

6 General Anatomy and Physiology

Chapter Outline

Why Study Anatomy and Physiology?

Anatomy, Physiology, and You

Cells

Tissues

Organs and Body Systems

The Skeletal System

The Muscular System

The Nervous System

The Circulatory System

The Lymphatic/Immune System

The Endocrine System

The Digestive System

The Excretory System

The Respiratory System

The Integumentary System

The Reproductive System



Learning Objectives

After completing this chapter, you will be able to:

- ✓ **LO1** Define and explain the importance of anatomy, physiology, and histology to the cosmetology profession.
- ✓ **LO2** Describe cells, their structure, and their reproduction.
- ✓ **LO3** Define tissue and identify the types of tissues found in the body.
- ✓ **LO4** Name the 9 major body organs and the 11 main body systems and explain their basic functions.

Key Terms

Page number indicates where in the chapter the term is used.

abductor digiti minimi pg. 126	auricularis anterior pg. 121	capillaries pg. 133	common peroneal nerve pg. 130
abductor hallucis pg. 126	auricularis posterior pg. 121	cardiac muscle pg. 120	connective tissue pg. 114
abductors pg. 125	auricularis superior pg. 121	carpus (wrist) pg. 119	corrugator muscle pg. 122
adductors pg. 125	auriculotemporal nerve pg. 128	catabolism pg. 114	cranium pg. 116
adipose tissue pg. 114	autonomic nervous system (ANS) pg. 126	cell membrane pg. 113	cytoplasm pg. 113
adrenal glands pg. 138	axon pg. 127	cells pg. 113	deep peroneal nerve (anterior tibial nerve) pg. 130
anabolism pg. 114	axon terminal pg. 127	central nervous system (CNS) pg. 126	deltoid pg. 124
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arteries pg. 133	brain pg. 127	clavicle (collarbone) pg. 118	digital nerve pg. 129
arterioles pg. 133	buccal nerve pg. 129	common carotid arteries pg. 134	
atrium pg. 131	buccinator muscle pg. 123		

Key Terms

Page number indicates where in the chapter the term is used.

dorsal nerve (dorsal cutaneous nerve) pg. 130	fifth cranial nerve (trifacial nerve, trigeminal nerve) pg. 128	internal carotid artery pg. 134	mentalis muscle pg. 123
dorsalis pedis artery pg. 136	flexor digiti minimi pg. 126	internal jugular vein pg. 136	metabolism pg. 114
eleventh cranial nerve (accessory nerve) pg. 129	flexor digitorum brevis pg. 126	interstitial fluid pg. 137	metacarpus pg. 119
endocrine glands (ductless glands) pg. 137	flexor pg. 125	intestines pg. 115	metatarsal pg. 119
endocrine system pg. 137	frontal artery pg. 135	joint pg. 116	middle temporal artery pg. 135
epicranial aponeurosis pg. 121	frontal bone pg. 117	kidneys pg. 115	mitosis pg. 113
epicranium (occipito-frontalis) pg. 121	frontalis pg. 121	lacrimal bones pg. 118	mitral valve (bicuspid valve) pg. 132
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excretory system pg. 139	greater auricular nerve pg. 129	levator labii superioris muscle (quadratus labii superioris muscle) pg. 123	muscular system pg. 120
exhalation pg. 140	greater occipital nerve pg. 129	liver pg. 115	myology pg. 120
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extensor hallucis longus pg. 125	histology (microscopic anatomy) pg. 112	lymph capillaries pg. 137	nerve tissue pg. 114
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eyes pg. 115	inferior labial artery pg. 135	mandibular nerve pg. 128	neuron (nerve cell) pg. 127
facial artery (external maxillary artery) pg. 135	infraorbital artery pg. 134	marginal mandibular nerve pg. 129	nonstriated muscles (smooth muscles) pg. 120
facial skeleton pg. 117	infraorbital nerve pg. 128	masseter pg. 122	nucleus pg. 113
femur pg. 119	infratrochlear nerve pg. 128	maxillae pg. 118	occipital artery pg. 135
fibula pg. 119	inhalation pg. 140	maxillary nerve pg. 128	occipital bone pg. 117
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	integumentary system pg. 140	mental nerve pg. 128	-ology pg. 112
			ophthalmic nerve pg. 128

Key Terms

Page number indicates where in the chapter the term is used.

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orbicularis oris muscle pg. 123	posterior auricular nerve pg. 129	smaller occipital nerve (lesser occipital nerve) pg. 129	thorax (chest, pulmonary trunk) pg. 118
organs pg. 114	posterior tibial artery pg. 136	soleus pg. 125	thyroid gland pg. 138
origin pg. 120	procerus muscle pg. 122	sphenoid bone pg. 117	tibia pg. 119
os pg. 115	pronator pg. 125	spinal cord pg. 127	tibial nerve pg. 130
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pectoralis minor pg. 124	respiration pg. 140	supinator pg. 125	ulnar artery pg. 136
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peroneus brevis pg. 125	risorius muscle pg. 123	supratrochlear nerve pg. 129	veins pg. 133
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pineal gland pg. 138	sensory nerves (afferent nerves) pg. 127	tarsal pg. 119	zygomatic bones (malar bones, cheekbones) pg. 118
pituitary gland pg. 138	serratus anterior pg. 124	temporal bones pg. 117	zygomatic nerve pg. 129
plasma pg. 134	seventh cranial nerve (facial nerve) pg. 129	temporal nerve pg. 129	zygomaticus major muscles pg. 123
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platysma muscle pg. 122	skin pg. 115		
popliteal artery pg. 136			

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 in 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.
- 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.

Anatomy, Physiology, and 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.

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** means *study of*.

Histology (his-TAHL-uh-jee), also known as **microscopic anatomy** (mi-kroh-SKAHP-ik ah-NAT-ah-mee), is the study of tiny structures found in living tissues. **LO1**



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. There are trillions of cells in the human body, and they vary widely in size, shape, and purpose.

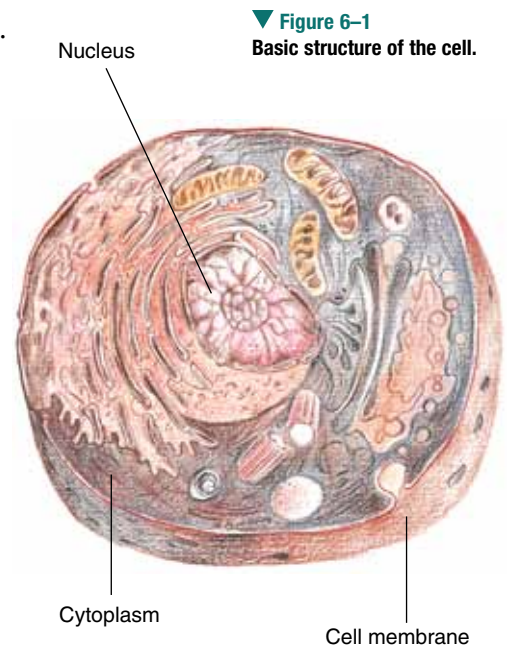
Basic Structure of the Cell

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**).

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 protoplasm of a cell, except for the protoplasm in the nucleus, that surrounds the nucleus; it is the watery fluid that cells need for growth, reproduction, and self-repair.

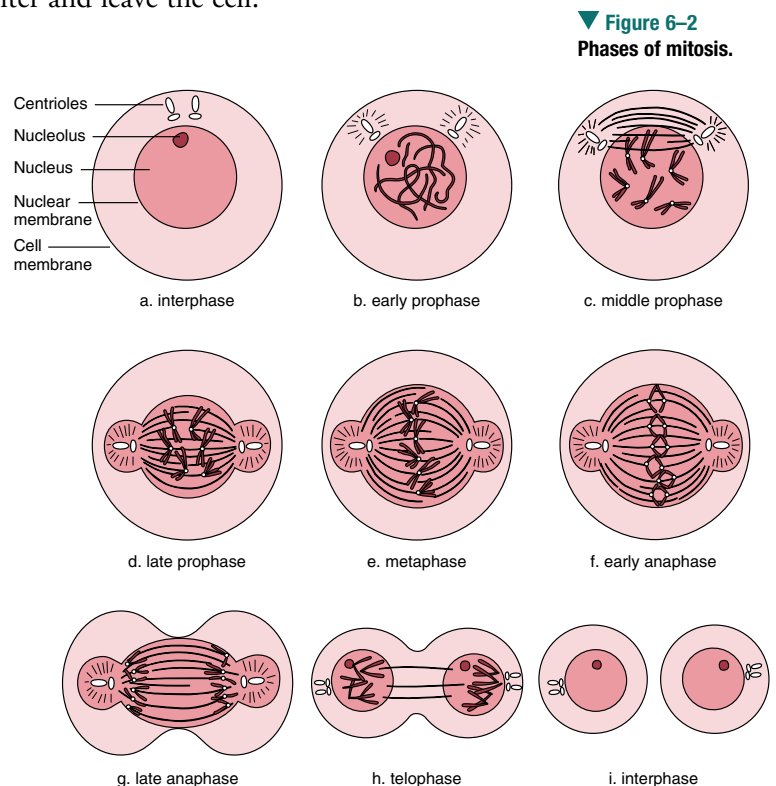
The **cell membrane** (SELL MEM-brayn) is the cell part that encloses the protoplasm and permits soluble substances to enter and leave the cell.

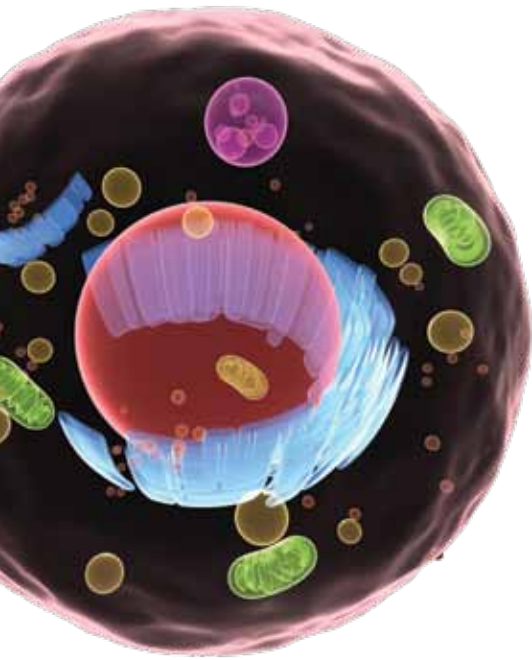


Cell Reproduction and Division

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. Two small structures near the nucleus called **centrioles** (SEN-tree-olz) move to each side during the mitosis process to help divide the cell. 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. If conditions become unfavorable, the cell will become impaired or may die. Unfavorable conditions include toxins (poisons), disease, and injury (**Figure 6–2**). **LO2**





Cell Metabolism

Metabolism (muh-TAB-uh-liz-um) is a chemical process that takes place in living organisms, through which the cells are nourished and carry out their activities. Metabolism has two phases.

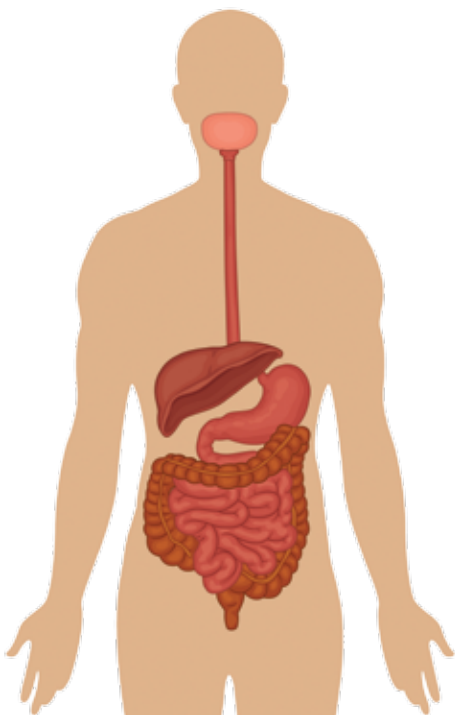
- **Anabolism** (uh-NAB-uh-liz-um) is constructive metabolism, the process of building up larger molecules from smaller ones. During this process, the body stores water, food, and oxygen for the times when these substances will be needed for cell growth, reproduction, or repair.
- **Catabolism** (kuh-TAB-uh-liz-um) is the phase of metabolism that involves the breaking down of complex compounds within the cells into smaller ones. This process releases energy that has been stored.

Anabolism and catabolism are carried out simultaneously and continuously within the cells as part of their normal processes.

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.
- **Epithelial tissue** (ep-ih-THEE-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** 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. **LO3**



Organs and Body Systems

Organs are structures composed of specialized tissues designed to perform specific functions in plants and animals. **Body systems**, also known as **systems**, are groups of body organs acting together to perform one or more functions. **Table 6–1, Nine Major Body Organs**

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NINE MAJOR BODY ORGANS AND THEIR FUNCTIONS

ORGAN	FUNCTION
BRAIN	Controls the body.
EYES	Control the body's vision.
HEART	Circulates the blood.
KIDNEYS	Excrete water and waste products.
LUNGS	Supply oxygen to the blood.
LIVER	Removes waste created by digestion.
SKIN	Covers the body and is the external protective coating.
STOMACH	Digests food, along with the intestines.
INTESTINES	Digest food, along with the stomach.

Table 6-1 Nine Major Body Organs and Their Functions.

and Their Functions, and **Table 6-2** (see next page), Eleven Main Body Systems and Their Functions, list some of the most important organs of the body and the main body systems and their functions. **LO4**

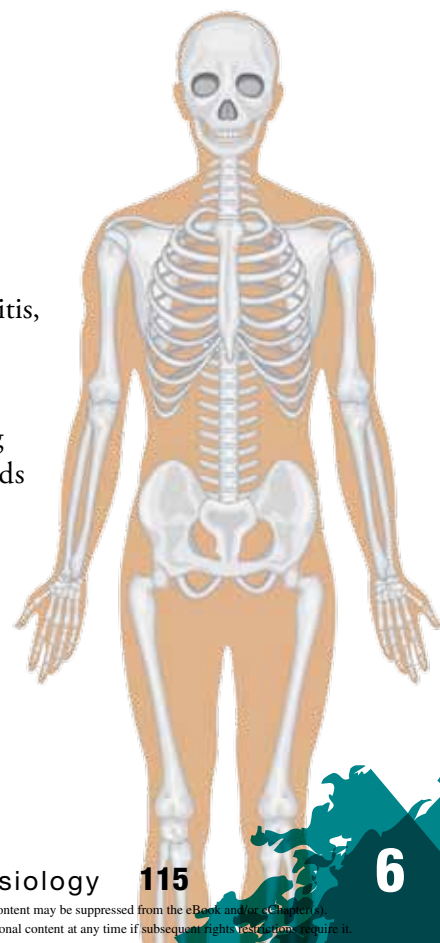
The Skeletal System

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. **Osteology** (ahs-tee-AHL-oh-jee) is the study of the anatomy, structure, and function of the bones. **Os** (AHS) means *bone*. It is used as a prefix in many medical terms, such as osteoarthritis, a joint disease.

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.



ELEVEN MAIN BODY SYSTEMS AND THEIR FUNCTIONS

SYSTEM	FUNCTION
CIRCULATORY	Controls the steady circulation of the blood through the body by means of the heart and blood vessels.
DIGESTIVE	Breaks down foods into nutrients and wastes; consists of mouth, stomach, intestines, salivary and gastric glands, and other organs.
ENDOCRINE	Affects the growth, development, sexual functions, and health of the entire body; consists of specialized glands.
EXCRETORY	Purifies the body by eliminating waste matter; consists of kidneys, liver, skin, large intestine, and lungs.
INTEGUMENTARY	Serves as a protective covering and helps regulate the body's temperature; consists of skin and its accessory organs, such as oil and sweat glands, sensory receptors, hair, and nails.
LYMPHATIC/IMMUNE	Protects the body from disease by developing immunities and destroying disease-causing toxins and bacteria.
MUSCULAR	Covers, shapes, and holds the skeletal system in place; the muscular system contracts and moves various parts of the body.
NERVOUS	Controls and coordinates all other systems of the body and makes them work harmoniously and efficiently; composed of the brain, spinal cord, and nerves.
REPRODUCTIVE	Produces offspring and passes on the genetic code from one generation to another.
RESPIRATORY	Enables breathing, supplying the body with oxygen, and eliminating carbon dioxide as a waste product; consists of the lungs and air passages.
SKELETAL	Forms the physical foundation of the body; composed of 206 bones that vary in size and shape and are connected by movable and immovable joints.

Table 6-2 Eleven Main Body Systems and Their Functions.

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did you know?

Humans are born with over 300 bones in their bodies. Then as we grow, some of these bones fuse together, so that adults end up with only 206 bones.

- 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** 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.

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 6–3**).

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.
- **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

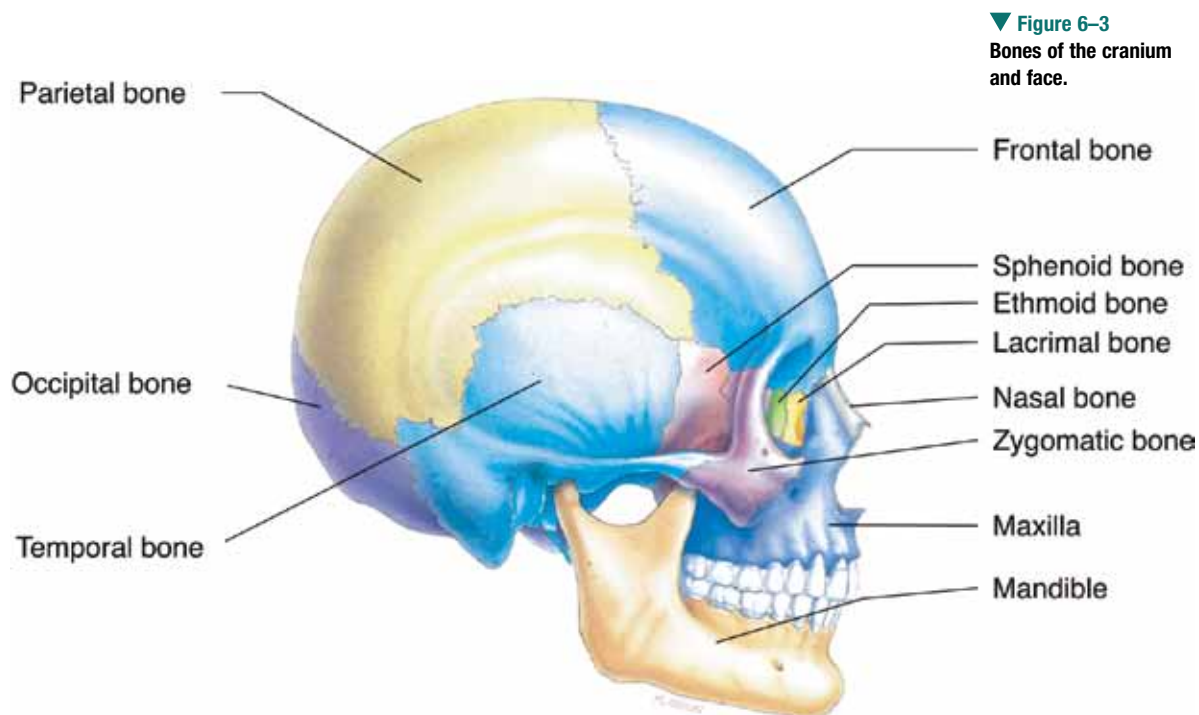
Of the 14 bones of the face, the bones directly involved in facial massage are the following:

- **Nasal bones** (NAY-zul BOHNS). Bones that form the bridge of the nose. There are two nasal 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.



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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.

- **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.

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.
- **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 6–4**).

Bones of the Chest, Shoulder, and Back

The bones of the trunk or torso are the following:

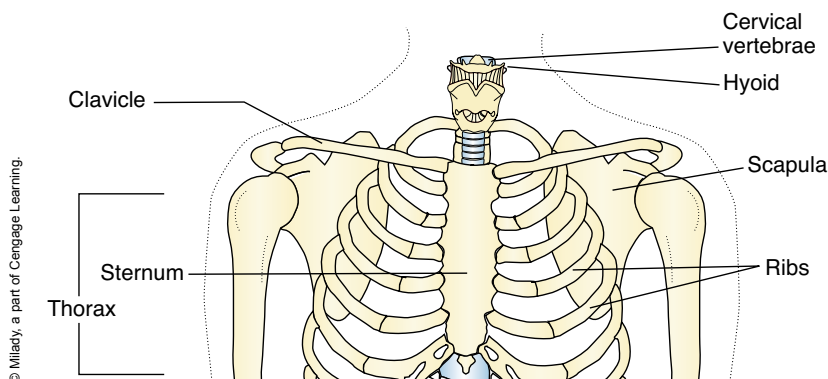
- **Thorax** (THOR-aks), also known as **chest** or **pulmonary trunk**. Consists of the sternum, ribs, and thoracic vertebrae. It is an elastic, bony cage that serves as a protective framework for the heart, lungs, and other internal organs.

- **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 scapulas.
- **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

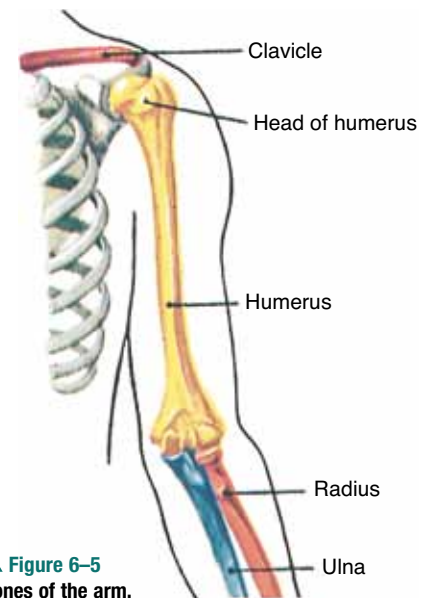
The important bones of the arms and hands that you should know include the following:

- **Humerus** (HYOO-muh-rus). Uppermost and largest bone in the arm, extending from the elbow to the shoulder.



▲ **Figure 6–4**
Bones of the neck, shoulder, and back.

- **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 6–5**).
- **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 6–6**).

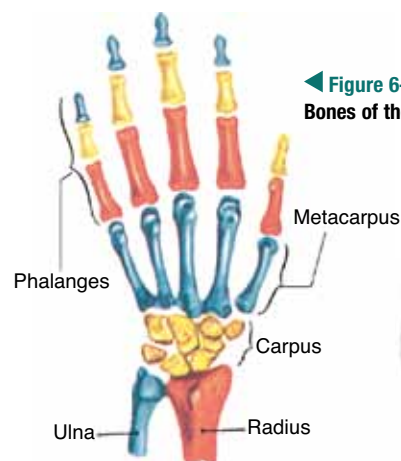


▲ **Figure 6–5**
Bones of the arm.

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 6–7**).



◀ **Figure 6–6**
Bones of the hand.

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 6–8**).



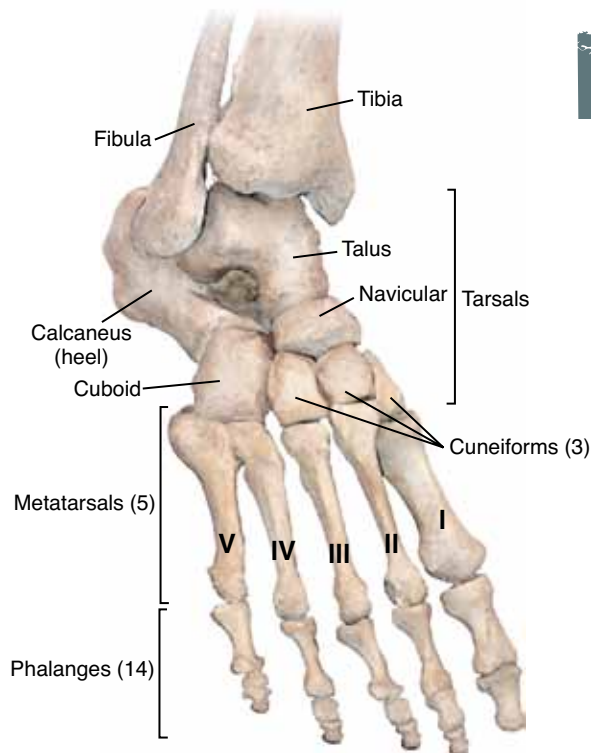
◀ **Figure 6–7**
Bones of the leg.

The Muscular System

The **muscular system** 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.

Myology (my-AHL-uh-jee) is the study of the nature, structure, function, and diseases of the muscles. The human body has over 630 muscles, which are responsible for approximately 40 percent of the body's weight. Muscles are fibrous tissues that have the ability to stretch and contract according to demands of the body's movements. There are three types of muscle tissue.



▲ **Figure 6–8**
Bones of the ankle and foot.

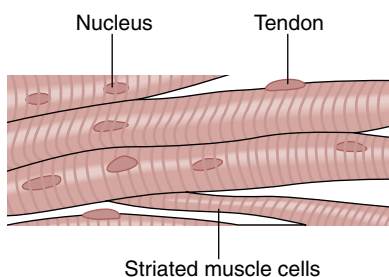
did you know?

Fingernails provide protection for the delicate tips of the phalanges in the hand. If a phalange 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.

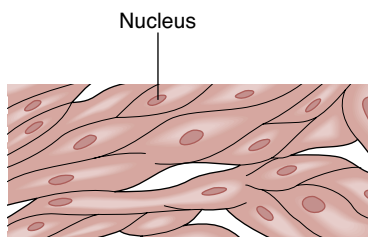
- **Striated muscles** (STRY-ayt-ed MUS-uls), also known as **skeletal muscles**. Muscles that are attached to the bones and are voluntary or are consciously controlled. Striated muscles assist in maintaining the body's posture and protect some internal organs (**Figure 6–9**).
- **Nonstriated muscles** (nahn-STRY-ayt-ed MUS-uls), also known as **smooth muscles**. Muscles that are involuntary and function automatically, without conscious will. These muscles are found in the internal organs of the body, such as the digestive or respiratory systems (**Figure 6–10**).
- **Cardiac muscle**. Involuntary muscle that is the heart. This type of muscle is not found in any other part of the body (**Figure 6–11**).

A muscle has three parts:

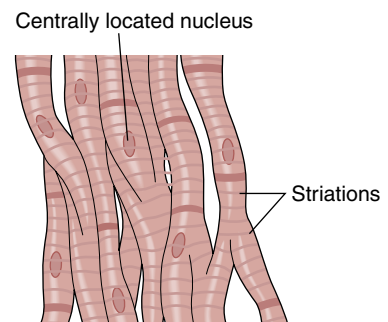
- **Origin**. The part of the muscle that does not move and is attached closest to the skeleton.
- **Belly**. The middle part of the muscle.



▲ **Figure 6–9**
Striated muscle cells.



▲ **Figure 6–10**
Nonstriated muscle cells.



▲ **Figure 6–11**
Cardiac muscle cells.

- **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.
- 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).

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.

Muscles of the Scalp

The four muscles of the scalp are the following:

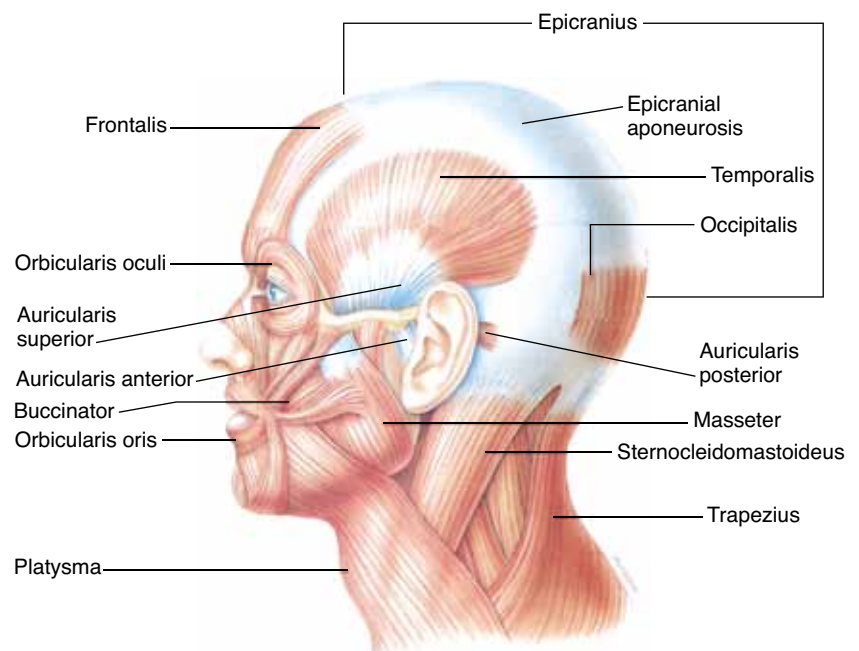
- **Epicranius** (ep-ih-KRAY-nee-us), also known as **occipitofrontalis** (ahk-SIP-ih-toh frun-TAY-lus). Broad muscle that covers the top of the skull and consists of the occipitalis and frontalis.
- **Occipitalis** (ahk-SIP-i-tahl-is). Back (posterior) portion of the epicranius; the muscle that draws 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 6–12**).

Muscles of the Ear

The three muscles of the ear are the following:

- **Auricularis superior** (aw-rik-yuh-LAIR-is soo-PEER-ee-ur). Muscle above the ear that draws the ear upward.
- **Auricularis anterior**. Muscle in front of the ear that draws the ear forward.
- **Auricularis posterior**. Muscle behind the ear that draws the ear backward.

▼ **Figure 6–12**
Muscles of the head, face, and neck.



Although these ear muscles have minimal movement in most humans, some people can contract them and wiggle their ears!

Muscles of Mastication (Chewing)

The main muscles of mastication, also known as the *chewing muscles*, are the following:

- **Masseter** (muh-SEE-tur).
- **Temporalis** (tem-poh-RAY-lis).

These muscles coordinate to open and close the mouth and bring the jaw forward or backward, assisted by the pterygoid (THER-ih-goyd) muscles.

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.

Muscles of the Eyebrow

The eyebrow 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 6–13**).

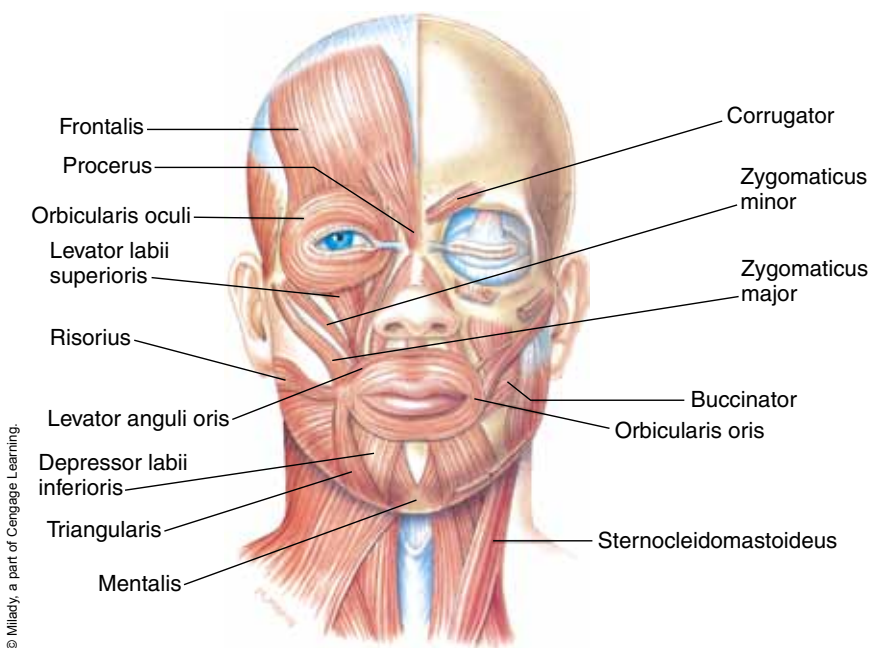
Muscles of the Nose

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.

▼ **Figure 6–13**
Muscles of the face.



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.
- **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 corner of the mouth.
- **Zygomaticus major muscles** (zy-goh-mat-ih-kus MAY-jor MUS-ul). 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-ul). 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. (See Figures 6-12 and 6-13.)

Muscles that Attach the Arms to the Body

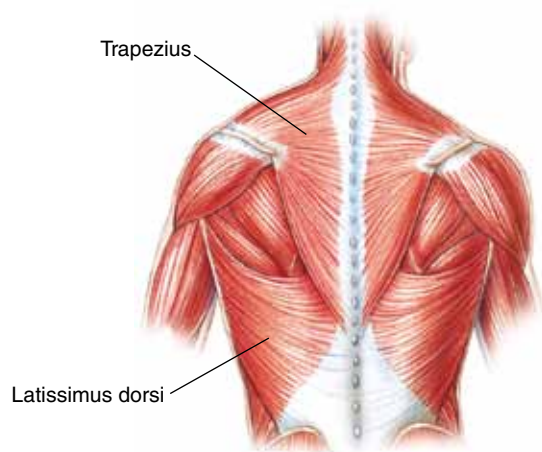
The muscles that attach the arms to the body are the following:

- **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.

did you know?

You have over 30 muscles in your face that control your expressions.





▲ **Figure 6-14**
Muscles of the back that attach the arms to the body.

- **Pectoralis major** (pek-tor-AL-is MAY-jor) and **pectoralis minor**, located under the pectoralis major (not shown in Figure 6-15). 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 6-14 and 6-15).

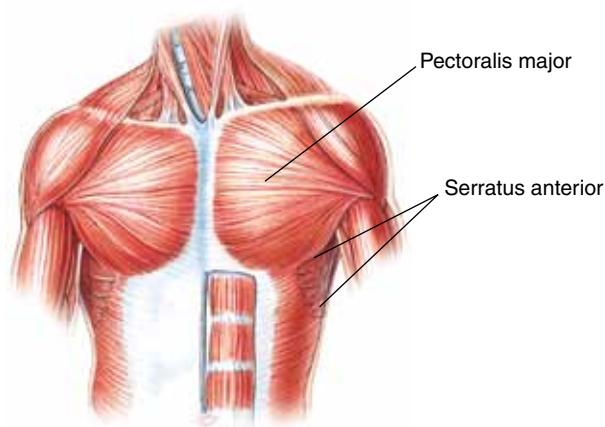
Muscles of the Shoulder and Arm

There are three principal muscles of the shoulders and upper arms (Figure 6-16):

- **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.

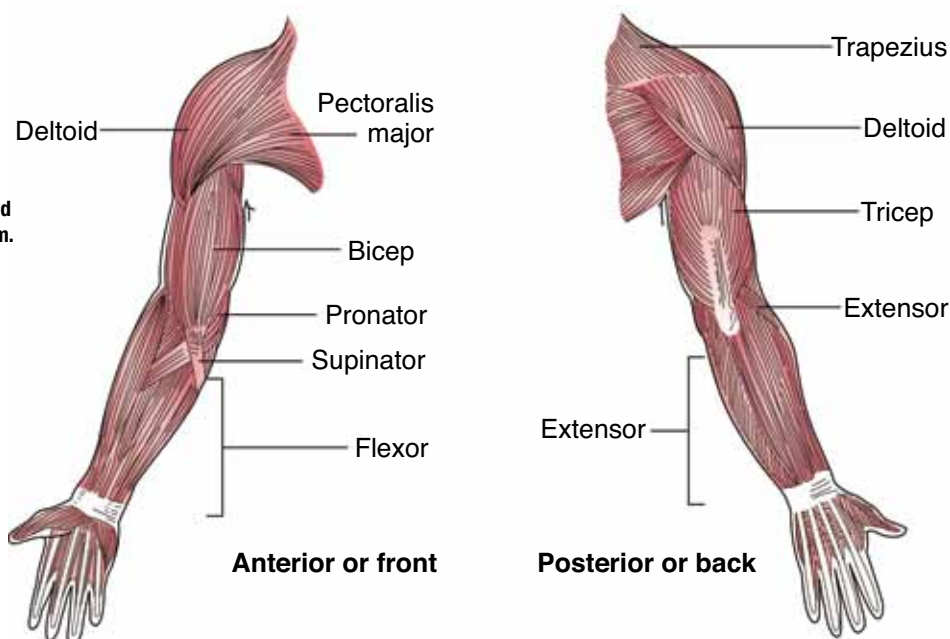
The forearm is made up of a series of muscles and strong tendons (Figure 6-16). As a cosmetologist, you will be concerned with the following muscles of the forearm:

- **Extensors** (ik-STEN-surs). Muscles that straighten the wrist, hand, and fingers to form a straight line.



▲ **Figure 6-15**
Muscles of the chest that attach the arms to the body.

► **Figure 6-16**
Muscles of the anterior and posterior shoulder and arm.

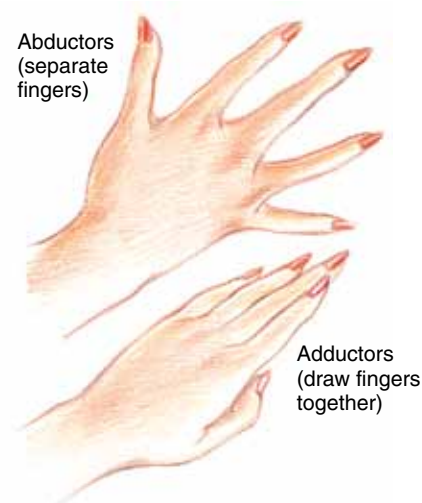


- **Flexor** (FLEK-sur). Extensor muscle of the wrist involved in flexing the wrist.
- **Pronator** (proh-NAY-tohr). Muscle that turns the hand inward so that the palm faces downward.
- **Supinator** (SOO-puh-nayt-ur). Muscle of the forearm that rotates the radius outward and the palm upward.

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 6-17**).



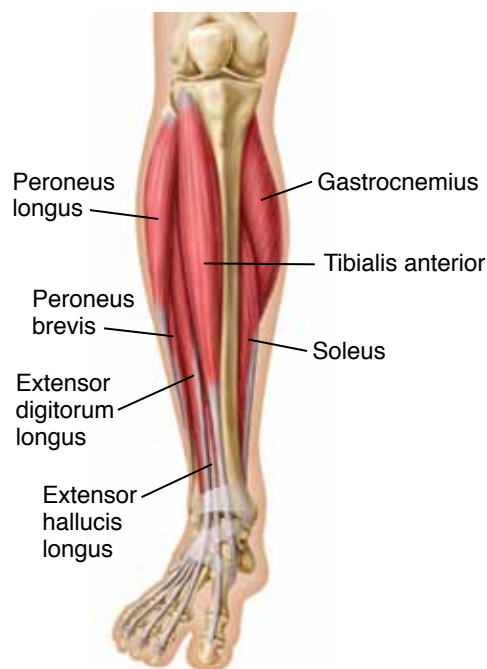
▲ **Figure 6-17**
Muscles of the hand.

Muscles of the Lower Leg and Foot

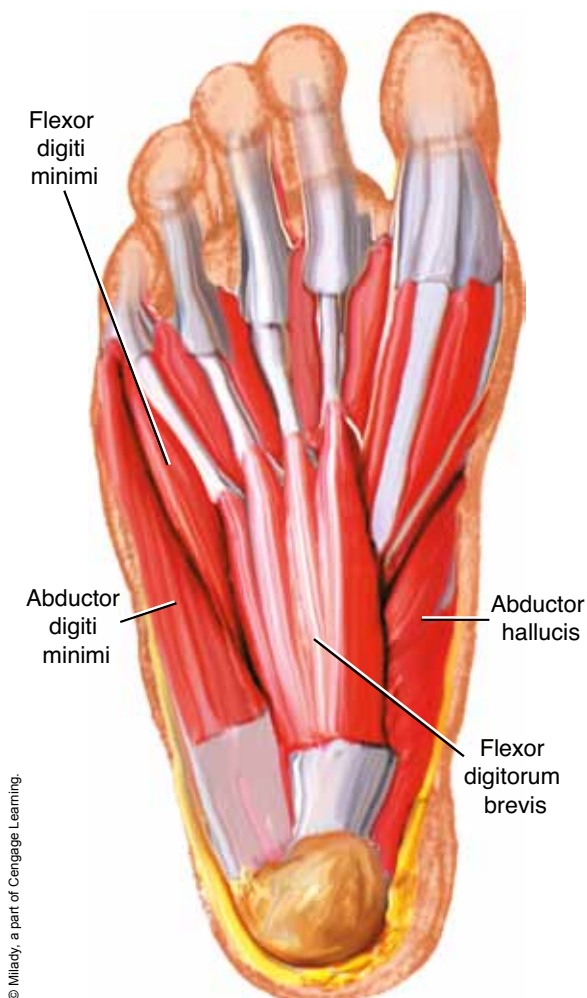
As a cosmetologist, you will use your knowledge of the muscles of the lower leg and foot during a pedicure. The muscles of the foot are small and provide proper support and cushioning for the foot and leg.

The muscles of the lower leg include the following:

- **Extensor digitorum longus** (eck-STEN-sur dij-it-TOHR-um LONG-us). Muscle that bends the foot up and extends the toes.
- **Extensor hallucis longus** (eck-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 6-18**).



▲ **Figure 6-18**
Muscles of the lower leg.



▲ **Figure 6–19**
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 moves the toes and helps maintain balance while walking and standing.
- **Abductor hallucis** (ab-DUK-tohr ha-LU-sis). Muscle that moves the toes and helps maintain balance while walking and standing.
- **Abductor digiti minimi** (ab-DUK-tohr dij-it-ty MIN-eh-mee). Muscle that separates the toes (**Figure 6–19**).

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. Every square inch of the human body is supplied with fine fibers known as nerves. There are over 100 billion nerve cells, known as neurons, in the body. 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. It will also help you understand the effects that these treatments have on the body as a whole.

Divisions of the Nervous System

The nervous system is 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, voluntary functions of the five senses (seeing, hearing, feeling, smelling, and tasting), 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 breathing (**Figure 6–20**).

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 nerve tissue and controls sensation, muscles, activity of glands, and the power to think, sense, and feel. On average, the brain weighs a little less than three pounds. It sends and receives messages through 12 pairs of cranial nerves that originate in the brain and reach various parts of the head, face, and neck.

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.

Nerve Cell Structure and Function

A **neuron** (NOO-rah-n), also known as **nerve cell**, is the primary structural unit of the nervous system, consisting of the cell body, nucleus, dendrites, and the axon.

Dendrites (DEN-dryts) are tree-like branchings of nerve fibers extending from the nerve cell that carry impulses toward the cell and receive impulses from other neurons. The **axon** (AK-sahn) and **axon terminal** (not shown in Figure 6–21) are extensions of a neuron through which impulses are sent away from the cell body to other neurons, glands, or muscles (**Figure 6–21**).

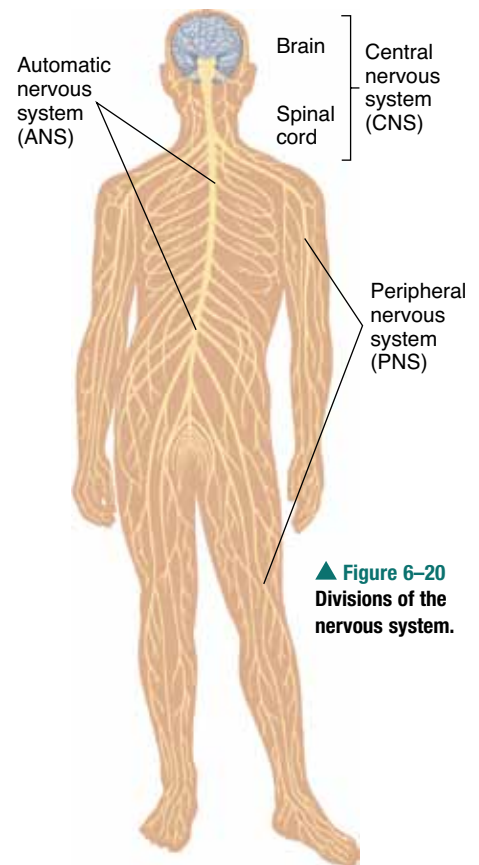
Nerves are whitish cords made up of bundles of nerve fibers held together by connective tissue, through which impulses are transmitted. Nerves have their origin in the brain and spinal cord and send their branches to all parts of the body.

Types of Nerves

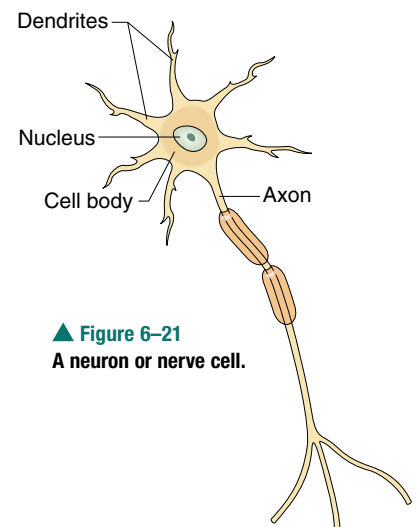
There are two types of nerves:

- **Sensory nerves**, also known as **afferent nerves** (AAF-eer-ent NURVS), carry impulses or messages from the sense organs to the brain, where sensations such as touch, cold, heat, sight, hearing, 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.

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



▲ **Figure 6–20**
Divisions of the
nervous system.



▲ **Figure 6–21**
A neuron or nerve cell.

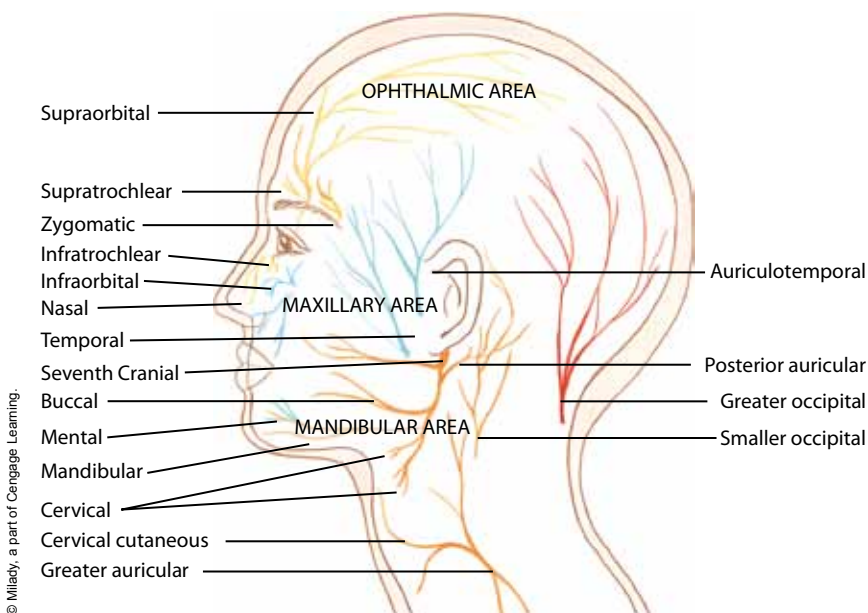
ACTivity

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.

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

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



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▲ **Figure 6–22**
Nerves of the head, face, and neck.

- **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 (**Figure 6–22**).

The following are the branches of the fifth cranial nerve that are affected by massage:

- **Auriculotemporal nerve** (aw-RIK-yuh-loh-TEM-puh-rul NURV). Affects the external ear and skin above the temple, up to the top of the skull.
- **Infraorbital nerve** (in-fruh-OR-bih-tul NURV). Affects the skin of the lower eyelid, side of the nose, upper lip, and mouth.
- **Infratrochlear nerve** (in-frah-TRAHK-lee-ur NURV). Affects the membrane and skin of the nose.
- **Mental nerve** (MEN-tul NURV). Affects the skin of the lower lip and chin.
- **Nasal nerve** (NAY-zul NURV). Affects the point and lower side of the nose.
- **Supraorbital nerve** (soo-pruh-OR-bih-tul NURV). Affects the skin of the forehead, scalp, eyebrow, and upper eyelid.

- **Supratrochlear nerve** (soo-pruh-TRAHK-lee-ur NURV). Affects the skin between the eyes and upper side of the nose.
- **Zygomatic nerve** (zy-goh-MAT-ik NURV). Affects the muscles of the upper part of the cheek.

The **seventh cranial nerve**, also known as **facial nerve**, 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. 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**. 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. Cervical nerves originate at the spinal cord, and their branches supply the muscles and scalp at the back of the head and neck as follows:
 - **Greater occipital nerve**. Located in the back of the head; affects the scalp as far up as the top of the head.
 - **Smaller occipital nerve**, also known as **lesser occipital nerve**. Located at the base of the skull; affects the scalp and muscles behind the ear.
 - **Greater auricular nerve**. Located at the side of the neck; affects the face, ears, neck, and parotid gland.
 - **Cervical cutaneous nerve** (SUR-vih-kul kyoo-TAY-nee-us NURV). Located at the side of the neck; affects the front and sides of the neck as far down as the breastbone.

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

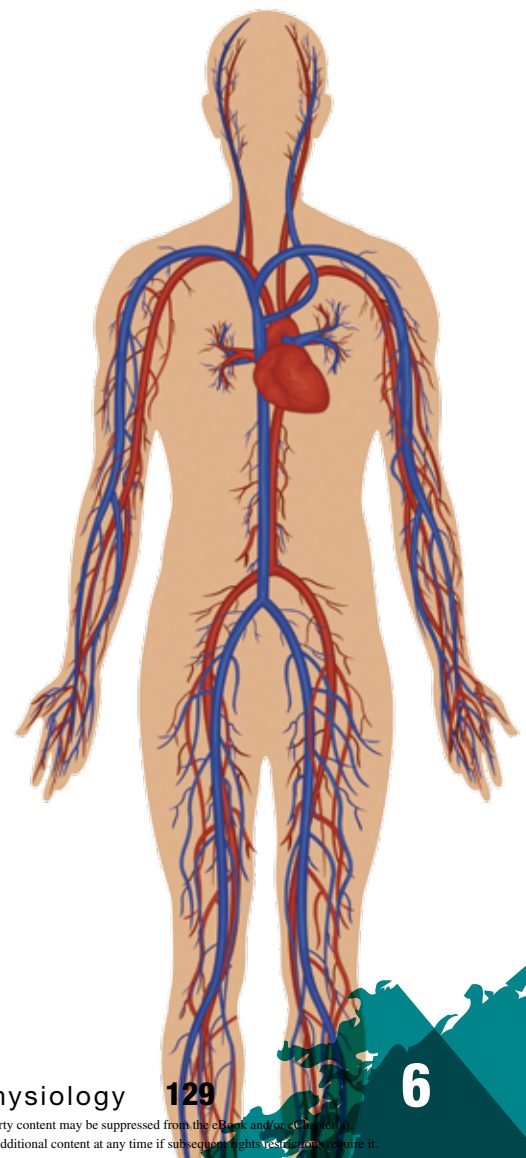
Nerves of the Arm and Hand

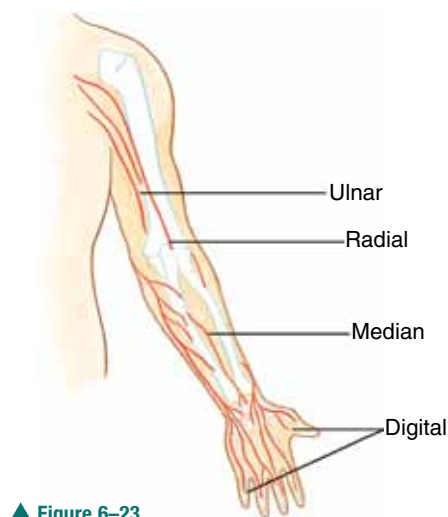
The principal nerves supplying the superficial parts of the arm and hand are the following:

- **Digital nerve** (DIJ-ut-tul NURV). Sensory-motor nerve that, with its branches, supplies impulses to the fingers.

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 6-23**
Nerves of the arm and hand.

did you know?

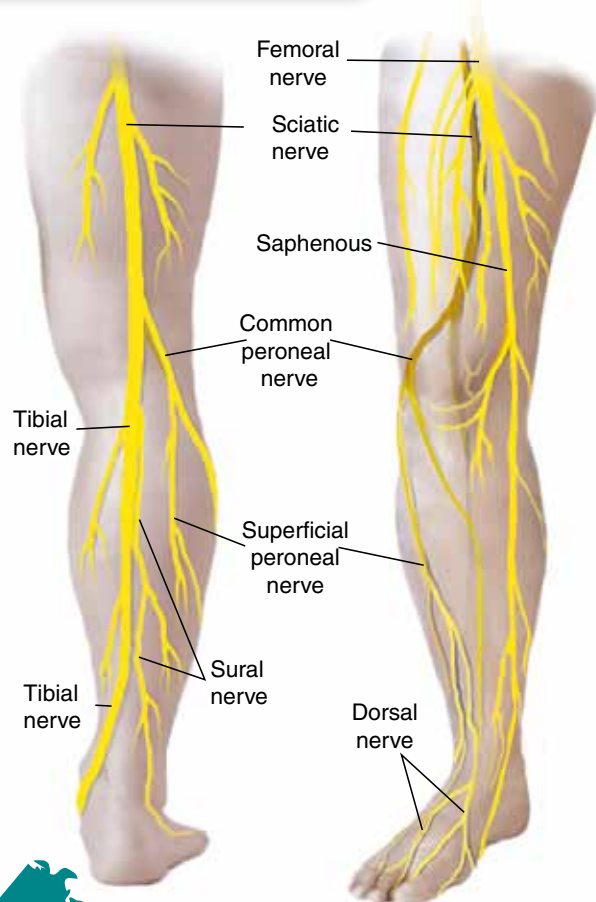
The ulnar nerve runs along the bottom of the elbow. This explains why leaning on the elbows for long periods can cause the little fingers to go numb. This is due to localized inflammation (irritation and swelling) around the nerve.

- **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 6-23**).

Nerves of the Lower Leg and Foot

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

- **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. The **sciatic nerve** (sy-AT-ik NURV) is the largest and longest nerve in the body.
- **Common peroneal nerve** (KAHM-un per-oh-NEE-al NURV). 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.
 - **Deep peroneal nerve**, 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 6-24**).
 - **Superficial peroneal nerve**, 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 6-24**).



◀ **Figure 6-24**
Nerves of the lower leg and foot.

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 heart is enclosed by a double-layered membranous sac known as the **pericardium** (payr-ih-KAR-dee-um), which is made of epithelial tissue.

The heart is approximately the size of a closed fist, weighs about nine ounces, and is located in the chest cavity. The heartbeat is regulated by the vagus (tenth cranial) nerve and other nerves in the autonomic nervous system. A normal adult heart beats about 60 to 80 times per minute, but it can beat as high as 100 times per minute.

The interior of the heart contains four chambers and four valves.

The **atrium** (AY-tree-um) is an upper, thin-walled chamber through which blood is pumped to the ventricles. There is a right atrium and a left atrium.

The **ventricle** (VEN-truh-kul) is a lower, thick-walled chamber that receives blood from the atrium. There is a right ventricle and a left ventricle.

Valves are structures that temporarily close a passage or permit blood flow in only one direction.

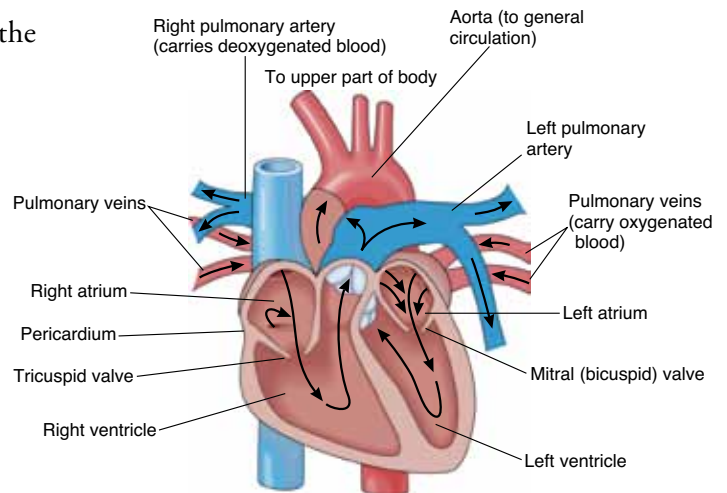
The blood is in constant and continuous circulation from the time that it leaves the heart, is distributed throughout the body, then returns to the heart.

Two systems attend to this circulation:

- **Pulmonary circulation** (PUL-muh-nayr-ee sur-kyoo-LAY-shun). Sends the blood from the heart to the lungs to be purified, then back to the heart again.
- **Systemic circulation** (sis-TEM-ik sur-kyoo-LAY-shun), also known as **general circulation**. Carries the blood from the heart throughout the body and back to the heart.

The following is a brief explanation of how the pulmonary circulation system and the systemic circulation system work:

1. Deoxygenated (oxygen-poor) blood flows from the body into the right atrium.



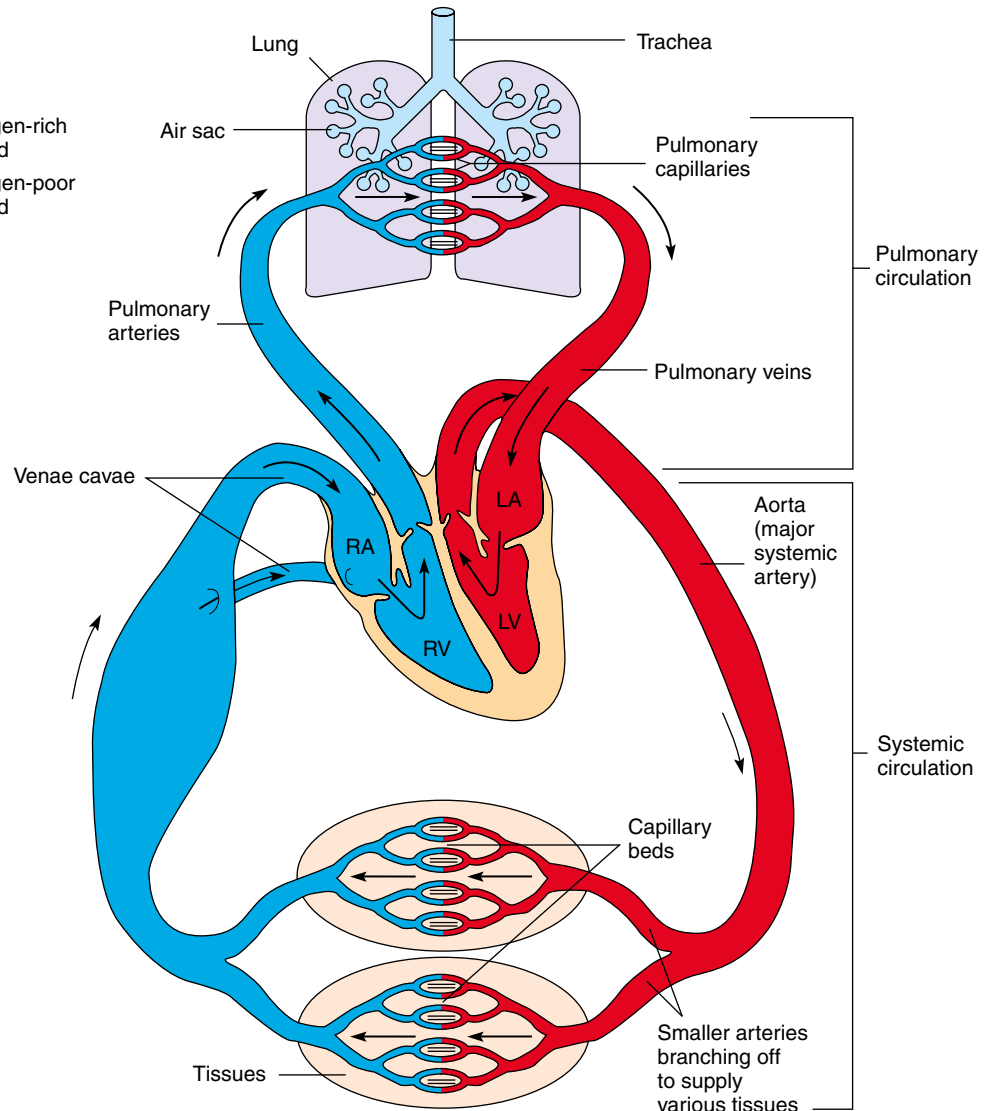
2. From the right atrium, it flows through the **tricuspid valve** (try-KUS-pid VALV), a valve between the right atrium and right ventricle of the heart, into the right ventricle.
3. The right ventricle pumps the blood to the pulmonary arteries, which move the deoxygenated blood to the lungs. When the blood reaches the lungs, it releases the waste gas (carbon dioxide) and receives oxygen. The blood is then considered to be oxygen rich.
4. The oxygen-rich blood returns to the heart through the pulmonary veins and enters the left atrium.
5. From the left atrium, the blood flows through the **mitral valve** (MYE-tral VALV), also known as **bicuspid valve** (by-KUS-pid VALV), the valve between the left atrium and the left ventricle of the heart, into the left ventricle.
6. The blood then leaves the left ventricle and travels throughout the body (**Figure 6–25**).

▼ **Figure 6–25**
Drawing of blood flow through the heart.

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RA = Right atrium
RV = Right ventricle
LA = Left atrium
LV = Left ventricle

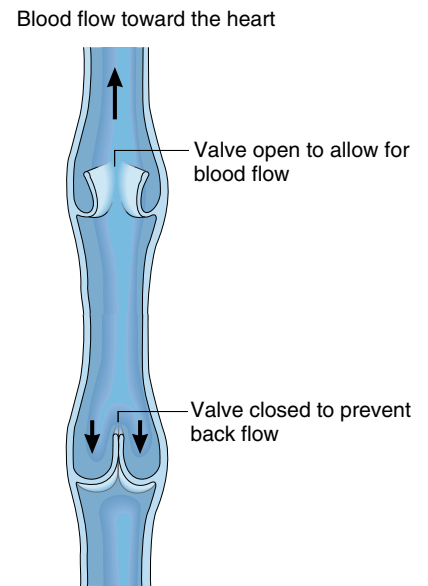
■ oxygen-rich blood
■ oxygen-poor blood



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 found in the body 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**. Tiny, thin-walled blood vessels that connect the smaller arteries to venules. Capillaries bring nutrients to the cells and carry away waste materials.
- **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 6–26**).



▲ **Figure 6–26**
Valves in the veins.

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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, which contribute about $\frac{1}{20}$ th of the body's weight. Blood is approximately 80 percent water. It is sticky and salty, with a normal temperature of 98.6 degrees Fahrenheit (37 degrees Celsius). 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.

Composition of the Blood

Blood is composed of red and white cells, platelets, plasma, and hemoglobin.

- **Red blood cells**. Carry oxygen from the lungs to the body cells and transport carbon dioxide from the cells back to the lungs. Red blood cells contain **hemoglobin** (HEE-muh-gloh-bun), a complex iron protein that binds to oxygen. Hemoglobin gives blood color.

did you know?

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

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!

- **White blood cells**, also known as **white corpuscles** (WHYT KOR-pus-uls) or **leukocytes** (LOO-koh-syts). Perform the function of destroying disease-causing toxins and bacteria.
- **Platelets** (PLAYT-lets). Contribute to the blood-clotting process, which stops bleeding. Platelets are much smaller than red blood cells.
- **Plasma** (PLAZ-muh). Fluid part of the blood in which the red and white blood cells and platelets flow. Plasma is about 90 percent water and contains proteins and sugars. The main function of plasma is to carry food and other useful substances to the cells and to take carbon dioxide away from the cells.

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.

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 6–27**).

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

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

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

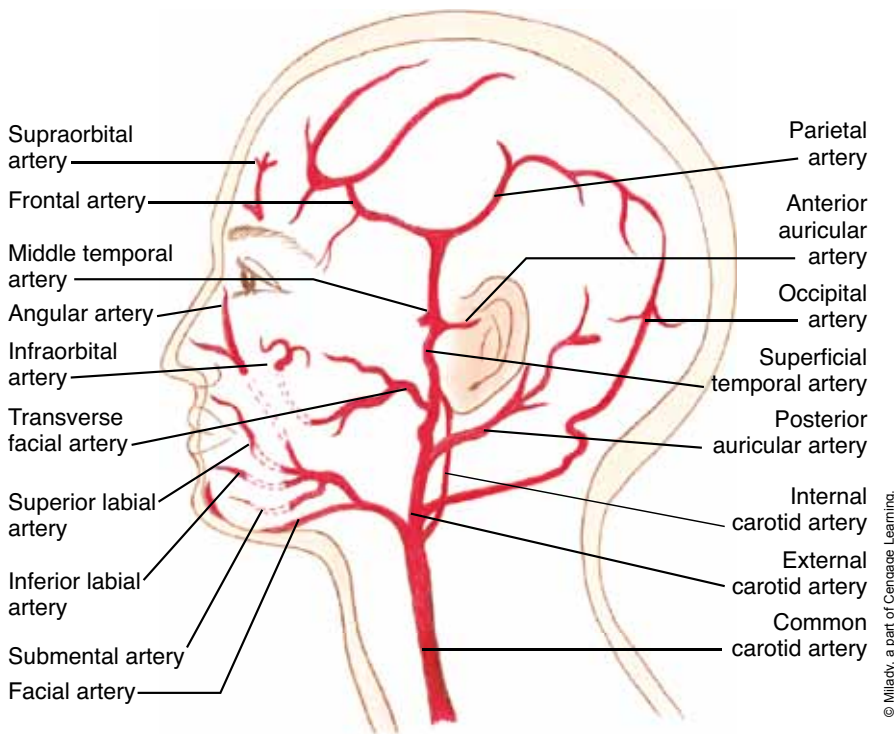


Figure 6–27
Arteries of the head, face, and neck.

The **facial artery**, also known as the **external maxillary artery** (eks-TURN-ul MAK-sah-lair-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**. Supplies blood to the upper lip and region of the nose.

The **superficial temporal artery** 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**. 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.
- **Middle temporal artery**. Supplies blood to the temples.
- **Anterior auricular artery**. Supplies blood to the front part of the ear.

The **occipital artery** supplies blood to the skin and muscles of the scalp and back of the head up to the crown.

The **posterior auricular artery** 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** and its numerous branches supply blood to the little-finger side of the arm and palm of the hand.

The **radial artery** 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 6–28**).

Blood Supply to the Lower Leg and Foot

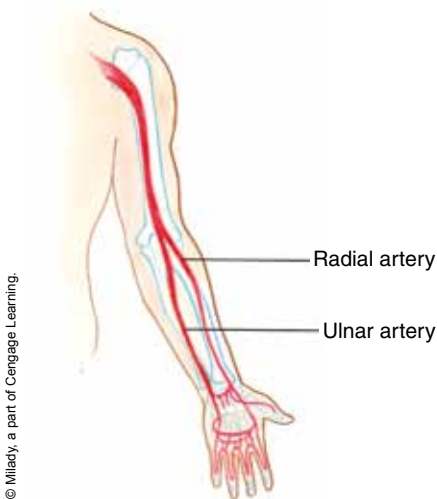
The major arteries that supply blood to the lower leg and foot are the popliteal artery and its branches and the dorsalis pedis artery.

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 6–29**).



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▲ **Figure 6–28**
Arteries of the arm and hand.

The Lymphatic/Immune System

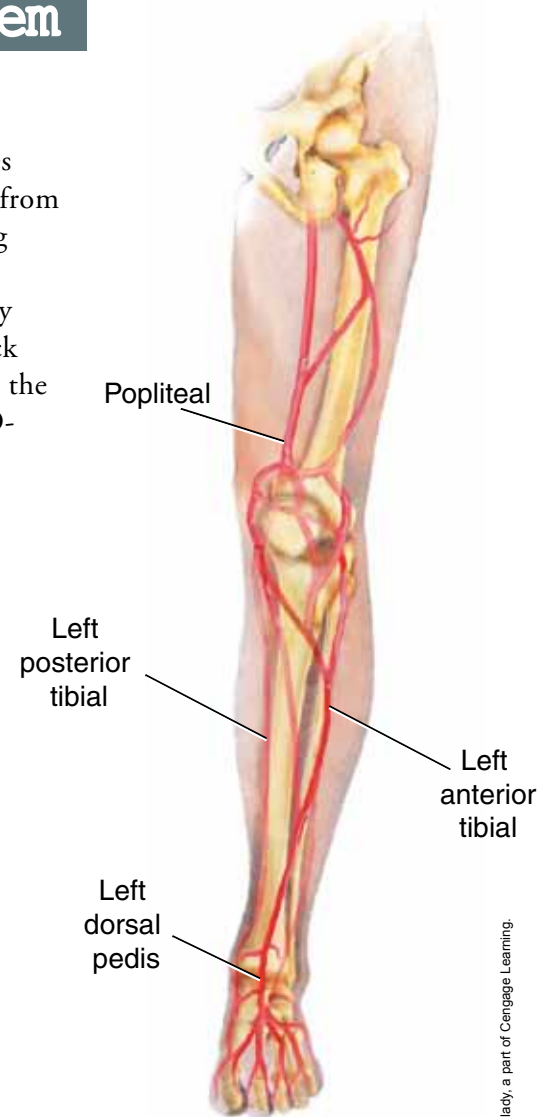
The **lymphatic/immune system** (lim-FAT-ik ih-MYOON SIS-tum) is made up of lymph, lymph nodes, the thymus gland, the spleen, and lymph vessels. The lymphatic/immune system carries waste and impurities away from the cells and protects the body from disease by developing immunities and destroying disease-causing 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 drains the tissue spaces of excess **interstitial fluid** (in-tur-STISH-al FLOO-id), which is blood plasma found in the spaces between tissue cells. 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. The lymph capillaries are distributed throughout most of the body (except the nervous system).

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.
- Remove waste material from the body cells to the blood.
- Provide a suitable fluid environment for the cells.



▲ **Figure 6–29**
Arteries of the lower leg
and foot (left leg view).

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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**, also known as **ductless glands**, such as the thyroid and pituitary glands, release hormonal secretions directly into the bloodstream.

did you know?

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

- **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.
- **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.

The endocrine glands and their functions are as follows:

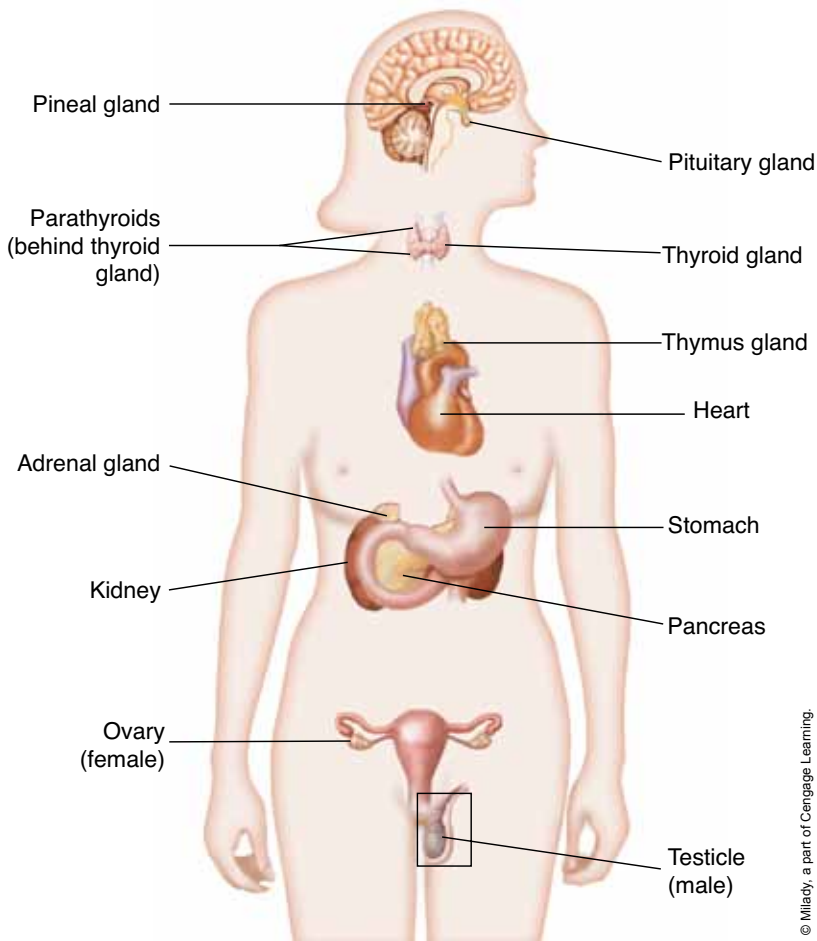
- **Pineal gland** (PY-nee-ul GLAND). Plays a major role in sexual development, sleep, and metabolism.
- **Pituitary gland** (puh-TOO-uh-tair-ee GLAND). Most complex organ of the endocrine system. This gland affects almost every physiologic process of the body: growth, blood pressure, contractions during childbirth, breast-milk production, sexual organ functions in both women and men, thyroid gland function, and the conversion of food into energy (metabolism).
- **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.
- **Parathyroid glands** (payr-uh-THY-royd GLANDZ). Regulate blood calcium and phosphorus levels so that the nervous and muscular systems can function properly.
- **Pancreas** (PANG-kree-us). Secretes enzyme-producing cells that are responsible for digesting carbohydrates, proteins, and fats. The islet of Langerhans cells within the pancreas control insulin and glucagon production.
- **Adrenal glands** (uh-DREEN-ul GLANDZ). Secrete about 30 steroid hormones and control metabolic processes of the body, including the fight-or-flight response.
- **Ovaries** (OH-vah-reez) (singular: ovary). Female sexual glands; function in reproduction, as well as determining female sexual characteristics (**Figure 6–30**).
- **Testes** (TES-teez) (singular: testicle). Male sexual glands; function in reproduction, as well as determining male sexual characteristics (**Figure 6–30**).

did you know?

The endocrine glands and the hormones they secrete have a tremendous influence on your 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.

The Digestive System

The **digestive system** (dy-JES-tiv SIS-tum), also known as **gastrointestinal system** (gas-troh-in-TES-tun-ul SIS-tum), is responsible for breaking down foods into nutrients and waste. The digestive system consists of the mouth, stomach, intestines, salivary and gastric glands, and other organs.



◀ **Figure 6–30**
Endocrine glands and other body organs.

did you know?

The average adult has about 25 feet of intestines. In your lifetime, your digestive system handles about 50 tons of food.

Digestive enzymes (dy-JES-tiv EN-zymz) are chemicals that change certain types of food into a soluble (capable of being dissolved) form that can be used by the body. The food, in soluble form, is transported by the bloodstream and used by the body's cells and tissues. The entire food digestion process takes about nine hours to complete.

did you know?

Your kidneys make sure that your blood is not too thick or too thin and is not overloaded with wastes made by other parts of your body. About 440 gallons of blood flow through your kidneys every day.

The Excretory System

The **excretory system** (EK-skre-tor-ee SIS-tum) is a group of organs, including the kidneys, liver, skin, large intestine, and lungs, that are responsible for purifying the body by eliminating waste matter. The metabolism of body cells forms toxic substances that, if retained, could poison the body.

Each of the following organs plays a crucial function in the excretory system:

- The kidneys excrete urine (water and waste products).
- The liver discharges toxins produced during digestion.
- The skin eliminates waste through perspiration.

did you know?

Your lungs contain almost 1,500 miles of airways that enable you to breathe. Every minute you breathe in about 13 pints of air.

- The large intestine eliminates decomposed and undigested food.
- The lungs exhale carbon dioxide.

The Respiratory System

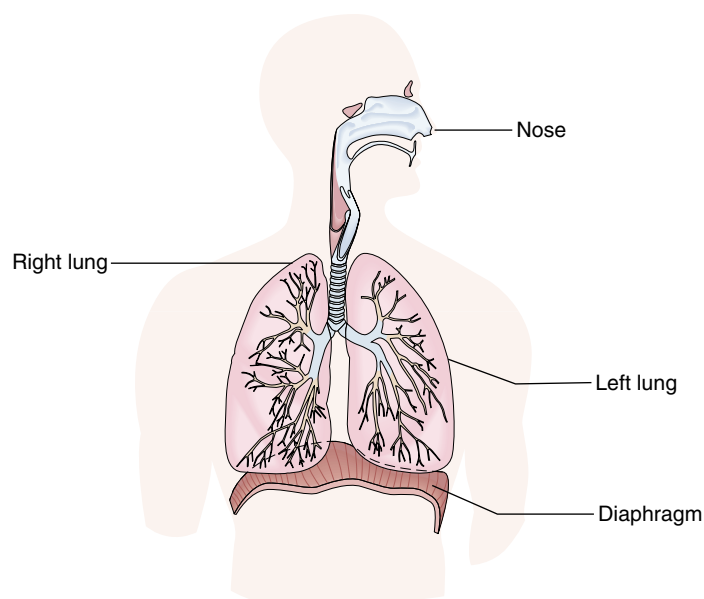
The **respiratory system** (RES-puh-ra-tor-ee SIS-tum) consists of the lungs and air passages; it enables respiration, supplying the body with oxygen and eliminating carbon dioxide. **Respiration**, the act of breathing, is the exchange of carbon dioxide and oxygen in the lungs and within each cell.

The **lungs** are spongy tissues composed of microscopic cells in which inhaled air is exchanged for carbon dioxide during one breathing cycle. They are the organs of respiration. The respiratory system is located

within the chest cavity and is protected on both sides by the ribs. The **diaphragm** (DY-uh-fram) is a muscular wall that separates the thorax (chest) from the abdominal region and helps control breathing.

With each breathing cycle, an exchange of gases takes place. During **inhalation** (in-huh-LAY-shun), or breathing in through the nose or mouth, oxygen is passed into the blood. During **exhalation** (eks-huh-LAY-shun), or breathing outward, carbon dioxide (collected from the blood) is expelled from the lungs.

Oxygen is more essential than either food or water. People may survive for more than sixty days without food and several days without water. If they are deprived of oxygen, they will die within a few minutes (**Figure 6–31**).

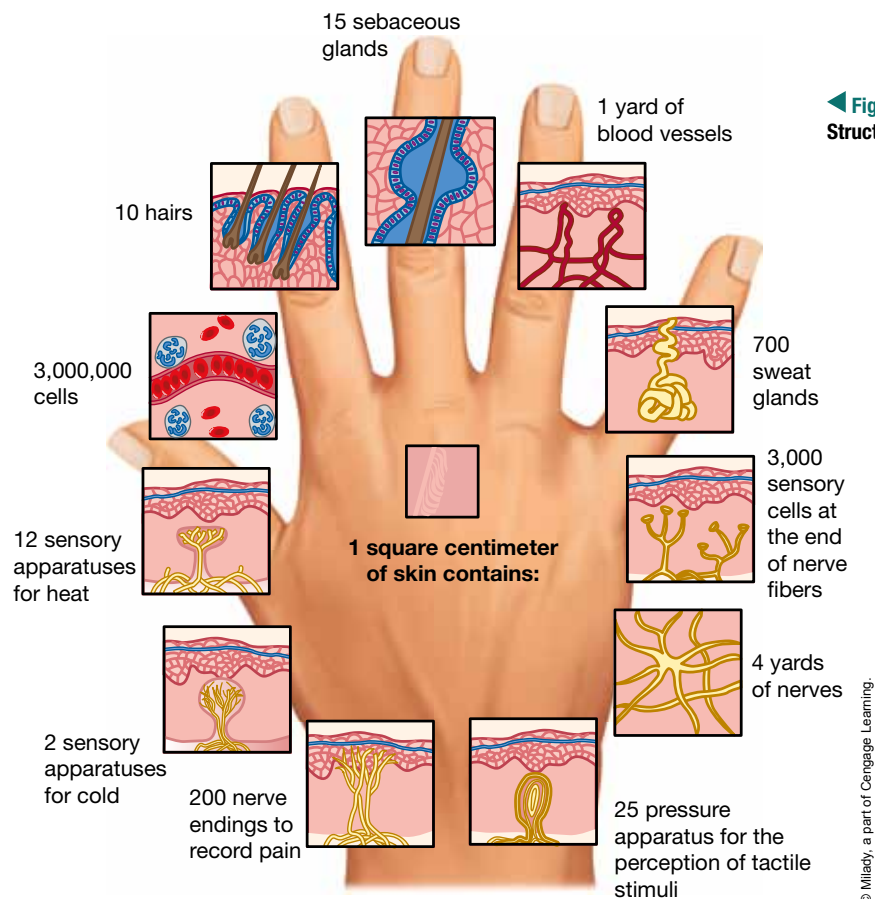


▲ **Figure 6–31**
The respiratory system.

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 6–32**).

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.



◀ **Figure 6-32**
Structures of the skin.

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!

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

The Reproductive System

The **reproductive system** (ree-proh-DUK-tiv SIS-tum) 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.

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.

Review Questions

1. Why is the study of anatomy, physiology, and histology important to cosmetologists?
2. Define anatomy, physiology, and histology.
3. Name and describe the basic structures of a cell.
4. Explain cell metabolism and its purpose.
5. List and describe the functions of the four types of tissue found in the human body.
6. What are organs?
7. List and describe the functions of the 9 major organs found in the body.
8. Name the 11 main body systems and their functions.
9. List the primary functions of the skeletal system.
10. Name and describe the three types of muscular tissue found in the body.
11. Name and describe the types of nerves found in the body and how they react.
12. Name and briefly describe the types of blood vessels found in the body.
13. List and describe the composition of blood.
14. Name and discuss the two main types of glands found in the human body.
15. List the organs of the excretory system and their functions.

Chapter Glossary

abductor digiti minimi	Muscle that separates the fingers and the toes.
abductor hallucis	Muscle that moves the toes and helps maintain balance while walking and standing.
abductors	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	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	Technical term for fat; gives smoothness and contour to the body.
adrenal glands	Glands of the endocrine system that secrete about 30 steroid hormones and control metabolic processes of the body, including the fight-or-flight response.
anabolism	Constructive metabolism, the process of building up larger molecules from smaller ones.
anatomy	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	Branch of the facial artery that supplies blood to the side of the nose.
anterior auricular artery	Branch of the superficial temporal artery that supplies blood to the front part of the ear.
anterior tibial artery	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.

Chapter Glossary

aorta	The largest artery in the body.
arteries	Thick-walled, muscular, flexible tubes that carry oxygenated blood away from the heart to the arterioles.
arterioles	Small arteries that deliver blood to capillaries.
atrium	Upper, thin-walled chamber of the heart through which blood is pumped to the ventricles. There is a right atrium and a left atrium.
auricularis anterior	Muscle in front of the ear that draws the ear forward.
auricularis posterior	Muscle behind the ear that draws the ear backward.
auricularis superior	Muscle above the ear that draws the ear upward.
auriculotemporal nerve	Branch of the fifth cranial nerve that affects the external ear and skin above the temple, up to the top of the skull.
autonomic nervous system	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.
axon	The extension of a neuron through which impulses are sent away from the body to other neurons, glands, or muscles.
axon terminal	The extension of a neuron through which impulses are sent away from the body to other neurons, glands, or muscles.
belly	Middle part of the muscle.
bicep	Muscle that produces the contour of the front and inner side of the upper arm; lifts the forearm and flexes the elbow.
blood	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	Tube-like structures that include arteries, arterioles, capillaries, venules, and veins.
body systems	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	Part of the central nervous system contained in the cranium; largest and most complex nerve tissue and controls sensation, muscles, activity of glands, and the power to think, sense, and feel.
buccal nerve	Branch of the seventh cranial nerve that affects the muscles of the mouth.
buccinator muscle	Thin, flat muscle of the cheek between the upper and lower jaw that compresses the cheeks and expels air between the lips.
capillaries	Tiny, thin-walled blood vessels that connect the smaller arteries to the venules. Capillaries bring nutrients to the cells and carry away waste materials.
cardiac muscle	The involuntary muscle that is the heart. This type of muscle is not found in any other part of the body.
carpus	Also known as <i>wrist</i> ; flexible joint composed of a group of eight small, irregular bones (carpals) held together by ligaments.

Chapter Glossary

catabolism	The phase of metabolism that involves the breaking down of complex compounds within the cells into smaller ones. This process releases energy that has been stored.
cell membrane	Cell part that encloses the protoplasm and permits soluble substances to enter and leave the cell.
cells	Basic units of all living things, from bacteria to plants to animals, including human beings.
central nervous system	Abbreviated CNS; consists of the brain, spinal cord, spinal nerves, and cranial nerves.
centrioles	Structures in a cell near the nucleus that move to each side during the mitosis process to help divide the cell.
cervical cutaneous nerve	Cervical nerve located at the side of the neck; affects the front and sides of the neck as far down as the breastbone.
cervical nerves	Branches of the seventh cranial nerve; originate at the spinal cord and affect the side of the neck and the platysma muscle.
cervical vertebrae	The seven bones of the top part of the vertebral column, located in the neck region.
circulatory system	Also known as <i>cardiovascular system</i> or <i>vascular system</i> ; body system that controls the steady circulation of the blood through the body by means of the heart and blood vessels.
clavicle	Also known as <i>collarbone</i> ; bone that joins the sternum and scapula.
common carotid arteries	Main arteries that supply blood to the head, face, and neck.
common peroneal nerve	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	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 adipose tissue).
corrugator muscle	Muscle located beneath the frontalis and orbicularis oculi muscles that draws the eyebrow down and wrinkles the forehead vertically.
cranium	An oval, bony case that protects the brain.
cytoplasm	The protoplasm of a cell, except for the protoplasm in the nucleus, that surrounds the nucleus; the watery fluid that cells need for growth, reproduction, and self-repair.
deep peroneal nerve	Also known as <i>anterior tibial nerve</i> ; 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	Large, triangular muscle covering the shoulder joint that allows the arm to extend outward and to the side of the body.
dendrites	Tree-like branching of nerve fibers extending from the nerve cell; carry impulses toward the cell and receive impulses from other neurons.
depressor labii inferioris muscle	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.
diaphragm	Muscular wall that separates the thorax from the abdominal region and helps control breathing.

Chapter Glossary

digestive enzymes	Chemicals that change certain types of food into a soluble (capable of being dissolved) form that can be used by the body.
digestive system	Also known as <i>gastrointestinal system</i> ; 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	Sensory-motor nerve that, with its branches, supplies impulses to the fingers.
dorsal nerve	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	Artery that supplies blood to the foot.
eleventh cranial nerve	Also known as <i>accessory nerve</i> ; a motor nerve that controls the motion of the neck and shoulder muscles.
endocrine glands	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	Body system consisting of a group of specialized glands that affect the growth, development, sexual functions, and health of the entire body.
epicranial aponeurosis	Tendon that connects the occipitalis and frontalis muscles.
epicranius	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	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	Light spongy bone between the eye sockets; forms part of the nasal cavities.
excretory system	Body system that consists of a group of organs, including the kidneys, liver, skin, large intestine, and lungs, that are responsible for purifying the body by eliminating waste matter.
exhalation	Breathing outward; expelling carbon dioxide (collected from the blood) from the lungs.
exocrine glands	Also known as <i>duct glands</i> ; 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	Muscle that bends the foot up and extends the toes.
extensor hallucis longus	Muscle that extends the big toe and flexes the foot.
extensors	Muscles that straighten the wrist, hand, and fingers to form a straight line.
external carotid artery	Artery that supplies blood to the anterior (front) parts of the scalp, ear, face, neck, and sides of the head.
external jugular vein	Vein located at the side of the neck that carries blood returning to the heart from the head, face, and neck.
eyes	Body organs that control the body's vision.
facial artery	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.

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facial skeleton	Framework of the face composed of 14 bones.
femur	Heavy, long bone that forms the leg above the knee.
fibula	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	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	Muscle that moves the little toe.
flexor digitorum brevis	Muscle that moves the toes and helps maintain balance while walking and standing.
flexor	Extensor muscle of the wrist involved in flexing the wrist.
frontal artery	Branch of the superficial temporal artery that supplies blood to the forehead and upper eyelids.
frontal bone	Bone that forms the forehead.
frontalis	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	Muscle attached to the lower rear surface of the heel and pulls the foot down.
glands	Organs that remove and release certain elements from the blood to convert them into new compounds.
greater auricular nerve	Cervical nerve that is located at the side of the neck; affects the face, ears, neck, and parotid gland.
greater occipital nerve	Cervical nerve that is located in the back of the head; affects the scalp as far up as the top of the head.
heart	Muscular, cone-shaped organ that keeps the blood moving within the circulatory system.
hemoglobin	Complex iron protein in red blood cells that binds to oxygen; gives blood color.
histology	Also known as <i>microscopic anatomy</i> ; the study of tiny structures found in living tissues.
hormones	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	Uppermost and largest bone in the arm, extending from the elbow to the shoulder.
hyoid bone	U-shaped bone at the base of the tongue that supports the tongue and its muscles.
inferior labial artery	Branch of the facial artery that supplies blood to the lower lip.
infraorbital artery	Branch of the internal carotid artery that supplies blood to the muscles of the eye.
infraorbital nerve	Branch of the fifth cranial nerve that affects the skin of the lower eyelid, side of the nose, upper lip, and mouth.
infratrochlear nerve	Branch of the fifth cranial nerve that affects the membrane and skin of the nose.
inhalation	Breathing in through the nose or mouth.

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insertion	The movable part of the muscle that is farthest from the skeleton.
integumentary system	Body system that consists of skin and its accessory organs, such as the oil and sweat glands, sensory receptors, hair, and nails; serves as a protective covering and helps regulate the body's temperature.
internal carotid artery	Artery that supplies blood to the brain, eyes, eyelids, forehead, nose, and internal ear.
internal jugular vein	Vein located at the side of the neck to collect blood from the brain and parts of the face and neck.
interstitial fluid	Blood plasma found in the spaces between tissue cells.
intestines	Body organ that digests food, along with the stomach.
joint	Connection between two or more bones of the skeleton.
kidneys	Body organs that excrete water and waste products.
lacrimal bones	Small, thin bones located at the front inner wall of the orbits (eye sockets).
latissimus dorsi	Large, flat, triangular muscle covering the lower back.
levator anguli oris muscle	Also known as <i>caninus muscle</i> ; muscle that raises the angle of the mouth and draws it inward.
levator labii superioris muscle	Also known as <i>quadratus labii superioris muscle</i> ; muscle surrounding the upper lip; elevates the upper lip and dilates the nostrils, as in expressing distaste.
liver	Body organ that removes waste created by digestion.
lungs	Spongy tissues composed of microscopic cells in which inhaled air is exchanged for carbon dioxide during one breathing cycle; organs of respiration.
lymph	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	Blind-end tubes that are the origin of lymphatic vessels.
lymph nodes	Gland-like structures found inside lymphatic vessels; filter the lymphatic vessels and help fight infection.
lymphatic/immune system	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	Lower jawbone; largest and strongest bone of the face.
mandibular nerve	Branch of the fifth cranial nerve that affects the muscles of the chin, lower lip, and external ear.
marginal mandibular nerve	Branch of the seventh cranial nerve that affects the muscles of the chin and lower lip.
masseter	Muscles that coordinate with the temporalis and pterygoid muscles to open and close the mouth and bring the jaw forward; sometimes referred to as chewing muscles.
maxillae (singular: maxilla)	Bones of the upper jaw.

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maxillary nerve	Branch of the fifth cranial nerve that supplies impulses to the upper part of the face.
median nerve	Sensory-motor nerve that is smaller than the ulner and radial nerves and that, with its branches, supplies the arm and hand.
mental nerve	Branch of the fifth cranial nerve that affects the skin of the lower lip and chin.
mentalis muscle	Muscle that elevates the lower lip and raises and wrinkles the skin of the chin.
metabolism	Chemical process that takes place in living organisms, through which the cells are nourished and carry out their activities; metabolism has two phases: anabolism and catabolism.
metacarpus	Bones of the palm of the hand; parts of the hand containing five bones between the carpus and phalanges.
metatarsal	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	Branch of the superficial temporal artery that supplies blood to the temples.
mitosis	Usual process of cell reproduction of human tissues that occurs when the cell divides into two identical cells called daughter cells.
mitral valve	Also known as <i>bicuspid valve</i> ; the valve between the left atrium and the left ventricle of the heart.
motor nerves	Also known as <i>efferent nerves</i> ; carry impulses from the brain to the muscles or glands.
muscle tissue	Tissue that contracts and moves various parts of the body.
muscular system	Body system that covers, shapes, and holds the skeleton system in place; muscular system contracts and moves various parts of the body.
myology	Study of the nature, structure, function, and diseases of the muscles.
nasal bones	Bones that form the bridge of the nose.
nasal nerve	Branch of the fifth cranial nerve that affects the point and lower side of the nose.
nerve tissue	Tissue that carries messages to and from the brain and controls and coordinates all bodily functions.
nerves	Whitish cords made up of bundles of nerve fibers held together by connective tissue, through which impulses are transmitted.
nervous system	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	Scientific study of the structure, function, and pathology of the nervous system.
neuron	Also known as <i>nerve cell</i> ; primary structural unit of the nervous system, consists of the cell body, nucleus, dendrites, and axon.
nonstriated muscles	Also known as <i>smooth muscles</i> ; these muscles are involuntary and function automatically, without conscious will.

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nucleus	Dense, active protoplasm found in the center of the cell; plays an important part in cell reproduction and metabolism.
occipital artery	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	Hindmost bone of the skull, below the parietal bones; forms the back of the skull above the nape.
occipitalis	Back (posterior) portion of the epicranium; muscle that draws the scalp backward.
-ology	Word ending meaning <i>study of</i> .
ophthalmic nerve	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	Ring muscle of the eye socket; enables you to close your eyes.
orbicularis oris muscle	Flat band of muscle around the upper and lower lips that compresses, contracts, puckers, and wrinkles the lips.
organs	Structures composed of specialized tissues designed to perform specific functions in plants and animals.
origin	Part of the muscle that does not move; attached closest to the skeleton.
os	Bone.
osteology	The study of anatomy, structure, and function of the bones.
ovaries (singular: ovary)	Female sexual glands of the endocrine system that function in reproduction, as well as determining female sexual characteristics.
pancreas	Gland of the endocrine system that secretes enzyme-producing cells that are responsible for digesting carbohydrates, proteins, and fats.
parathyroid glands	Glands of the endocrine system that regulate blood calcium and phosphorus levels so that the nervous and muscular systems can function properly.
parietal artery	Branch of the superficial temporal artery that supplies blood to the side and crown of the head.
parietal bones	Bones that form the sides and top of the cranium.
patella	Also known as <i>accessory bone</i> or <i>kneecap</i> ; forms the kneecap joint.
pectoralis major	Muscles of the chest that assist the swinging movements of the arm.
pectoralis minor	Muscles of the chest that assist the swinging movements of the arm.
pericardium	Double-layered membranous sac enclosing the heart; made of epithelial tissue.
peripheral nervous system	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	Muscle that originates on the lower surface of the fibula; bends the foot down and out.

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peroneus longus	Muscle that covers the outer side of the calf; inverts the foot and turns it outward.
phalanges (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	Study of the functions and activities performed by the body's structures.
pineal gland	Endocrine system gland that plays a major role in sexual development, sleep, and metabolism.
pituitary gland	The most complex organ of the endocrine system. It 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).
plasma	Fluid part of the blood in which the red and white blood cells and platelets flow.
platelets	Contribute to the blood-clotting process, which stops bleeding; platelets are much smaller than red blood cells.
platysma muscle	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	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	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	Branch of the seventh cranial nerve that affects the muscles behind the ear at the base of the skull.
posterior tibial artery	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	Muscle that covers the bridge of the nose, lowers the eyebrows, and causes wrinkles across the bridge of the nose.
pronator	Muscle that turn tshe hand inward so that the palm faces downward.
protoplasm	Colorless jelly-like substance found inside cells in which food elements such as protein, fats, carbohydrates, mineral salts, and water are present.
pulmonary circulation	The system that sends the blood from the heart to the lungs to be purified, then back to the heart again.
radial artery	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	Sensory-motor nerve that, with its branches, supplies the thumb side of the arm and back of the hand.
radius	Smaller bone in the forearm (lower arm) on the same side as the thumb.
red blood cells	Blood cells that carry oxygen from the lungs to the body cells and transport carbon dioxide from the cells back to the lungs.

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reflex	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	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.
respiration	Act of breathing; the exchange of carbon dioxide and oxygen in the lungs and within each cell.
respiratory system	Body system consisting of the lungs and air passages; enables respiration (breathing), supplying the body with oxygen and eliminating carbon dioxide.
ribs	Twelve pairs of bones forming the wall of the thorax.
risorius muscle	Muscle of the mouth that draws the corner of the mouth out and back, as in grinning.
saphenous nerve	Nerve of the leg that supplies impulses to the skin of the inner side of the leg and foot.
scapula	Also known as <i>shoulder blade</i> ; large, flat, triangular bone of the shoulder. There are two scapulas.
sciatic nerve	Largest and longest nerve in the body.
sensory nerves	Also known as <i>afferent nerves</i> ; carry impulses or messages from the sense organs to the brain, where sensations of touch, cold, heat, sight, hearing, taste, smell, pain, and pressure are experienced.
serratus anterior	Muscle of the chest that assists in breathing and in raising the arm.
seventh cranial nerve	Also known as <i>facial nerve</i> ; chief motor nerve of the face. Its divisions and their branches supply and control all the muscles of facial expression.
skeletal system	Forms the physical foundation of the body, composed of 206 bones that vary in size and shape and are connected by movable and immovable joints.
skin	Body organ that covers the body and is the external protective coating.
skull	Skeleton of the head; divided into two parts: cranium and facial skeleton.
smaller occipital nerve	Also known as <i>lesser occipital nerve</i> ; cervical nerve located at the base of the skull, affects the scalp and muscles behind the ear.
soleus	Muscle that originates at the upper portion of the fibula and bends the foot down.
sphenoid bone	Bone that joins all of the bones of the cranium together.
spinal cord	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.
sternocleido-mastoideus	Muscle of the neck that lowers and rotates the head.
sternum	Also known as <i>breastbone</i> ; flat bone that forms the ventral (front) support of the ribs.
stomach	Body organ that digests food, along with the intestines.
striated muscles	Also known as <i>skeletal muscles</i> ; muscles that are attached to the bones and that are voluntary or are consciously controlled.

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submental artery	Branch of the facial artery that supplies blood to the chin and lower lip.
superficial peroneal nerve	Also known as <i>musculocutaneous nerve</i> ; 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	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	Branch of the facial artery that supplies blood to the upper lip and region of the nose.
supinator	Muscle of the forearm that rotates the radius outward and the palm upward.
supraorbital artery	Branch of the internal carotid artery that supplies blood to the upper eyelid and forehead.
supraorbital nerve	Branch of the fifth cranial nerve that affects the skin of the forehead, scalp, eyebrow, and upper eyelid.
supratrochlear nerve	Branch of the fifth cranial nerve that affects the skin between the eyes and upper side of the nose.
sural nerve	Nerve of the lower left leg that supplies impulses to the skin on the outer side and back of the foot and leg.
systemic circulation	Also known as <i>general circulation</i> ; system that carries the blood from the heart throughout the body and back to the heart.
talus	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	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	Bones that form the sides of the head in the ear region.
temporal nerve	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.
temporalis	Muscles that coordinate with the masseter and the pterygoid muscles to open and close the mouth and bring the jaw forward; sometimes referred to as chewing muscles.
testes (singular: testicle)	Male sexual glands of the endocrine system that function in reproduction, as well as determining male sexual characteristics.
thorax	Also known as <i>chest</i> or <i>pulmonary trunk</i> ; 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	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	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.

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tibial nerve	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	Muscle that covers the front of the shin; bends the foot upward and inward.
tissue	Collection of similar cells that perform a particular function.
transverse facial artery	Branch of the superficial temporal artery that supplies blood to the skin and masseter muscle.
trapezius	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	Muscle extending alongside the chin that pulls down the corner of the mouth.
tricep	Large muscle that covers the entire back of the upper arm and extends the forearm.
tricuspid valve	Valve between the right atrium and right ventricle of the heart.
ulna	Inner and larger bone in the forearm (lower arm), attached to the wrist and located on the side of the little finger.
ulnar artery	Artery, along with numerous branches, that supplies blood to the little-finger side of the arm and palm of the hand.
ulnar nerve	Sensory-motor nerve that, with its branches, affects the little-finger side of the arm and palm of the hand.
valves	Structures of the heart that temporarily close a passage or permit blood flow in only one direction.
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.
ventricle	A lower, thick-walled chamber of the heart that receives blood pumped from the atrium. There is a right ventricle and a left ventricle.
venules	Small vessels that connect the capillaries to the veins. They collect blood from the capillaries and drain it into veins.
white blood cells	Also known as <i>white corpuscles</i> or <i>leukocytes</i> ; blood cells that perform the function of destroying disease-causing bacteria.
zygomatic bones	Also known as <i>malar bones</i> or <i>cheekbones</i> ; bones that form the prominence of the cheeks.
zygomatic nerve	Branch of the fifth and seventh cranial nerves that affects the muscles of the upper part of the cheek.
zygomaticus major muscles	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	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.