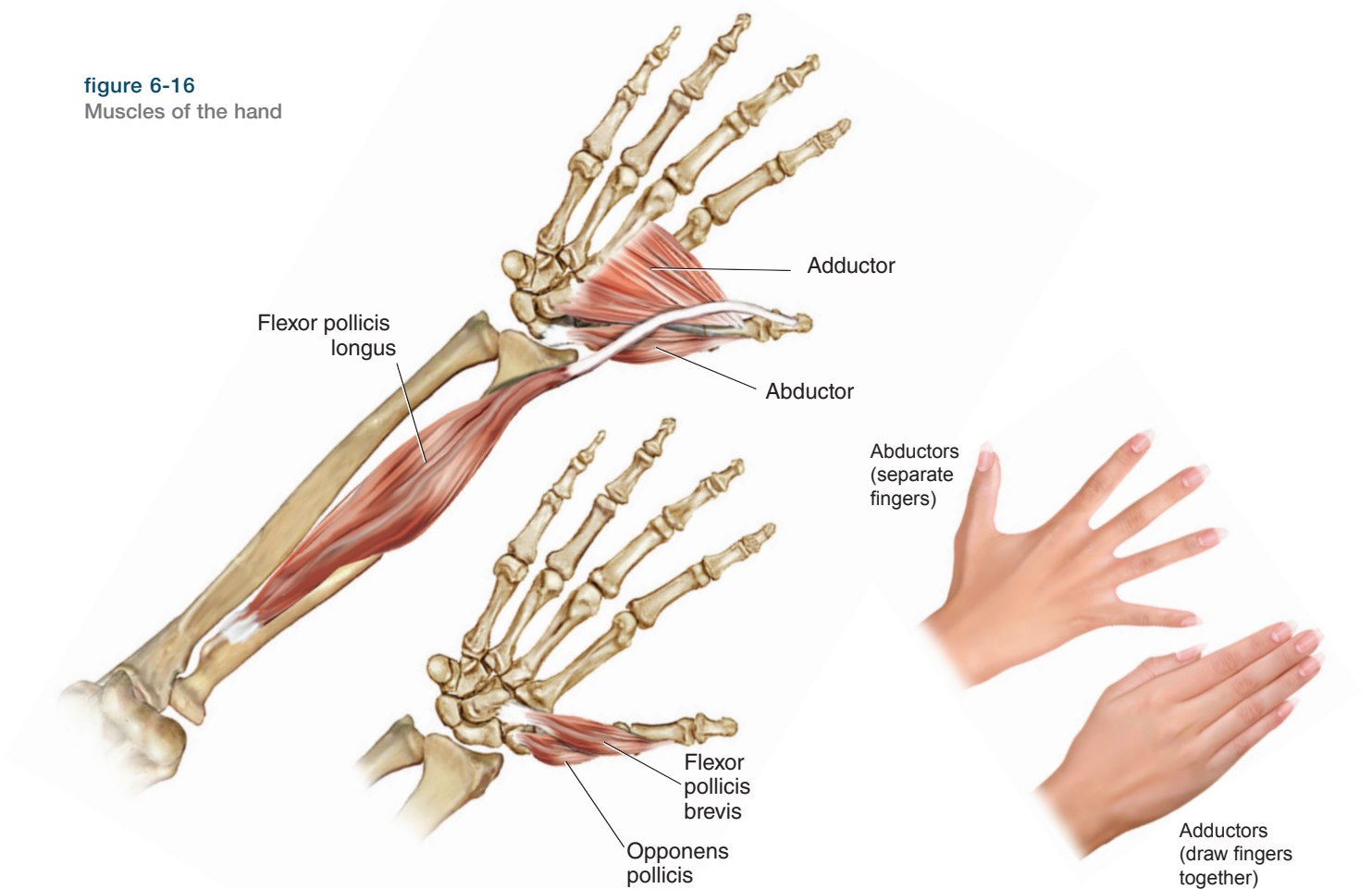
figure 6-15
Muscles of the anterior and posterior
shoulder and arm

Muscles of the Hand

The hand is one of the most complex parts of the body, with many small muscles that overlap from joint to joint and provide the flexibility and strength to open and close the hand and fingers. Important muscles to know include the following:

- **Abductors** (ab-DUK-turz). Muscles that draw a body part, such as a finger, arm, or toe, away from the midline of the body or of an extremity. In the hand, abductors separate the fingers.
- **Adductors** (ah-DUK-turz). Muscles that draw a body part, such as a finger, arm, or toe, inward toward the median axis of the body or of an extremity. In the hand, adductors draw the fingers together (figure 6-16).

figure 6-16
Muscles of the hand



Muscles of the Lower Leg and Foot

As a cosmetologist, you will use your knowledge of the muscles of the lower leg and foot during a pedicure. The muscles of the foot are small and provide proper support and cushioning for the foot and leg.

The muscles of the lower leg include the following:

- **Extensor digitorum longus** (ik-STEN-sur dij-it-TOHR-um LONG-us). Muscle that bends the foot up and extends the toes.
- **Extensor hallucis longus** (ik-STEN-sur ha-LU-sis LONG-us). Muscle that extends the big toe and flexes the foot.
- **Tibialis anterior** (tib-ee-AHL-is an-TEHR-ee-ohr). Muscle that covers the front of the shin. It bends the foot upward and inward.
- **Peroneus longus** (per-oh-NEE-us LONG-us). Muscle that covers the outer side of the calf. It inverts the foot and turns it outward.
- **Peroneus brevis** (per-oh-NEE-us BREV-us). Muscle that originates on the lower surface of the fibula. It bends the foot down and out.
- **Gastrocnemius** (gas-truc-NEEM-e-us). Muscle that is attached to the lower rear surface of the heel and pulls the foot down.
- **Soleus** (SO-lee-us). Muscle that originates at the upper portion of the fibula and bends the foot down (**figure 6-17**).

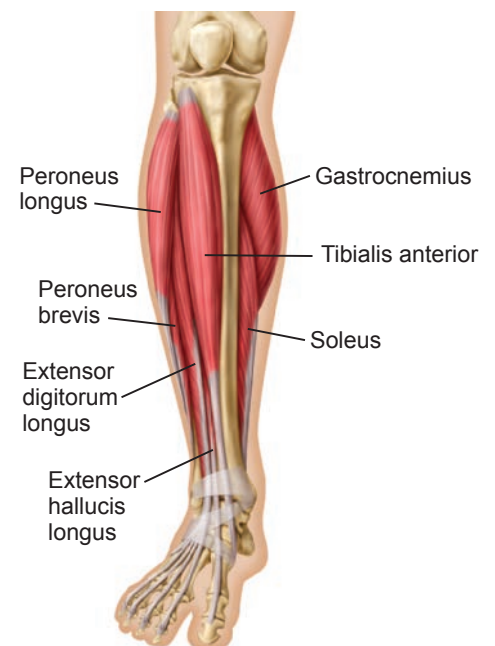


figure 6-17
Muscles of the lower leg

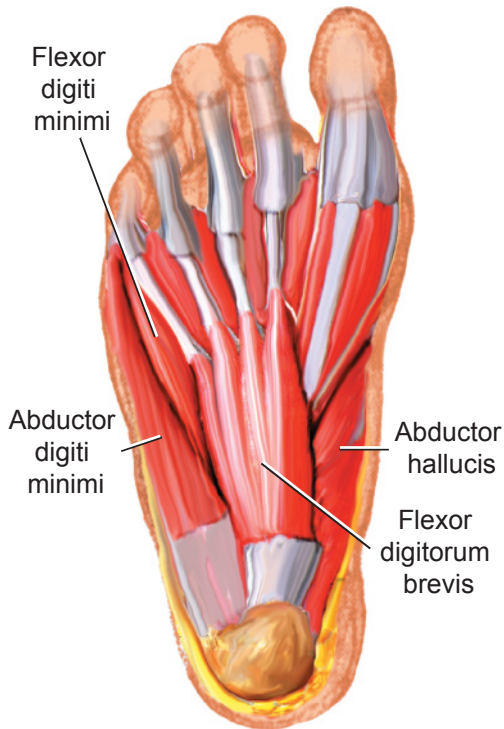


figure 6-18
Muscles of the foot (bottom)

The muscles of the feet include the following:

- **Flexor digiti minimi** (FLEK-sur dij-it-ty MIN-eh-mee). Muscle that moves the little toe.
- **Flexor digitorum brevis** (FLEK-sur dij-ut-TOHR-um BREV-us). Muscle that flexes the toes and helps maintain balance while walking and standing.
- **Abductor hallucis** (ab-DUK-tohr ha-LU-sis). Muscle that moves the big toe away from the other toes.
- **Abductor digiti minimi** (ab-DUK-tohr dij-it-ty MIN-eh-mee). Muscle that separates the fingers and the toes (**figure 6-18**).

Review the Nervous System

The **nervous system** is an exceptionally well-organized body system, composed of the brain, spinal cord, and nerves, that is responsible for controlling and coordinating all other systems of the body and makes them work harmoniously and efficiently. The scientific study of the structure, function, and pathology of the nervous system is known as **neurology** (nuh-RAHL-uh-jee).

An understanding of how nerves work will help you perform services in a more proficient manner when administering shampoos and massage techniques.

Divisions of the Nervous System

The nervous system can be divided into three main subdivisions:

- The **central nervous system (CNS)** consists of the brain, spinal cord, spinal nerves, and cranial nerves. It controls consciousness and many mental activities, functions of the five senses (sight, sound, taste, touch, and smell), and voluntary muscle actions, including all body movements and facial expressions.
- The **peripheral nervous system (PNS)** (puh-RIF-uh-rul NURV-vus SIS-tum) is a system of nerves that connects the peripheral (outer) parts of the body to the central nervous system; it has both sensory and motor nerves. Its function is to carry impulses, or messages, to and from the central nervous system.
- The **autonomic nervous system (ANS)** (aw-toh-NAHM-ik NURV-us SIS-tum) is the part of the nervous system that controls the involuntary muscles; it regulates the action of the smooth muscles, glands, blood vessels, heart, and breath (**figure 6-19**).



DID YOU KNOW?

Some sources divide the nervous system into two main divisions (central and peripheral), and then further divides the peripheral into autonomic and somatic subdivisions which represent the involuntary versus voluntary actions of the peripheral nervous system.

The Brain and Spinal Cord

The **brain** is the part of the central nervous system contained in the cranium. It is the largest and most complex organization of nerve tissue

and it controls sensation, muscles, activity of glands, and the power to think, sense, and feel.

The **spinal cord** is the portion of the central nervous system that originates in the brain and extends down to the lower extremity of the trunk. It is protected by the spinal column. Thirty-one pairs of spinal nerves extending from the spinal cord are distributed to the muscles and skin of the trunk and limbs.

Nerves

Nerves are whitish cords made up of bundles of nerve fibers, held together by connective tissue, through which impulses are transmitted. Nerves have their origin in the brain and spinal cord and send their branches to all parts of the body (figure 6-20).

Types of Nerves

There are two types of nerves:

- **Sensory nerves**, also known as *afferent nerves* (AAF-er-ent NURVS), carry impulses or messages from the sense organs to the brain, where sensations such as touch, cold, heat, sight, sound, taste, smell, pain, and pressure are experienced. Sensory nerve endings called receptors are located close to the surface of the skin. Impulses pass from the sensory nerves to the brain and back through the motor nerves to the muscles; the muscles move as a result of the completed circuit.
- **Motor nerves**, also known as *efferent nerves* (EF-uh-rent NURVS), carry impulses from the brain to the muscles or glands. These transmitted impulses produce movement.

The simplest form of nervous activity that includes a sensory and motor nerve is called a reflex. A **reflex** (REE-fleks) is an automatic reaction to a stimulus that involves the movement of an impulse from a sensory receptor along the sensory nerve to the spinal cord. A responsive impulse is sent along a motor neuron to a muscle, causing a reaction (for example, the quick removal of your hand from a hot object). Reflexes do not have to be learned; they are automatic.

Nerves of the Head, Face, and Neck

Cranial nerves connect the brain with the muscles of the head, face, and neck (figure 6-21a).

The largest of the cranial nerves is the **fifth cranial nerve**, also known as *trifacial nerve* (try-FAY-shul NURV) or *trigeminal nerve*

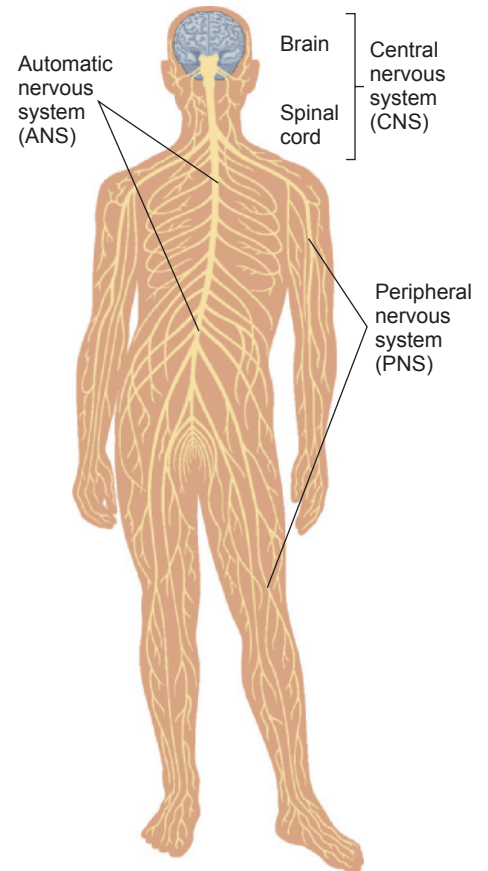


figure 6-19
Divisions of the nervous system

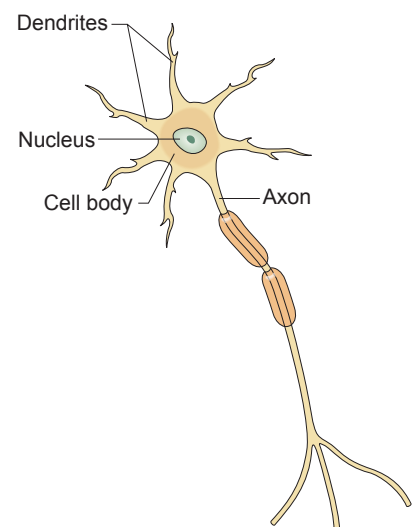
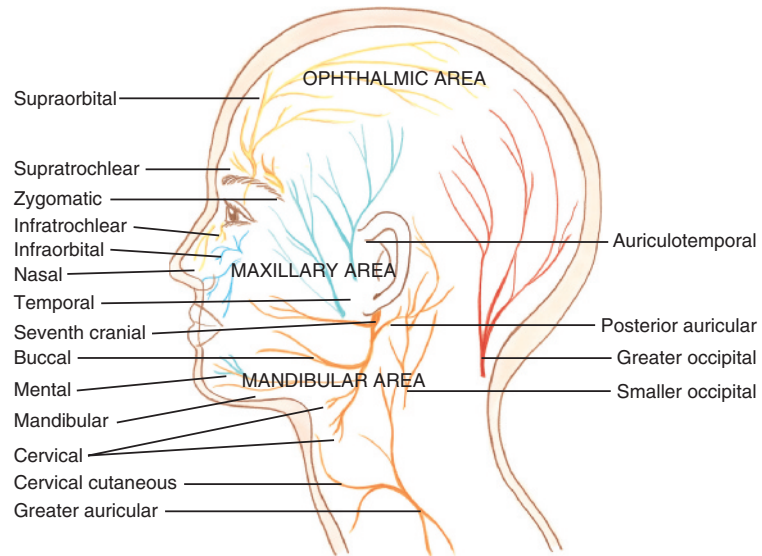


figure 6-20
A neuron or nerve cell

ACTIVITY

There are sensory nerve endings all over the body. Try gently pinching a small piece of the skin on your arm. You feel a slight pressure, right? That is the sensory nerve endings sending a message from your arm to your brain that something is happening to the arm.

figure 6-21a
Nerves of the head, face, and neck



(try-JEM-un-ul NURV). It is the chief sensory nerve of the face and serves as the motor nerve of the muscles that control chewing (**figure 6-21b**). It consists of three branches:

- **Ophthalmic nerve** (ahf-THAL-mik NURV). Supplies impulses to the skin of the forehead, upper eyelids, and interior portion of the scalp, orbit, eyeball, and nasal passage.
- **Mandibular nerve** (man-DIB-yuh-lur NURV). Affects the muscles of the chin, lower lip, and external ear.
- **Maxillary nerve** (MAK-suh-lair-ee NURV). Supplies impulses to the upper part of the face.

The **seventh cranial nerve**, also known as the *facial nerve*, is the chief motor nerve of the face (**figure 6-21c**). Its divisions and their branches supply and control all the muscles of facial expression. It emerges near the lower part

? **DID YOU KNOW?**
If you did not have a central nervous system, you could not taste, smell, see, hear, think, breathe, move, run, sleep, remember, sing, laugh, or write—to name just a few things.

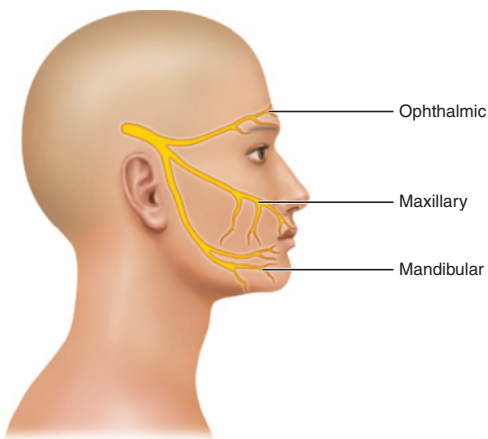


figure 6-21b
Fifth cranial nerve

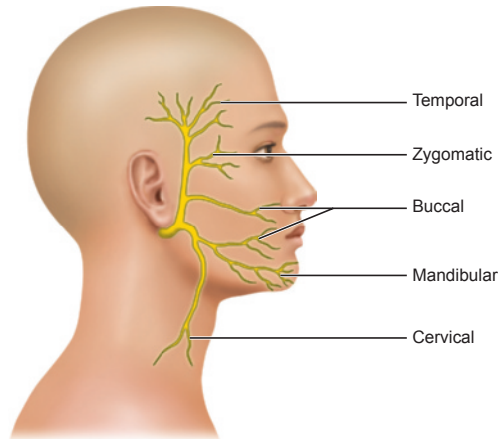


figure 6-21c
Seventh cranial nerve

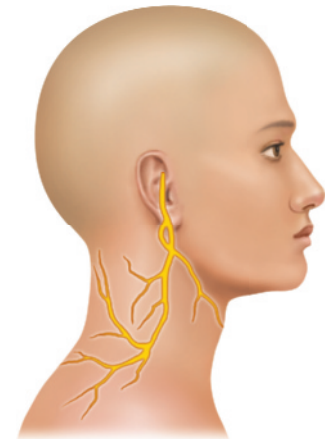


figure 6-21d
Eleventh cranial nerve

of the ear and extends to the muscles of the neck. The following are the most important branches of the facial nerve:

- **Posterior auricular nerve** (poh-STEER-ee-ur aw-RIK-yuh-lur NURV). Affects the muscles behind the ear at the base of the skull.
- **Temporal nerve** (TEM-poh-rul NURV). Affects the muscles of the temple, side of the forehead, eyebrow, eyelid, and upper part of the cheek.
- **Zygomatic nerve (upper and lower)**. Affects the muscles of the upper part of the cheek.
- **Buccal nerve** (BUK-ul NURV). Affects the muscles of the mouth.
- **Marginal mandibular nerve** (MAR-jin-ul man-DIB-yuh-lur NURV). Affects the muscles of the chin and lower lip.
- **Cervical nerves** (SUR-vih-kul NURVS). Affect the side of the neck and the platysma muscle.

The **eleventh cranial nerve**, also known as the *accessory nerve*, is a motor nerve that controls the motion of the neck and shoulder muscles (**figure 6-21d**). This nerve is important to cosmetologists because it is affected during facials, primarily when you are giving a massage to your client.

Nerves of the Arm and Hand

The principal nerves of the arm and hand are the following:

- **Digital nerve** (DIJ-ut-tul NURV). Sensory–motor nerve that, with its branches, supplies impulses to the fingers.
- **Radial nerve** (RAY-dee-ul NURV). Sensory–motor nerve that, with its branches, supplies the thumb side of the arm and back of the hand.
- **Median nerve** (MEE-dee-un NURV). Sensory–motor nerve that is smaller than the ulnar and radial nerves and that, with its branches, supplies the arm and hand.
- **Ulnar nerve** (UL-nur NURV). Sensory–motor nerve that, with its branches, affects the little-finger side of the arm and palm of the hand (**figure 6-22**).

Nerves of the Lower Leg and Foot

The nerves of the lower leg and foot are the following:

- **Sciatic nerve** (sy-AT-ik NURV). The largest and longest nerve in the body. It passes through the gluteal region into the thigh, where it branches into smaller nerves. Pain from injury or compression of the sciatic nerve can radiate throughout the abdomen and be sensed in the lower back, hip, or lower abdomen.
- **Tibial nerve** (TIB-ee-al NURV). Division of the sciatic nerve that passes behind the knee. It subdivides and supplies impulses to the knee, the muscles of the calf, the skin of the leg, and the sole, heel, and underside of the toes.
- **Common peroneal nerve** (KAHM-un per-oh-NEE-al NURV). Division of the sciatic nerve that extends from behind the knee to

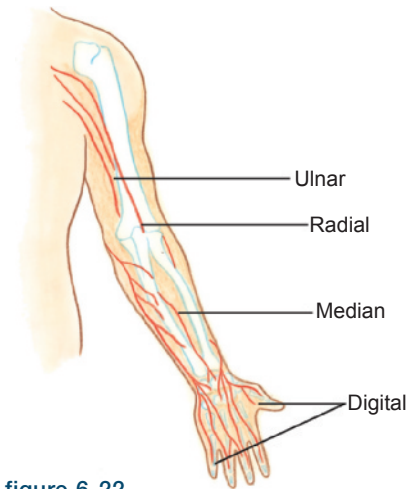


figure 6-22
Nerves of the arm and hand

? **DID YOU KNOW?**
The ulnar nerve runs along the bottom of the elbow. This explains why leaning on the elbows for long periods can cause the little fingers to go numb. This is due to localized inflammation (irritation and swelling) around the nerve. This is also the nerve that is associated with the term “funny bone.” It is the impulse of the ulnar nerve when you hit your elbow against an object that causes the sensation of “hitting your funny bone.”

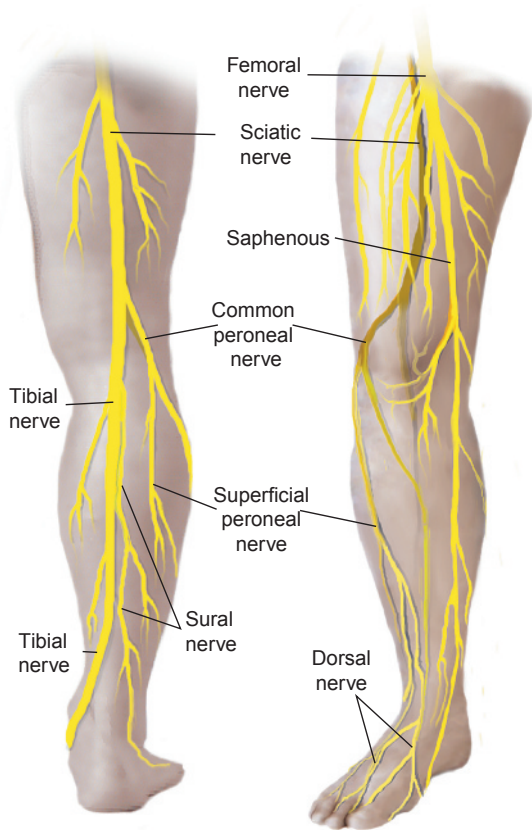


figure 6-23
Nerves of the lower leg and foot

wind around the head of the fibula to the front of the leg, where it divides into two branches.

- **Deep peroneal nerve** (DEEP pare-oh-NEE-uhl NURV), also known as *anterior tibial nerve*. Extends down the front of the leg, behind the muscles. It supplies impulses to these muscles and also to the muscles and skin on the top of the foot and adjacent sides of the first and second toes (not shown in [figure 6-23](#)).
- **Superficial peroneal nerve** (soo-pur-FISH-ul pare-oh-NEE-uhl NURV), also known as *musculocutaneous nerve* (MUS-kyoo-loh-kyoo-TAY-nee-us NURV). Extends down the leg, just under the skin, supplying impulses to the muscles and the skin of the leg, as well as to the skin and toes on the top of the foot, where it becomes the **dorsal nerve** (DOOR-sal NURV), also known as *dorsal cutaneous nerve*. The dorsal nerve extends up from the toes and foot, just under the skin, supplying impulses to the toes and foot, as well as the muscles and skin of the leg.
- **Saphenous nerve** (sa-FEEN-us NURV). Supplies impulses to the skin of the inner side of the leg and foot. The saphenous nerve begins in the thigh.
- **Sural nerve** (SUR-ul NURV). Supplies impulses to the skin on the outer side and back of the foot and leg ([figure 6-23](#)).

Review the Circulatory System

The **circulatory system**, also known as *cardiovascular system* (KAHRD-ee-oh-VAS-kyoo-lur SIS-tum) or *vascular system*, controls the steady circulation of the blood through the body by means of the heart and blood vessels. The circulatory system consists of the heart, arteries, veins, and capillaries that distribute blood throughout the body.

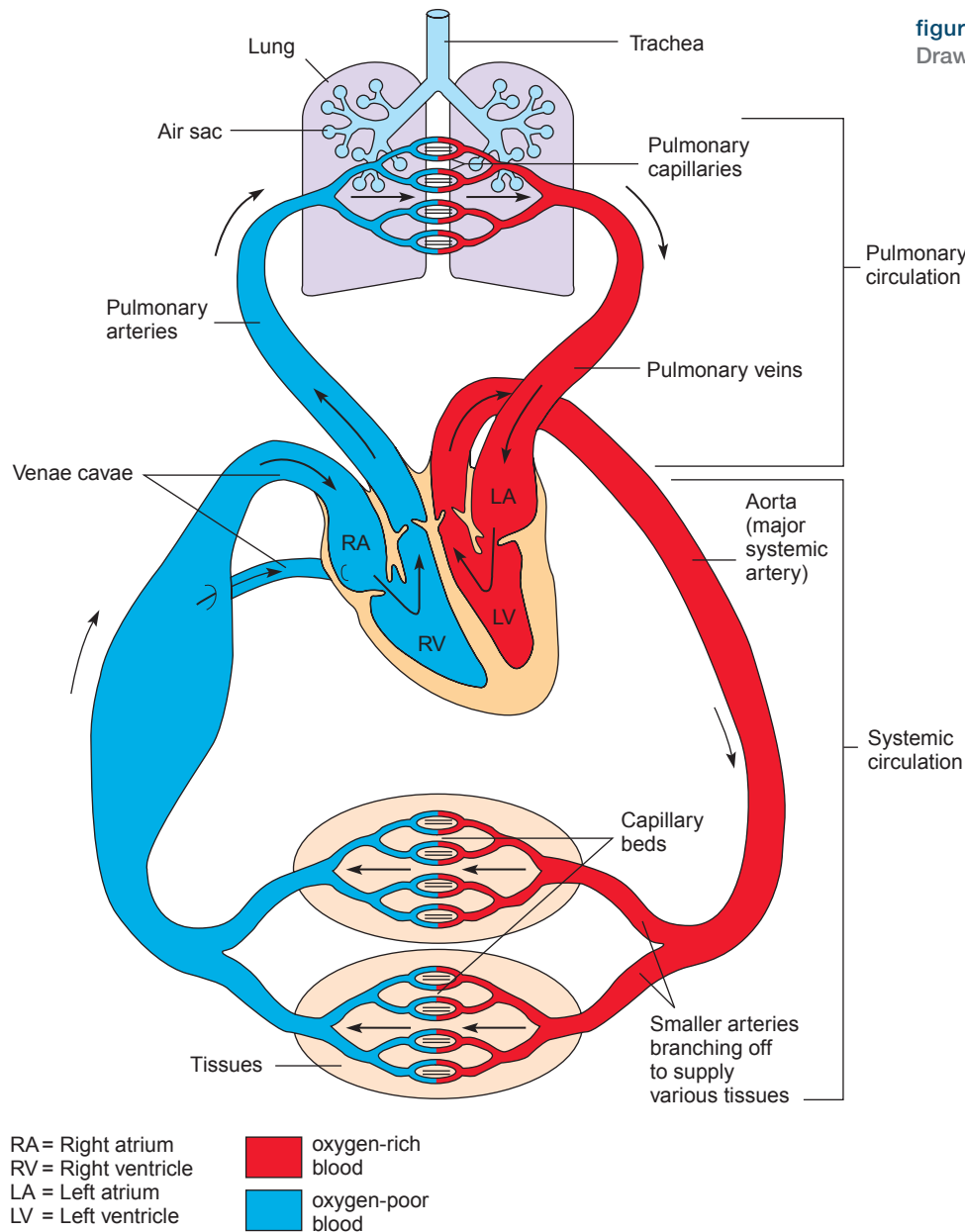
The Heart

The **heart** is a muscular, cone-shaped organ that keeps the blood moving within the circulatory system. It is often referred to as the body's pump.

The blood is in constant and continuous circulation from the time that it leaves the heart, is distributed throughout the body to deliver nutrients and oxygen, and then returns to the heart to be sent to the lungs and replenished with oxygen. Two systems are important to this circulation ([figure 6-24](#)):

- **Pulmonary circulation** (PUL-muh-nayr-ee sur-kyoo-LAY-shun). Takes deoxygenated blood to the lungs for oxygenation and waste removal and then returns that blood to the heart (left atrium) so oxygen-rich blood can be delivered to the body.
- **Systemic circulation** (sis-TEM-ik sur-kyoo-LAY-shun), also known as *general circulation*. Carries the oxygen-rich blood from the heart throughout the body and returns deoxygenated blood back to the heart.

figure 6-24
Drawing of blood flow through the heart



Blood Vessels

The **blood vessels** are tube-like structures that include the arteries, arterioles, capillaries, venules, and veins. The function of these vessels is to transport blood to and from the heart and then to various tissues of the body. The types of blood vessels important to a cosmetologist are:

- **Arteries** (AR-tuh-rees). Thick-walled, muscular, flexible tubes that carry oxygenated blood away from the heart to the arterioles. The largest artery in the body is the **aorta** (ay-ORT-uh).
- **Arterioles** (ar-TEER-ee-ohls). Small arteries that deliver blood to capillaries.
- **Capillaries** (KAP-ih-lair-eez). Tiny, thin-walled blood vessels that connect the smaller arteries to venules. Capillaries bring nutrients to the cells and carry away waste materials.

Blood flow toward the heart

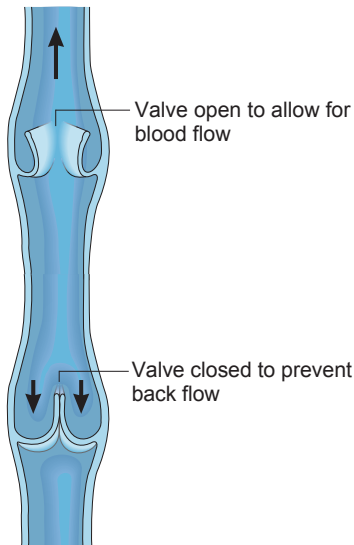


figure 6-25
Valves in the veins

- **Venules** (VEEN-yools). Small vessels that connect the capillaries to the veins. They collect blood from the capillaries and drain it into the veins.
- **Veins**. Thin-walled blood vessels that are less elastic than arteries; veins contain cup-like valves that keep blood flowing in one direction to the heart and prevent blood from flowing backward. Veins carry blood containing waste products back to the heart and lungs for cleaning and to pick up oxygen. Veins are located closer to the outer skin surface of the body than arteries (**figure 6-25**).

The Blood

Blood is a nutritive fluid circulating through the circulatory system (heart and blood vessels) to supply oxygen and nutrients to cells and tissues and to remove carbon dioxide and waste from them. There are approximately 8 to 10 pints of blood in the human body. Blood is approximately 80 percent water. It is bright red in the arteries (except for the pulmonary artery) and dark red in the veins. The color change occurs with the exchange of carbon dioxide for oxygen as the blood passes through the lungs, and again with the exchange of oxygen for carbon dioxide as the blood circulates throughout the body.

Chief Functions of the Blood

Blood performs the following critical functions:

- Carries water, oxygen, and food to all cells and tissues of the body.
- Carries away carbon dioxide and waste products to be eliminated through the lungs, skin, kidneys, and large intestines.
- Helps to equalize the body's temperature, thus protecting the body from extreme heat and cold.
- Works with the immune system to protect the body from harmful toxins and bacteria.
- Seals leaks found in injured blood vessels by forming clots, thus preventing further blood loss.

DID YOU KNOW?

Adults have over 60,000 miles of blood vessels in their bodies. If you tied all of your blood vessels together, they would go around the Earth about two and one-half times!

Arteries of the Head, Face, and Neck

The **common carotid arteries** (KAHM-un kuh-RAHT-ud ART-uh-rees) are the main arteries that supply blood to the head, face, and neck. They are located on both sides of the neck, and each artery is divided into an internal and external branch.

The **internal carotid artery** supplies blood to the brain, eyes, eyelids, forehead, nose, and internal ear. The **external carotid artery** supplies blood to the anterior (front) parts of the scalp, ear, face, neck, and sides of the head (**figure 6-26**).

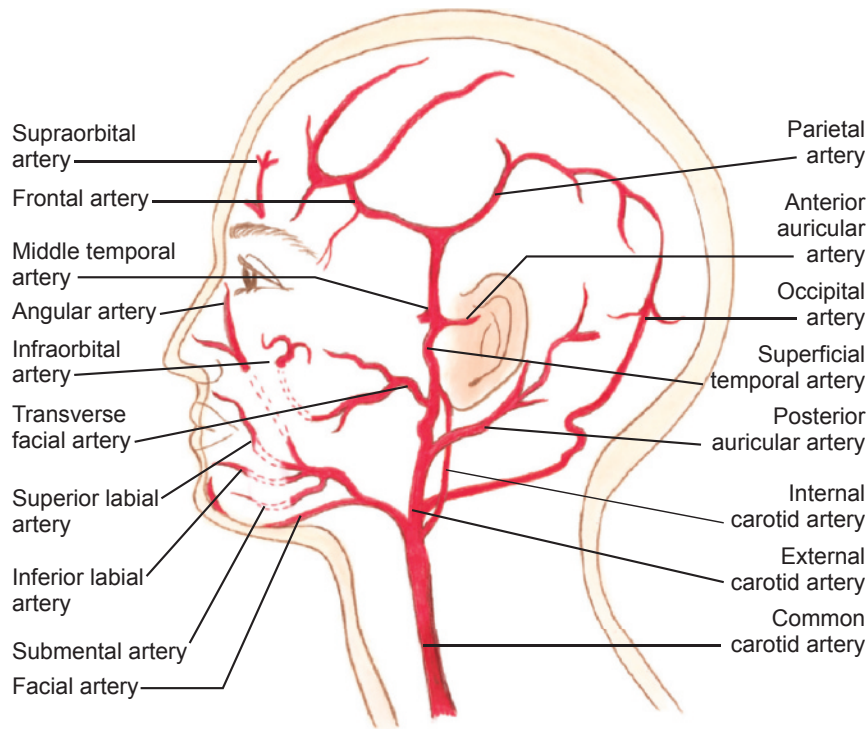
Two branches of the internal carotid artery that are important to know are the following:

- **Supraorbital artery** (soo-pruh-OR-bih-tul AR-tuh-ree). Supplies blood to the upper eyelid and forehead.
- **Infraorbital artery** (in-frah-OR-bih-tul AR-tuh-ree). Supplies blood to the muscles of the eye.

DID YOU KNOW?

An adult heart beats about 30 million times a year and pumps nearly 4,000 gallons of blood every day.

figure 6-26
Arteries of the head, face, and neck.



There are four branches of the external carotid artery—the facial artery, the superficial temporal artery, the occipital artery, and the posterior auricular artery.

The **facial artery**, also known as the *external maxillary artery* (eks-TURN-uh-lay-ee ART-uh-ree), supplies blood to the lower region of the face, mouth, and nose. Some of the important facial artery branches include:

- **Submental artery** (sub-MEN-tul ART-uh-ree). Supplies blood to the chin and lower lip.
- **Inferior labial artery** (in-FEER-ee-ur LAY-bee-ul ART-ur-ee). Supplies blood to the lower lip.
- **Angular artery** (ANG-gyoo-lur ART-ur-ee). Supplies blood to the side of the nose.
- **Superior labial artery** (soo-PEER-ee-ur LAY-bee-ul AR-tuh-ree). Supplies blood to the upper lip and region of the nose.

The **superficial temporal artery** (soo-pur-FISH-ul TEM-puh-rul ART-uh-ree) is a continuation of the external carotid artery and supplies blood to the muscles of the front, side, and top of the head. Some of the important superficial temporal artery branches include:

- **Frontal artery**. Supplies blood to the forehead and upper eyelids.
- **Parietal artery** (puh-RY-ate-ul ART-uh-ree). Supplies blood to the side and crown of the head.
- **Transverse facial artery** (tranz-VURS FAY-shul ART-ur-ee). Supplies blood to the skin and masseter muscle (coordinates opening and closing of the mouth).
- **Middle temporal artery**. Supplies blood to the temples.
- **Anterior auricular artery** (an-TEER-ee-ur aw-RIK-yuh-lur ART-uh-ree). Supplies blood to the front part of the ear.

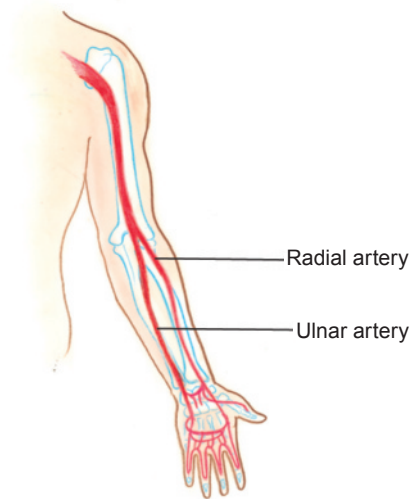


figure 6-27
Arteries of the arm and hand

The **occipital artery** (ahk-SIP-it-ul AR-tuh-ree) supplies blood to the skin and muscles of the scalp and back of the head up to the crown.

The **posterior auricular artery** (poh-STEER-ee-ur aw-RIK-yuh-lur ART-tuh-ree) supplies blood to the scalp, the area behind and above the ear, and the skin behind the ear.

Veins of the Head, Face, and Neck

The blood returning to the heart from the head, face, and neck flows on each side of the neck in two principal veins:

- The **internal jugular vein** (in-TUR-nul JUG-yuh-lur VAYN) is located at the side of the neck to collect blood from the brain and parts of the face and neck.
- The **external jugular vein** is located at the side of the neck and carries blood returning to the heart from the head, face, and neck.

The most important veins of the face and neck are parallel to the arteries and take the same names as the arteries.

Blood Supply to the Arm and Hand

The ulnar and radial arteries are the main blood supply of the arms and hands.

The **ulnar artery** (UL-nur AR-tuh-ree) and its numerous branches supply blood to the little-finger side of the arm and palm of the hand.

The **radial artery** (RAY-dee-ul AR-tur-ree) and its branches supply blood to the thumb side of the arm and the back of the hand; the radial artery also supplies blood to the muscles of the skin, hands, fingers, wrist, elbow, and forearm.

While the arteries are found deep in the tissues, the veins lie nearer to the surface of the arms and hands (**figure 6-27**).

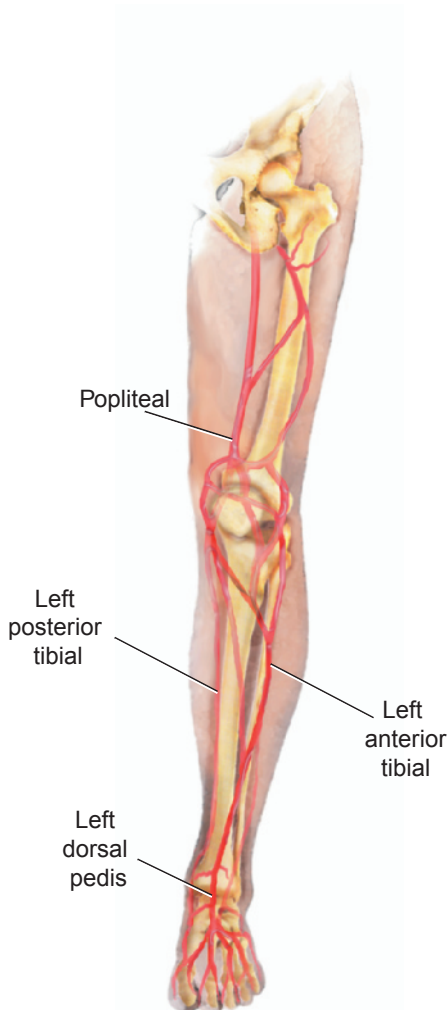


figure 6-28
Arteries of the lower leg and foot
(left leg view)

Blood Supply to the Lower Leg and Foot

The major arteries that supply blood to the lower leg and foot are the popliteal artery and its branches and the dorsalis pedis artery.

The **popliteal artery** (pop-lih-TEE-ul ART-uh-ree), which supplies blood to the foot, divides into two separate arteries known as the anterior tibial artery and the posterior tibial artery.

- **Anterior tibial artery** (an-TEER-ee-ur TIB-ee-al ART-uh-ree). Supplies blood to the lower leg muscles and to the muscles and skin on the top of the foot and adjacent sides of the first and second toes. This artery continues to the foot, where it becomes the dorsalis pedis artery.
- **Posterior tibial artery** (poh-STEER-ee-ur TIB-ee-al ART-uh-ree). Supplies blood to the ankle and the back of the lower leg.

The **dorsalis pedis artery** (DOR-sul-is PEED-us ART-uh-ree) supplies blood to the foot.

As in the arms and hand, the important veins of the lower leg and foot are almost parallel with the arteries and take the same names (**figure 6-28**).

Review the Lymphatic/Immune System

The **lymphatic/immune system** (lim-FAT-ik ih-MYOON SIS-tum) is made up of lymph, lymph nodes, the thymus gland, the spleen, and lymph vessels. The lymphatic/immune system carries waste and impurities away from the cells and protects the body from disease by developing immunities and destroying disease-causing microorganisms. **Lymph** (LIMF) is a clear fluid that circulates in the lymph spaces (lymphatics) of the body. Lymph helps carry wastes and impurities away from the cells before it is routed back to the circulatory system. The lymphatic/immune system is closely connected to the cardiovascular system. They both transport streams of fluids, like rivers throughout the body. The difference is that the lymphatic/immune system transports lymph, which eventually returns to the blood where it originated.

Lymphatic vessels start as tubes that are closed at one end. They can occur individually or in clusters that are called **lymph capillaries**—blind-end tubes that are the origin of lymphatic vessels. **Lymph nodes** are gland-like structures found inside lymphatic vessels. Lymph nodes filter the lymphatic vessels, which helps fight infection.

The primary functions of the lymphatic/immune system are to:

- Carry nourishment from the blood to the body cells.
- Act as a defense against toxins and bacteria, and remove by-products of infection such as pus and dead tissue.
- Remove waste material from the body cells to the blood.
- Provide a suitable fluid environment for the cells.

? **DID YOU KNOW?**
Every minute, you shed about 30,000 to 40,000 dead skin cells from your body. That can total up to about 40 pounds of skin in your lifetime!

Review the Integumentary System

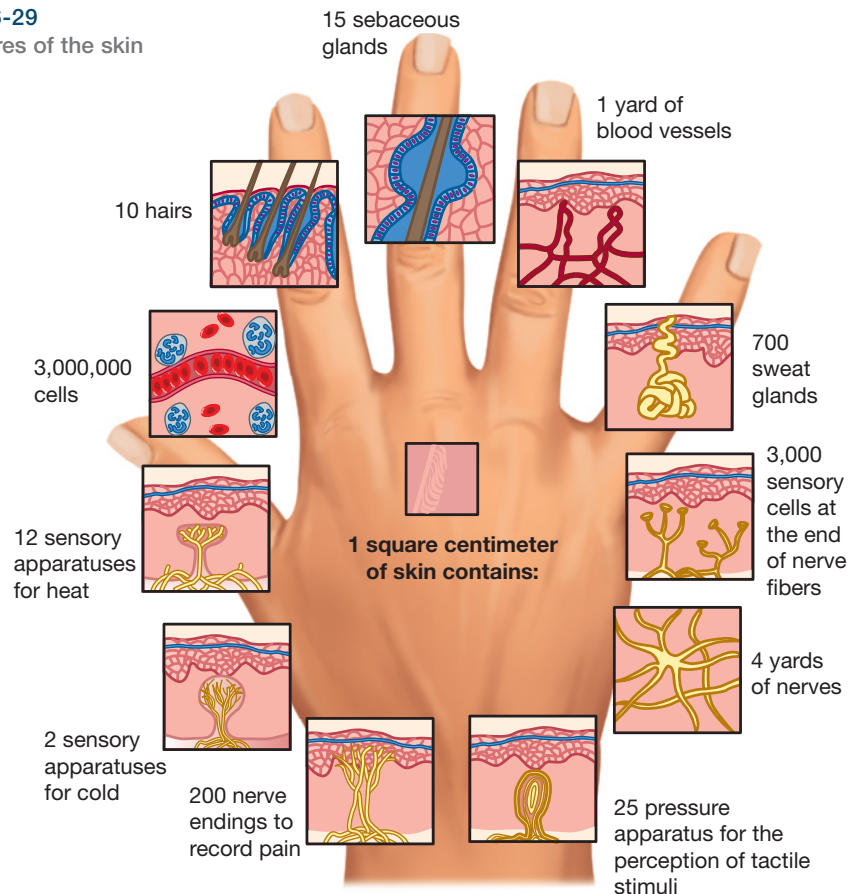
The **integumentary system** (in-TEG-yuh-ment-uh-ree SIS-tum) consists of the skin and its accessory organs, such as the oil and sweat glands, sensory receptors, hair, and nails. It is a very complex system that serves as a protective covering and helps regulate the body's temperature (figure 6-29).

The word *integument* means a natural covering. So you can think of the skin as a protective overcoat for your body against the outside elements that you encounter every day, such as germs, chemicals, and sun exposure. Skin is also water-resistant.

Skin structure and growth are discussed in detail in Chapter 7, Skin Structure, Growth, and Nutrition.



figure 6-29
Structures of the skin



Review the Endocrine System

The **endocrine system** (EN-duh-krin SIS-tum) is a group of specialized glands that affect the growth, development, sexual functions, and health of the entire body. **Glands** are secretory organs that remove and release certain elements from the blood to convert them into new compounds.

There are two main types of glands:

- **Endocrine glands** (EN-duh-krin GLANDZ), also known as *ductless glands*, such as the thyroid and pituitary glands, release hormonal secretions directly into the bloodstream.
- **Exocrine glands** (EK-suh-krin GLANDZ), also known as *duct glands*, such as sweat and oil glands of the skin, produce a substance that travels through small, tube-like ducts.

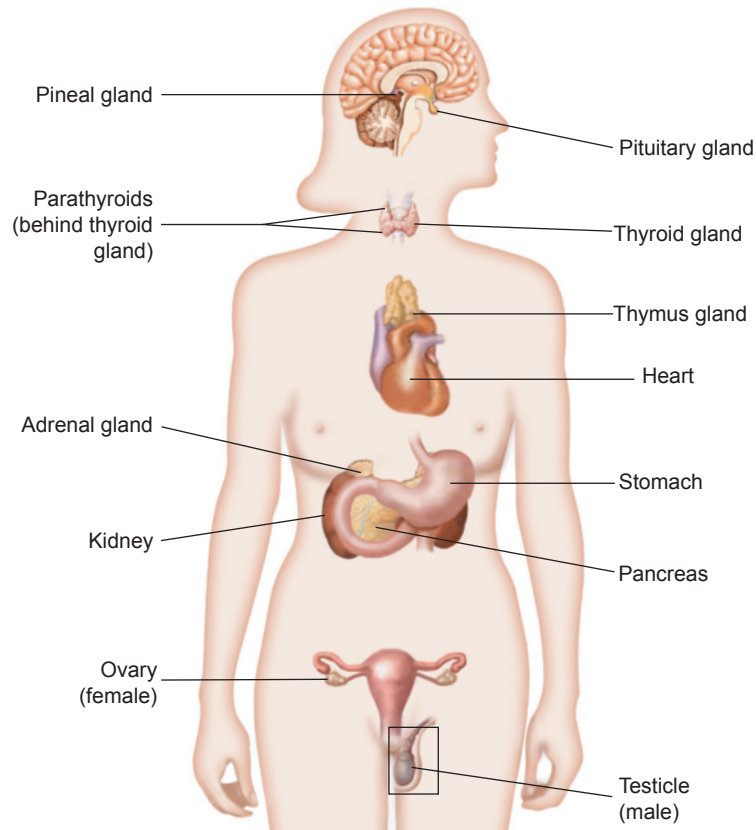
The endocrine glands and the hormones they secrete have a tremendous influence on your body (**figure 6-30**). **Hormones** (HOR-mohnz) are secretions, such as insulin, adrenaline, and estrogen, that stimulate functional activity or other secretions in the body. Hormones influence the welfare of the entire body. They affect sleep, digestion, growth, sexual development, and many other important functions. You can see that endocrine glands are as important to us as our brain.



DID YOU KNOW?

Hormones are actually chemicals. There are over 30 hormones telling your body what it should do every day.

figure 6-30
Endocrine glands and other
body organs



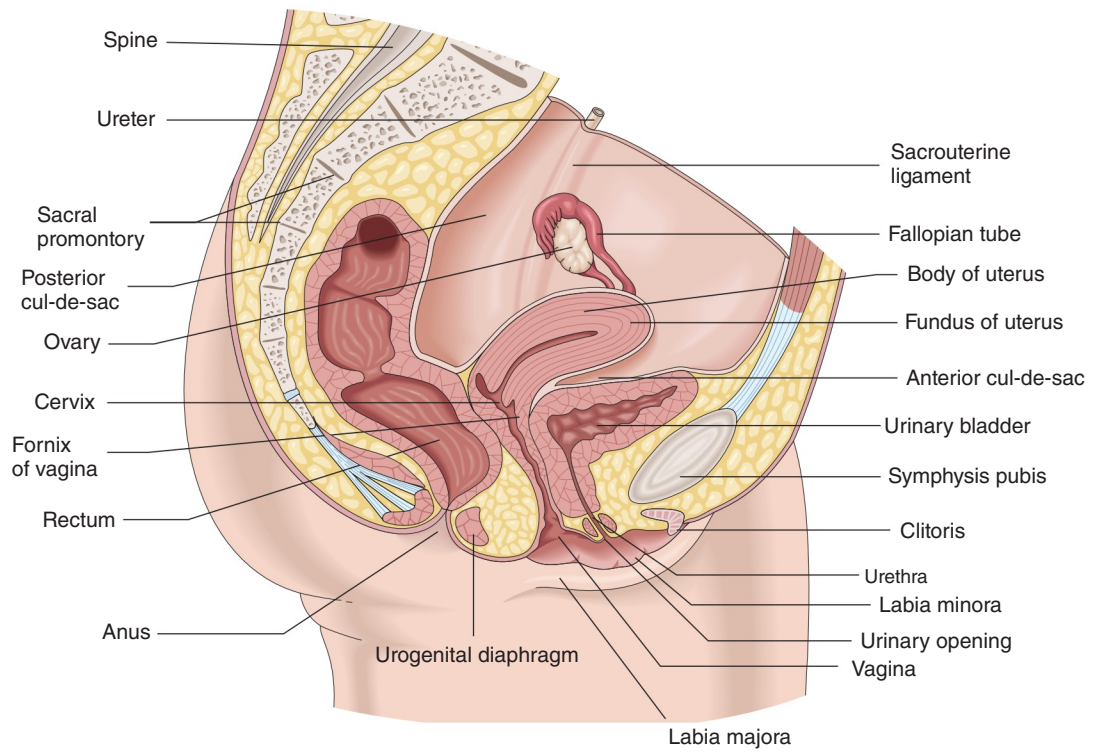
The endocrine glands and their functions are as follows:

- **Pineal gland** (PY-nee-ul GLAND). Plays a major role in sexual development, sleep, and metabolism.
- **Pituitary gland** (puh-TOO-uh-tair-ee GLAND). This gland affects almost every physiologic process of the body: growth, blood pressure, contractions during childbirth, breast-milk production, sexual organ functions in both women and men, thyroid gland function, and the conversion of food into energy (metabolism).
- **Thyroid gland** (THY-royd GLAND). Controls how quickly the body burns energy (metabolism), makes proteins, and how sensitive the body should be to other hormones. Thyroid malfunction is very common and sometimes can be seen by cosmetologist as a change in the growth rate of hair or nails or quality or texture of hair or nails that changes significantly.

Review the Reproductive System

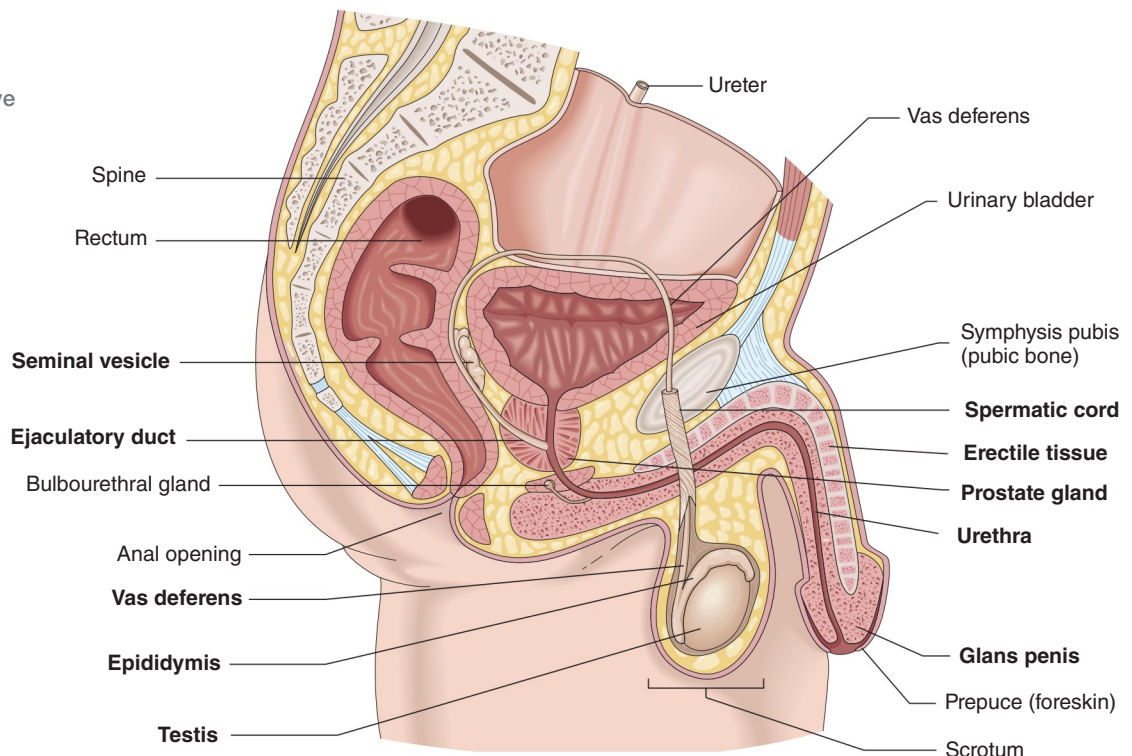
The **reproductive system** (ree-proh-DUK-tiv SIS-tum) includes the ovaries, uterine tubes, uterus, and vagina in the female (**figure 6-31a**) and the testes, prostate gland, penis, and urethra in the male (**figure 6-31b**). This performs the function of producing offspring and passing on the genetic code from one generation to another.

figure 6-31a
The female reproductive system



The reproductive system produces hormones—primarily estrogen in females and primarily testosterone in males. These hormones affect and change the skin in several ways. Acne, loss of scalp hair, facial hair growth and color, and darker skin pigmentations are some of the results of changing or fluctuating hormones. Fortunately, cosmetologists have access to many products and treatments that can address unwanted changes of this nature and help clients feel more comfortable and confident about themselves. This is one more example of how important your role is in your clients' lives.

figure 6-31b
The male reproductive system



REVIEW QUESTIONS

- 1 Why is the study of anatomy and physiology important to cosmetologists?
- 2 Define anatomy and physiology.
- 3 Name and describe the basic structures of a cell.
- 4 List and describe the functions of the four types of tissue found in the human body.
- 5 What are organs?
- 6 Name the 11 main body systems and their functions.
- 7 List the primary functions of the skeletal system.
- 8 Name and describe the two types of nerves found in the body and how they work.
- 9 Name and briefly describe the five types (venous and arterial) of blood vessels found in the body.
- 10 Name and discuss the two main types of glands found in the human body.

STUDY TOOLS

- **Reinforce what you just learned:** Complete the activities and exercises in your Theory or Practical Workbook, or your Study Guide.
- **Expand your knowledge:** Search for websites about the topics in this chapter and make a list of additional resources.
- **Study and prepare for your quiz:** Take the chapter test in your Exam Review or your Milady U: Online Licensing Prep.
- **Re-Test your knowledge:** Take the Chapter 6 Quizzes!
- **Learn even more:** Look up in a dictionary or search the internet for the definitions of any additional terms you want to learn about.

CHAPTER GLOSSARY

abductor digiti minimi ab-DUK-tohr dij-it-ty MIN-eh-mee	p. 128	Muscle that separates the fingers and the toes.
abductor hallucis ab-DUK-tohr ha-LU-sis	p. 128	Muscle that moves the big toe away from the other toes.
abductors ab-DUK-turz	p. 126	Muscles that draw a body part, such as a finger, arm, or toe, away from the midline of the body or of an extremity.
adductors ah-DUK-turz	p. 126	Muscles that draw a body part, such as a finger, arm, or toe, inward toward the median axis of the body or of an extremity.
adipose tissue ADD-ih-pohz TISH-oo	p. 117	The technical term for fat; it gives smoothness and contour to the body.
anatomy ah-NAT-ah-mee	p. 115	The study of human body structures that can be seen with the naked eye and how the body parts are organized; the science of the structure of organisms or of their parts.

angular artery ANG-gyoo-lur ART-ur-ee	p. 135	Branch of the facial artery that supplies blood to the side of the nose.
anterior auricular artery an-TEER-ee-ur aw-RIK-yuh-lur ART-uh-ree	p. 135	Branch of the superficial temporal artery that supplies blood to the front part of the ear.
anterior tibial artery an-TEER-ee-ur TIB-ee-al ART-uh-ree	p. 136	One of the popliteal arteries (the other is the posterior tibial artery) that supplies blood to the lower leg muscles and to the muscles and skin on the top of the foot and adjacent sides of the first and second toes. This artery continues to the foot where it becomes the dorsalis pedis artery.
aorta ay-ORT-uh	p. 133	The largest artery in the body.
arteries AR-tuh-rees	p. 133	Thick-walled, muscular, flexible tubes that carry oxygenated blood away from the heart to the arterioles.
arterioles ar-TEER-ee-ohls	p. 133	Small arteries that deliver blood to capillaries.
autonomic nervous system aw-toh-NAHM-ik NURV-us SIS-tum	p. 128	Abbreviated ANS; the part of the nervous system that controls the involuntary muscles; regulates the action of the smooth muscles, glands, blood vessels, heart, and breathing.
belly	p. 122	The middle part of the muscle.
bicep BY-sep	p. 126	Muscle that produces the contour of the front and inner side of the upper arm; lifts the forearm and flexes the elbow.
blood	p. 134	Nutritive fluid circulating through the circulatory system (heart and blood vessels) to supply oxygen and nutrients to cells and tissues and to remove carbon dioxide and waste from them.
blood vessels	p. 133	Tube-like structures that include arteries, arterioles, capillaries, venules, and veins.
body systems	p. 117	Also known as <i>systems</i> ; groups of body organs acting together to perform one or more functions. The human body is composed of 11 major systems.
brain	p. 128	Part of the central nervous system contained in the cranium; it is the largest and most complex nerve tissue and controls sensation, muscles, activity of glands, and the power to think, sense, and feel.
buccal nerve BUK-ul NURV	p. 131	Branch of the seventh cranial nerve that affects the muscles of the mouth.
buccinator muscle BUK-sih-nay-tur MUS-ul	p. 124	Thin, flat muscle of the cheek between the upper and lower jaw that compresses the cheeks and expels air between the lips.
capillaries KAP-ih-lair-eez	p. 133	Tiny, thin-walled blood vessels that connect the smaller arteries to the venules. Capillaries bring nutrients to the cells and carry away waste materials.
carpus KAR-pus	p. 121	Also known as <i>wrist</i> ; flexible joint composed of a group of eight small, irregular bones (carpals) held together by ligaments.
cell membrane SELL MEM-brayn	p. 116	A cell part that encloses the protoplasm and permits soluble substances to enter and leave the cell.

cells	p. 115	Basic units of all living things—from bacteria to plants to animals, including human beings.
central nervous system	p. 128	Abbreviated CNS; consists of the brain, spinal cord, spinal nerves, and cranial nerves.
cervical nerves SUR-vih-kul NURVS	p. 131	Branches of the seventh cranial nerve; originate at the spinal cord and affect the side of the neck and the platysma muscle.
cervical vertebrae SUR-vih-kul VURT-uh-bray	p. 120	The seven bones of the top part of the vertebral column, located in the neck region.
circulatory system	p. 132	Also known as <i>cardiovascular system</i> or <i>vascular system</i> ; The body system that controls the steady circulation of the blood through the body by means of the heart and blood vessels.
clavicle KLAV-ih-kul	p. 121	Also known as <i>collarbone</i> ; the bone that joins the sternum and scapula.
common carotid arteries KAHM-un kuh-RAHT-ud ART-uh-rees	p. 134	Main arteries that supply blood to the head, face, and neck.
common peroneal nerve KAHM-un per-oh-NEE-al NURV	p. 131	A division of the sciatic nerve that extends from behind the knee to wind around the head of the fibula to the front of the leg where it divides into two branches.
connective tissue	p. 117	Fibrous tissue that binds together, protects, and supports the various parts of the body. Examples of connective tissue are bone, cartilage, ligaments, tendons, blood, lymph, and fat (see <i>adipose tissue</i>).
corrugator muscle KOR-oo-gay-tohr MUS-ul	p. 124	Muscle located beneath the frontalis and orbicularis oculi muscles that draws the eyebrow down and wrinkles the forehead vertically.
cranium KRAY-nee-um	p. 119	An oval, bony case that protects the brain.
cytoplasm sy-toh-PLAZ-um	p. 116	The protoplasm of a cell; the watery fluid that surrounds the nucleus of the cell and is needed for growth, reproduction, and self-repair.
deep peroneal nerve DEEP pare-oh-NEE-uhl NURV	p. 132	Also known as <i>anterior tibial nerve</i> ; it extends down the front of the leg, behind the muscles. It supplies impulses to these muscles and also to the muscles and skin on the top of the foot and adjacent sides of the first and second toes.
deltoid DEL-toyd	p. 126	Large, triangular muscle covering the shoulder joint that allows the arm to extend outward and to the side of the body.
depressor labii inferioris muscle dee-PRES-ur LAY-bee-eye in-FEER-ee-or-us MUS-ul	p. 125	Also known as <i>quadratus labii inferioris muscle</i> ; muscle surrounding the lower lip; lowers the lower lip and draws it to one side, as in expressing sarcasm.
digestive system	p. 118	Also known as <i>gastrointestinal system</i> ; the body system that is responsible for breaking down foods into nutrients and wastes; consists of the mouth, stomach, intestines, salivary and gastric glands, and other organs.
digital nerve DIJ-ut-tul NURV	p. 131	Sensory–motor nerve that, with its branches, supplies impulses to the fingers.

dorsal nerve DOOR-sal NURV	p. 132	Also known as <i>dorsal cutaneous nerve</i> ; a nerve that extends up from the toes and foot, just under the skin, supplying impulses to toes and foot, as well as the muscles and skin of the leg, where it becomes the superficial peroneal nerve.
dorsalis pedis artery DOR-sul-is PEED-us ART-uh-ree	p. 136	Artery that supplies blood to the foot.
eleventh cranial nerve	p. 131	Also known as <i>accessory nerve</i> ; a motor nerve that controls the motion of the neck and shoulder muscles.
endocrine glands EN-duh-krin GLANDZ	p. 138	Also known as <i>ductless glands</i> ; glands such as the thyroid and pituitary gland that release hormonal secretions directly into the bloodstream.
endocrine system EN-duh-krin SIS-tum	p. 138	The body system consisting of a group of specialized glands that affect the growth, development, sexual functions, and health of the entire body.
epicranial aponeurosis ep-ih-KRAY-nee-al ap-uh-noo-ROH-sus	p. 123	Tendon that connects the occipitalis and frontalis muscles.
epicranium ep-ih-KRAY-nee-us	p. 123	Also known as <i>occipitofrontalis</i> ; the broad muscle that covers the top of the skull and consists of the occipitalis and frontalis.
epithelial tissue ep-ih-THÉE-lee-ul TISH-oo	p. 117	A protective covering on body surfaces, such as skin, mucous membranes, the tissue inside the mouth, the lining of the heart, digestive and respiratory organs, and the glands.
ethmoid bone ETH-moyd BOHN	p. 120	Light, spongy bone between the eye sockets; forms part of the nasal cavities.
exocrine glands EK-suh-krin GLANDZ	p. 138	Also known as <i>duct glands</i> ; they produce a substance that travels through small, tube-like ducts. Sweat glands and oil glands of the skin belong to this group.
extensor digitorum longus ik-STEN-sur dij-it-TOHR-um LONG-us	p. 127	Muscle that bends the foot up and extends the toes.
extensor hallucis longus ik-STEN-sur ha-LU-sis LONG-us	p. 127	Muscle that extends the big toe and flexes the foot.
extensors ik-STEN-surs	p. 126	Muscles that straighten the wrist, hand, and fingers to form a straight line.
external carotid artery eks-TUR-nul kuh-RAHT-ud ART-uh-rees	p. 134	Artery that supplies blood to the anterior (front) parts of the scalp, ear, face, neck, and sides of the head.
external jugular vein	p. 136	Vein located at the side of the neck that carries blood returning to the heart from the head, face, and neck.
facial artery FAY-shul ART-ur-ee	p. 135	Also known as <i>external maxillary artery</i> ; branch of the external carotid artery that supplies blood to the lower region of the face, mouth, and nose.
facial skeleton	p. 119	The framework of the face; composed of 14 bones.
femur FEE-mur	p. 121	Heavy, long bone that forms the leg above the knee.
fibula FIB-ya-lah	p. 121	Smaller of the two bones that form the leg below the knee. The fibula may be visualized as a bump on the little-toe side of the ankle.

fifth cranial nerve	p. 129	Also known as <i>trifacial nerve</i> or <i>trigeminal nerve</i> ; the chief sensory nerve of the face that serves as the motor nerve of the muscles that control chewing.
flexor digiti minimi FLEK-sur djij-it-ty MIN-eh-mee	p. 128	Muscle that moves the little toe.
flexor digitorum brevis FLEK-sur djij-ut-TOHR-um BREV-us	p. 128	Muscle that flexes the toes and helps maintain balance while walking and standing.
flexor FLEK-sur	p. 126	Extensor muscle of the wrist involved in flexing the wrist.
frontal artery	p. 135	Branch of the superficial temporal artery that supplies blood to the forehead and upper eyelids.
frontal bone FRUNT-ul BOHN	p. 119	The bone that forms the forehead.
frontalis frun-TAY-lus	p. 123	Front (anterior) portion of the epicranium; muscle of the scalp that raises the eyebrows, draws the scalp forward, and causes wrinkles across the forehead.
gastrocnemius gas-truc-NEEM-e-us	p. 127	Muscle attached to the lower rear surface of the heel and pulls the foot down.
glands	p. 138	Organs that remove and release certain elements from the blood to convert them into new compounds.
heart	p. 132	Muscular, cone-shaped organ that keeps the blood moving within the circulatory system.
hormones HOR-mohnz	p. 138	Secretions, such as insulin, adrenaline, and estrogen, that stimulate functional activity or other secretions in the body. Hormones influence the welfare of the entire body.
humerus HYOO-muh-rus	p. 121	Uppermost and largest bone in the arm, extending from the elbow to the shoulder.
hyoid bone HY-oyd BOHN	p. 120	U-shaped bone at the base of the tongue that supports the tongue and its muscles.
inferior labial artery in-FEER-ee-ur LAY-bee-ul ART-ur-ee	p. 135	Branch of the facial artery that supplies blood to the lower lip.
infraorbital artery in-frah-OR-bih-tul AR-tuh-ree	p. 134	Branch of the internal carotid artery that supplies blood to the muscles of the eye.
insertion	p. 122	The movable part of the muscle that is farthest from the skeleton.
integumentary system in-TEG-yuh-ment-uh-ree SIS-tum	p. 137	The body system that consists of skin and its accessory organs, such as the oil and sweat glands, sensory receptors, hair, and nails; it serves as a protective covering and helps regulate the body's temperature.
internal carotid artery	p. 134	Artery that supplies blood to the brain, eyes, eyelids, forehead, nose, and internal ear.
internal jugular vein in-TUR-nul JUG-yuh-lur VAYN	p. 136	Vein located at the side of the neck to collect blood from the brain and parts of the face and neck.
joint JOYNT	p. 119	A connection between two or more bones of the skeleton.

lacrimal bones LAK-ruh-mul BOHNS	p. 120	Small, thin bones located at the front inner wall of the orbits (eye sockets).
latissimus dorsi lah-TIS-ih-mus DOR-see	p. 125	Large, flat, triangular muscle covering the lower back.
levator anguli oris muscle lih-VAYT-ur ANG-yoo-ly OH-ris MUS-ul	p. 125	Also known as <i>caninus muscle</i> ; muscle that raises the angle of the mouth and draws it inward.
levator labii superioris muscle lih-VAYT-ur LAY-bee-eye soo-peer-ee-OR-is MUS-ul	p. 125	Also known as <i>quadratus labii superioris muscle</i> ; muscle surrounding the upper lip. It elevates the upper lip and dilates the nostrils, as in expressing distaste.
levator palpebrae superioris muscle lih-VAYT-ur [insert palpebrae] soo-peer-ee-OR-is MUS-ul	p. 124	Thin muscle that controls the movement of the eyelid.
lymph LIMF	p. 137	Clear fluid that circulates in the lymph spaces (lymphatics) of the body. Lymph helps carry wastes and impurities away from the cells before it is routed back to the circulatory system.
lymph capillaries	p. 137	Blind-end tubes that are the origin of lymphatic vessels.
lymph nodes	p. 137	Gland-like structures found inside lymphatic vessels; filter the lymphatic vessels and help fight infection.
lymphatic/immune system lim-FAT-ik ih-MYOON SIS-tum	p. 137	The body system that consists of lymph, lymph nodes, the thymus gland, the spleen, and lymph vessels. It carries waste and impurities away from the cells and protects the body from disease by developing immunities and destroying disease-causing microorganisms.
mandible MAN-duh-bul	p. 120	Lower jawbone; largest and strongest bone of the face.
mandibular nerve man-DIB-yuh-lur NURV	p. 130	Affects the muscles of the chin, lower lip, and external ear.
marginal mandibular nerve MAR-jin-ul man-DIB-yuh-lur NURV	p. 131	Branch of the seventh cranial nerve that affects the muscles of the chin and lower lip.
maxillae mak-SIL-ee	p. 120	Singular: maxilla. Bones of the upper jaw.
maxillary nerve MAK-suh-lair-ee NURV	p. 130	Branch of the fifth cranial nerve that supplies impulses to the upper part of the face.
median nerve MEE-dee-un NURV	p. 131	Sensory–motor nerve that is smaller than the ulnar and radial nerves and that, with its branches, supplies the arm and hand.
mentalis muscle men-TAY-lis MUS-ul	p. 125	Muscle that elevates the lower lip and raises and wrinkles the skin of the chin.
metacarpus met-uh-KAR-pus	p. 121	Bones of the palm of the hand; parts of the hand containing five bones between the carpus and phalanges.
metatarsal met-ah-TAHR-sul	p. 122	One of three subdivisions of the foot; long and slender bones, similar to the metacarpal bones of the hand. The other two subdivisions are the tarsal and phalanges.
middle temporal artery TEM-puh-rul AR-tuh-ree	p. 135	Branch of the superficial temporal artery that supplies blood to the temples.

mitosis my-TOH-sis	p. 116	The usual process of cell reproduction of human tissues that occurs when the cell divides into two identical cells called daughter cells.
motor nerves	p. 129	Also known as <i>efferent nerves</i> ; carry impulses from the brain to the muscles or glands.
muscle tissue	p. 117	Tissue that contracts and moves various parts of the body.
muscular system MUS-kuyh-lur SIS-tum	p. 122	The body system that covers, shapes, and holds the skeletal system in place; the muscular system contracts and moves various parts of the body.
nasal bones NAY-zul BOHNS	p. 120	Bones that form the bridge of the nose.
nerve tissue NURV TISH-oo	p. 117	Tissue that carries messages to and from the brain and controls and coordinates all bodily functions.
nerves	p. 129	Whitish cords made up of bundles of nerve fibers held together by connective tissue, through which impulses are transmitted.
nervous system	p. 128	Body system that consists of the brain, spinal cord, and nerves; controls and coordinates all other systems of the body and makes them work harmoniously and efficiently.
neurology nuh-RAHL-uh-jee	p. 128	Scientific study of the structure, function, and pathology of the nervous system.
nucleus NOO-klee-us	p. 116	Dense, active protoplasm found in the center of the cell; plays an important part in cell reproduction and metabolism.
occipital artery ahk-SIP-it-ul AR-tuh-ree	p. 136	Branch of the external carotid artery that supplies blood to the skin and muscles of the scalp and back of the head up to the crown.
occipital bone ahk-SIP-ih-tul BOHN	p. 119	The hindmost bone of the skull, below the parietal bones; forms the back of the skull above the nape.
occipitalis ahk-SIP-i-tahl-is	p. 123	Back (posterior) portion of the epicranium; muscle that draws the scalp backward.
-ology AHL-O-jee	p. 115	Word ending meaning <i>study of</i> .
ophthalmic nerve ahf-THAL-mik NURV	p. 130	Branch of the fifth cranial nerve that supplies impulses to the skin of the forehead, upper eyelids, and interior portion of the scalp, orbit, eyeball, and nasal passage.
orbicularis oculi muscle or-bik-yuh-LAIR-is AHK-yuh-lye MUS-ul	p. 124	Ring muscle of the eye socket; enables you to close your eyes.
orbicularis oris muscle or-bik-yuh-LAIR-is OH-ris MUS-ul	p. 125	Flat band of muscle around the upper and lower lips that compresses, contracts, puckers, and wrinkles the lips.
organs	p. 117	Structures composed of specialized tissues designed to perform specific functions in plants and animals.
origin	p. 122	The part of the muscle that does not move; attached closest to the skeleton.
parietal artery puh-RY-ate-ul ART-uh-ree	p. 135	Branch of the superficial temporal artery that supplies blood to the side and crown of the head.

parietal bones puh-RY-uh-tul BOHNS	p. 119	Bones that form the sides and top of the cranium.
patella pah-TEL-lah	p. 121	Also known as <i>accessory bone</i> or <i>kneecap</i> ; forms the kneecap joint.
pectoralis major pek-tor-AL-is MAY-jor	p. 125	Muscles of the chest that assist the swinging movements of the arm.
pectoralis minor pek-tor-AL-is MY-nur	p. 125	Muscles of the chest that assist the swinging movements of the arm.
peripheral nervous system puh-RIF-uh-rul NURV-vus SIS-tum	p. 128	Abbreviated PNS; system of nerves that connects the peripheral (outer) parts of the body to the central nervous system; it has both sensory and motor nerves.
peroneus brevis per-oh-NEE-us BREV-us	p. 127	Muscle that originates on the lower surface of the fibula. It bends the foot down and out.
peroneus longus per-oh-NEE-us LONG-us	p. 127	Muscle that covers the outer side of the calf; inverts the foot and turns it outward.
phalanges fuh-LAN-jeez (singular: phalanx [FAY-langks])	p. 121	Singular: phalanx. Also known as <i>digits</i> ; bones of the fingers or toes; one of the three subdivisions of the foot. The other two subdivisions are the tarsal and metatarsal.
physiology fiz-ih-OL-oh-jee	p. 115	The study of the functions and activities performed by the body's structures.
pineal gland PY-nee-ul GLAND	p. 139	Endocrine system gland that plays a major role in sexual development, sleep, and metabolism.
pituitary gland puh-TOO-uh-tair-ee GLAND	p. 139	The most complex organ of the endocrine system. This gland affects almost every physiologic process of the body: growth, blood pressure, contractions during childbirth, breast-milk production, sexual organ functions in both women and men, thyroid gland function, and the conversion of food into energy (metabolism).
platysma muscle plah-TIZ-muh MUS-ul	p. 123	Broad muscle extending from the chest and shoulder muscles to the side of the chin; responsible for lowering the lower jaw and lip.
popliteal artery pop-lih-TEE-ul ART-uh-ree	p. 136	Artery that supplies blood to the foot; divides into two separate arteries known as the anterior tibial artery and the posterior tibial artery.
posterior auricular artery poh-STEER-ee-ur aw-RIK-yuh-lur ART-tuh-ree	p. 136	Branch of the external carotid artery that supplies blood to the scalp, the area behind and above the ear, and the skin behind the ear.
posterior auricular nerve poh-STEER-ee-ur aw-RIK-yuh-lur NURV	p. 131	Branch of the seventh cranial nerve that affects the muscles behind the ear at the base of the skull.
posterior tibial artery poh-STEER-ee-ur TIB-ee-al ART-uh-ree	p. 136	One of the popliteal arteries (the other is the anterior tibial artery) that supplies blood to the ankle and the back of the lower leg.
procerus muscle proh-SEE-rus MUS-ul	p. 124	Muscle that covers the bridge of the nose, lowers the eyebrows, and causes wrinkles across the bridge of the nose.
pronator proh-NAY-tohr	p. 126	Muscle that turns the hand inward so that the palm faces downward.
protoplasm PROH-toh-plaz-um	p. 115	A colorless, jelly-like substance found inside cells in which food elements such as proteins, fats, carbohydrates, mineral salts, and water are present.

pulmonary circulation PUL-muh-nayr-ee sur-kyoo-LAY-shun	p. 132	The system that takes deoxygenated blood from the heart to the lungs for oxygenation and waste removal and then returns that blood to the heart (left atrium) so oxygen-rich blood can be delivered to the body.
radial artery RAY-dee-ul AR-tur-ree	p. 136	Artery, along with numerous branches, that supplies blood to the thumb side of the arm and the back of the hand; supplies blood to the muscles of the skin, hands, fingers, wrist, elbow, and forearm.
radial nerve RAY-dee-ul NURV	p. 131	Sensory–motor nerve that, with its branches, supplies the thumb side of the arm and back of the hand.
radius RAY-dee-us	p. 121	Smaller bone in the forearm (lower arm) on the same side as the thumb.
reflex REE-fleks	p. 129	Automatic reaction to a stimulus that involves the movement of an impulse from a sensory receptor along the sensory nerve to the spinal cord.
reproductive system ree-proh-DUK-tiv SIS-tum	p. 139	The body system that includes the ovaries, uterine tubes, uterus, and vagina in the female and the testes, prostate gland, penis, and urethra in the male. This system performs the function of producing offspring and passing on the genetic code from one generation to another.
respiratory system RES-puh-rah-tor-ee SIS-tum	p. 118	Body system consisting of the lungs and air passages; makes blood and oxygen available to body structures through respiration (breathing) and eliminating carbon dioxide.
ribs	p. 121	Twelve pairs of bones forming the wall of the thorax.
risorius muscle rih-ZOR-ee-us MUS-ul	p. 125	Muscle of the mouth that draws the corner of the mouth out and back, as in grinning.
saphenous nerve sa-FEEN-us NURV	p. 132	Nerve of the leg that supplies impulses to the skin of the inner side of the leg and foot.
scapula SKAP-yuh-luh	p. 121	Also known as <i>shoulder blade</i> ; large, flat, triangular bone of the shoulder. There are two scapulae.
sciatic nerve sy-AT-ik NURV	p. 131	Largest and longest nerve in the body; it passes through the gluteal region into the thigh, where it branches into smaller nerves. Pain from injury or compression of the sciatic nerve can radiate throughout the abdomen and be sensed in the lower back, hip, or lower abdomen.
sensory nerves	p. 129	Also known as <i>afferent nerves</i> (AAF-eer-ent NURVS); carry impulses or messages from the sense organs to the brain, where sensations of touch, cold, heat, sight, sound, taste, smell, pain, and pressure are experienced.
serratus anterior ser-RAT-us an-TEER-ee-or	p. 125	Muscle of the chest that assists in breathing and in raising the arm.
seventh cranial nerve	p. 130	Also known as <i>facial nerve</i> ; is the chief motor nerve of the face. Its divisions and their branches supply and control all the muscles of facial expression. It emerges near the lower part of the ear and extends to the muscles of the neck.
skeletal system	p. 118	Forming the physical foundation of the body, it composed of 206 bones that vary in size and shape and are connected by movable and immovable joints.
skull	p. 119	Skeleton of the head; divided into two parts: cranium and facial skeleton.

soleus SO-lee-us	p. 127	Muscle that originates at the upper portion of the fibula and bends the foot down.
sphenoid bone SFEEN-oyd BOHN	p. 120	Bone that joins all of the bones of the cranium together.
spinal cord	p. 129	Portion of the central nervous system that originates in the brain and extends down to the lower extremity of the trunk. It is protected by the spinal column.
sternocleidomastoideus STUR-noh-KLEE-ih-doh-mas-TOYD-ee-us	p. 123	Muscle of the neck that lowers and rotates the head.
sternum STUR-num	p. 121	Also known as <i>breastbone</i> ; flat bone that forms the ventral (front) support of the ribs.
submental artery sub-MEN-tul ART-uh-ree	p. 135	Branch of the facial artery that supplies blood to the chin and lower lip.
superficial peroneal nerve soo-pur-FISH-ul pare-oh-NEE-uhl NURV	p. 132	Also known as <i>musculocutaneous nerve</i> (MUS-kyoo-loh-kyoo-TAY-nee-us NURV); extends down the leg, just under the skin, supplying impulses to the muscles and the skin of the leg, as well as to the skin and toes on the top of the foot, where it becomes the dorsal nerve.
superficial temporal artery soo-pur-FISH-ul TEM-puh-rul AR-tuh-ree	p. 135	A continuation of the external carotid nerve artery; supplies blood to the muscles of the front, side, and top of the head.
superior labial artery soo-PEER-ee-ur LAY-bee-ul AR-tuh-ree	p. 135	Branch of the facial artery that supplies blood to the upper lip and region of the nose.
supinator SOO-puh-nayt-ur	p. 126	Muscle of the forearm that rotates the radius outward and the palm upward.
supraorbital artery soo-pruh-OR-bih-tul AR-tuh-ree	p. 134	Branch of the internal carotid artery that supplies blood to the upper eyelid and forehead.
sural nerve SUR-ul NURV	p. 132	Nerve of the lower leg that supplies impulses to the skin on the outer side and back of the foot and leg.
systemic circulation sis-TEM-ik sur-kyoo-LAY-shun	p. 132	Also known as <i>general circulation</i> ; system that carries the oxygen-rich blood from the heart throughout the body and returns deoxygenated blood back to the heart.
talus TA-lus	p. 122	Also known as <i>ankle bone</i> ; one of three bones that comprise the ankle joint. The other two bones are the tibia and fibula.
tarsal TAHR-sul	p. 122	One of three subdivisions of the foot. There are seven bones—talus, calcaneus, navicular, three cuneiform bones, and the cuboid. The other two subdivisions are the metatarsal and the phalanges.
temporal bones TEM-puh-rul BOHNS	p. 119	Bones that form the sides of the head in the ear region.
temporal nerve TEM-poh-rul NURV	p. 131	Branch of the seventh cranial nerve that affects the muscles of the temple, side of the forehead, eyebrow, eyelid, and upper part of the cheek.
thorax THOR-aks	p. 121	Also known as <i>chest</i> or <i>pulmonary trunk</i> (PUL-muh-nayr-ee TRUNK); consists of the sternum, ribs, and thoracic vertebrae; elastic, bony cage that serves as a protective framework for the heart, lungs, and other internal organs.

thyroid gland THY-royd GLAND	p. 139	Gland of the endocrine system that controls how quickly the body burns energy (metabolism), makes proteins, and how sensitive the body should be to other hormones.
tibia TIB-ee-ah	p. 121	Larger of the two bones that form the leg below the knee. The tibia may be visualized as a bump on the big-toe side of the ankle.
tibial nerve TIB-ee-al NURV	p. 131	A division of the sciatic nerve that passes behind the knee. It subdivides and supplies impulses to the knee, the muscles of the calf, the skin of the leg, and the sole, heel, and underside of the toes.
tibialis anterior tib-ee-AHL-is an-TEHR-ee-ohr	p. 127	Muscle that covers the front of the shin; bends the foot upward and inward.
tissue TISH-oo	p. 117	A collection of similar cells that perform a particular function.
transverse facial artery tranz-VURS FAY-shul ART-ur-ee	p. 135	Branch of the superficial temporal artery that supplies blood to the skin and masseter muscle.
trapezius trah-PEE-zee-us	p. 125	Muscle that covers the back of the neck and upper and middle region of the back; rotates and controls swinging movements of the arm.
triangularis muscle try-ang-gyuh-LAY-rus MUS-ul	p. 125	Muscle extending alongside the chin that pulls down the corners of the mouth.
triceps TRY-sep	p. 126	Large muscle that covers the entire back of the upper arm and extends the forearm.
ulna UL-nuh	p. 121	Inner and larger bone in the forearm (lower arm); attached to the wrist and located on the side of the little finger.
ulnar artery UL-nur AR-tuh-ree	p. 136	Artery, along with numerous branches, that supplies blood to the little-finger side of the arm and palm of the hand.
ulnar nerve UL-nur NURV	p. 131	Sensory–motor nerve that, with its branches, affects the little-finger side of the arm and palm of the hand.
veins	p. 134	Thin-walled blood vessels that are less elastic than arteries; veins contain cup-like valves that keep blood flowing in one direction to the heart and prevent blood from flowing backward.
venules VEEN-yools	p. 134	Small vessels that connect the capillaries to the veins. They collect blood from the capillaries and drain it into veins.
zygomatic bones zy-goh-MAT-ik BOHNS	p. 120	Also known as <i>malar bones</i> (MAY-lur BOHNS) or <i>cheekbones</i> ; bones that form the prominence of the cheeks.
zygomaticus major muscles zy-goh-mat-ih-kus MAY-jor MUS-uls	p. 125	Muscles on both sides of the face that extend from the zygomatic bone to the angle of the mouth. These muscles pull the mouth backward, upward, and outward, as when you are laughing or smiling.
zygomaticus minor muscles zy-goh-mat-ih-kus MY-nor MUS-uls	p. 125	Muscles on both sides of the face that extend from the zygomatic bone to the upper lips. These muscles pull the upper lip backward, upward, and outward, as when you are smiling.