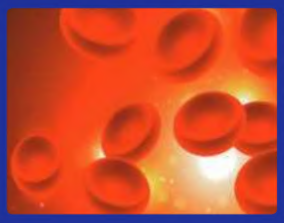
CHAPTER 3


Basic Human Anatomy and Physiology

OBJECTIVES

After studying this chapter, you should be able to:

1. Describe how a person would be positioned to describe the specific location of one body part in relationship to another.
2. Describe the characteristics of different types of body systems.
3. Identify each of the cell structures and their purpose.
4. Identify the four tissues and where each type of tissue can be found.
5. Explain the purpose of the integumentary system and how this system changes in an older patient in ways that affect how a phlebotomist performs a venipuncture.
6. Give a short explanation of the purpose of the skeletal, muscular, nervous, and respiratory systems.
7. Explain types of tests that can determine the function of the urinary system.
8. List the types of devices the phlebotomist needs to be aware of when collecting blood from a patient on dialysis.
9. Identify and explain the activities that take place in the digestive system for food processing.
10. Identify the most common disorder of the endocrine system.
11. Explain some of the problems a patient can have with the reproductive system.
12. Explain the purpose of the lymph system.

NAACLS Competencies Relevant to Chapter 3

Demonstrate basic understanding of the anatomy and physiology of body systems and anatomic terminology in order to relate major areas of the clinical laboratory to general pathologic conditions associated with the body systems.

- Describe the basic functions of each of the main body systems, and demonstrate basic knowledge of the circulatory, urinary, and other body systems necessary to perform assigned sample collection tasks.

KEY TERMS

Anabolism	Process of the body using simple substances to build complex substances.
Anatomy	Study of the shape and structure of the body and the relationship of one body part to another.
Appendicular Skeleton	Skeletal system that provides an anchor for muscles.
Axial Skeleton	Skeletal system that provides protection for parts of the body.
Catabolism	Process of producing energy by breaking down complex compounds into simple compounds.
Connective Tissue	Tissue that supports and connects organs and tissues of the body.
Cytoplasm	Semifluid inside of the cell membrane.
Dermis	Skin layer underneath the epidermis.
Endoplasmic Reticulum	Channel for transport of material in and out of the nucleus.
Epidermis	Outermost covering of the skin.
Epithelial Tissue	Tissue that protects the body by covering surfaces.
Golgi Apparatus	Layers of membranes within a cell that synthesize carbohydrates and combine with protein molecules.
Hemodialysis	Process for purifying blood by passing it through a dialyzer.
Hemopoiesis (Hematopoiesis)	Formation of blood cells.
Homeostasis	Occurs when all parts of the body work together to form a steady state.
Lysosomes	Spherical bodies in the cell cytoplasm that break down components.
Median Plane	Imaginary line equally dividing the right and left sides of the body.
Metabolism	Process in the body of making substances and breaking down substances so the body can function.
Mitochondria	Serve as sites for cell respiration and energy production.
Muscle Tissue	Tissue that has the ability to shorten, thicken, or contract.
Nervous Tissue	Tissue consisting of neurons that have the ability to react.
Nucleus	Part of cell that controls cell division and other activities of the cell.
Physiology	Study of the function of each body part and how the functions of the various parts coordinate to form a living organism.
Skeletal Muscle	Muscles attached to the bone.
Smooth Muscle	Muscles involved in involuntary movement.

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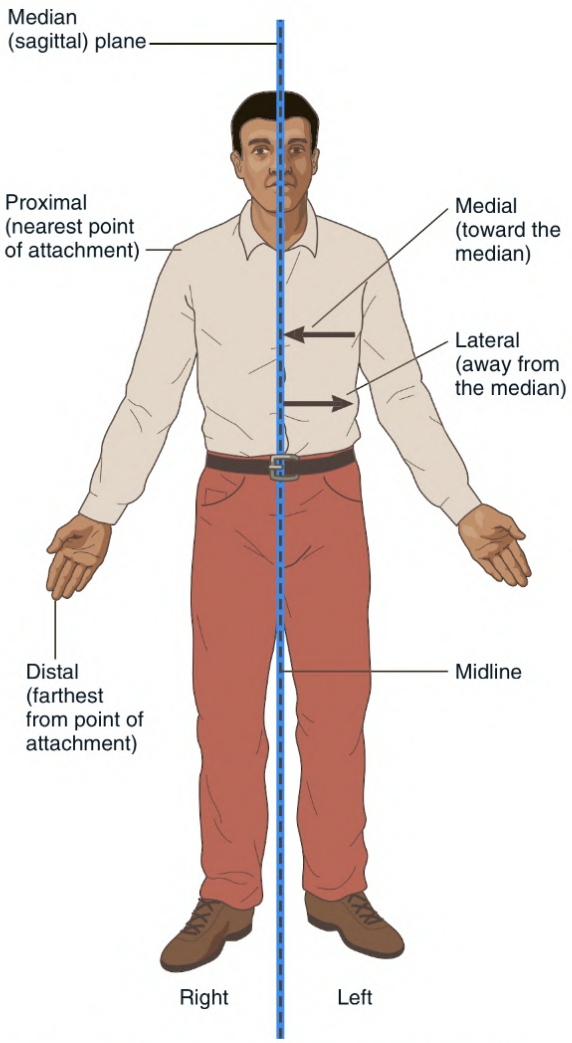
THE HUMAN BODY

To understand phlebotomy and related testing, one must have a basic understanding of the human body. This study involves **anatomy**, which is the study of the structure and morphology of the body, and **physiology**, which is the study of the functions of body parts.

BODY POSITIONS

Special terminology is used to describe the specific location of one body part in relationship to another. Figure 3.1 illustrates the planes of the body when the person is in the anatomic position of standing erect with face forward, arms at the side, and palms forward. The body is divided in equal right- and left-side sections by an imaginary line called the **median** (sagittal) **plane**. Any structure toward the point of attachment to the body is termed



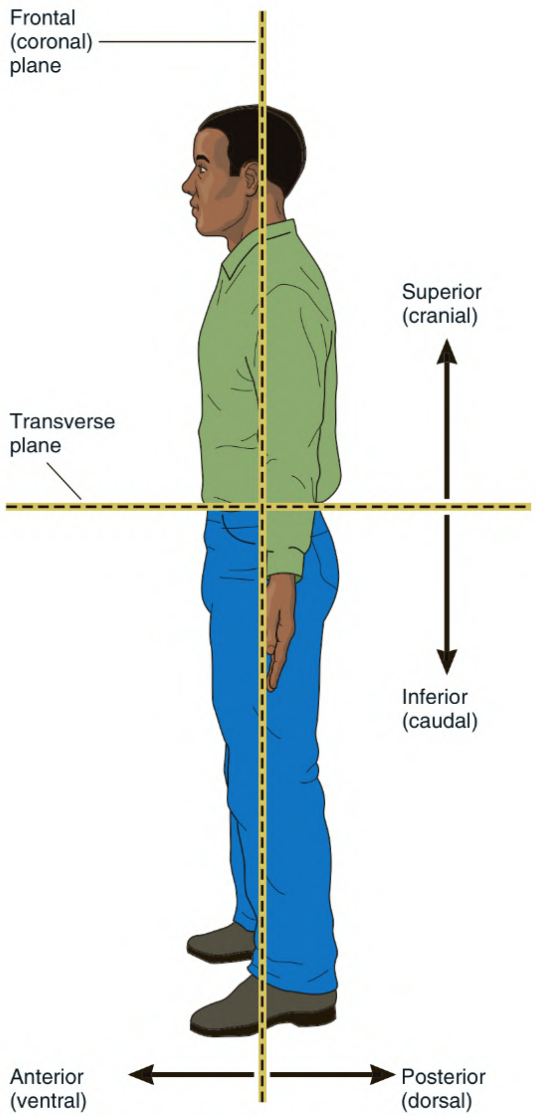
▲ FIGURE 3.1 Anatomical terms used to describe body division parts.

proximal; structures farthest from the point of attachment are termed *distal*. These terms can be used to describe the relationship between one part of the body and another. The fingers are proximal to the wrist but distal to the elbow. Any structure toward the midline of the median plane in reference to another structure is medial to that structure. For example, the nose is medial to the eyes. Any structure away from the median plane is lateral to the other structure. For example, the ears are lateral to the nose.

An imaginary vertical cut at a right angle to the median plane is known as the frontal (coronal) plane (Figure 3.2). *Anterior (ventral)* is anything in front of this frontal plane. Structures to the back of the coronal plane are determined to be *posterior (dorsal)* to the plane.

A transverse plane is a horizontal plane that divides the body into upper and lower halves. Structures above this plane are listed as *superior (cranial)* to the plane. Structures below the plane are listed as *inferior (caudal)* to the plane.

Instead of always referring to persons as standing, they may be referred to as in a lying-down position. When a person is lying on his or her back, face up, he or she is in the supine position. A person lying on his or her front is in the prone position.



▲ FIGURE 3.2 Imaginary lines, or planes, separate body structures.

BODY SYSTEMS

The human body has a variety of systems and functions. Homeostasis and metabolism are two of the main bodily functions. The body maintains its own internal environment of many processes that work both independently and together to maintain equilibrium. When all parts work together to maintain a steady state, the body is maintaining **homeostasis**. Consider a person with anemia. In anemia, the person does not have enough hemoglobin, or red blood cells, to provide oxygen in adequate amounts to all parts of the body. The entire body slows down, and the person has little energy, so not as much oxygen is needed.

Metabolism in the body is the process of making substances or breaking down substances so the body can function. **Catabolism** is the process of producing energy by breaking down complex compounds into simpler ones. This is the way that energy is provided to all parts of the body. **Anabolism** is the constructive part of metabolism in which the body uses simple substances to build complex substances. The body is constantly replacing itself to maintain a healthy individual. Skin grows over a cut to heal the injury. Blood cells are constantly being created, demonstrating the need for anabolism. Through these body functions, nonliving material is converted into the living cytoplasm of the cell.

CELL STRUCTURE

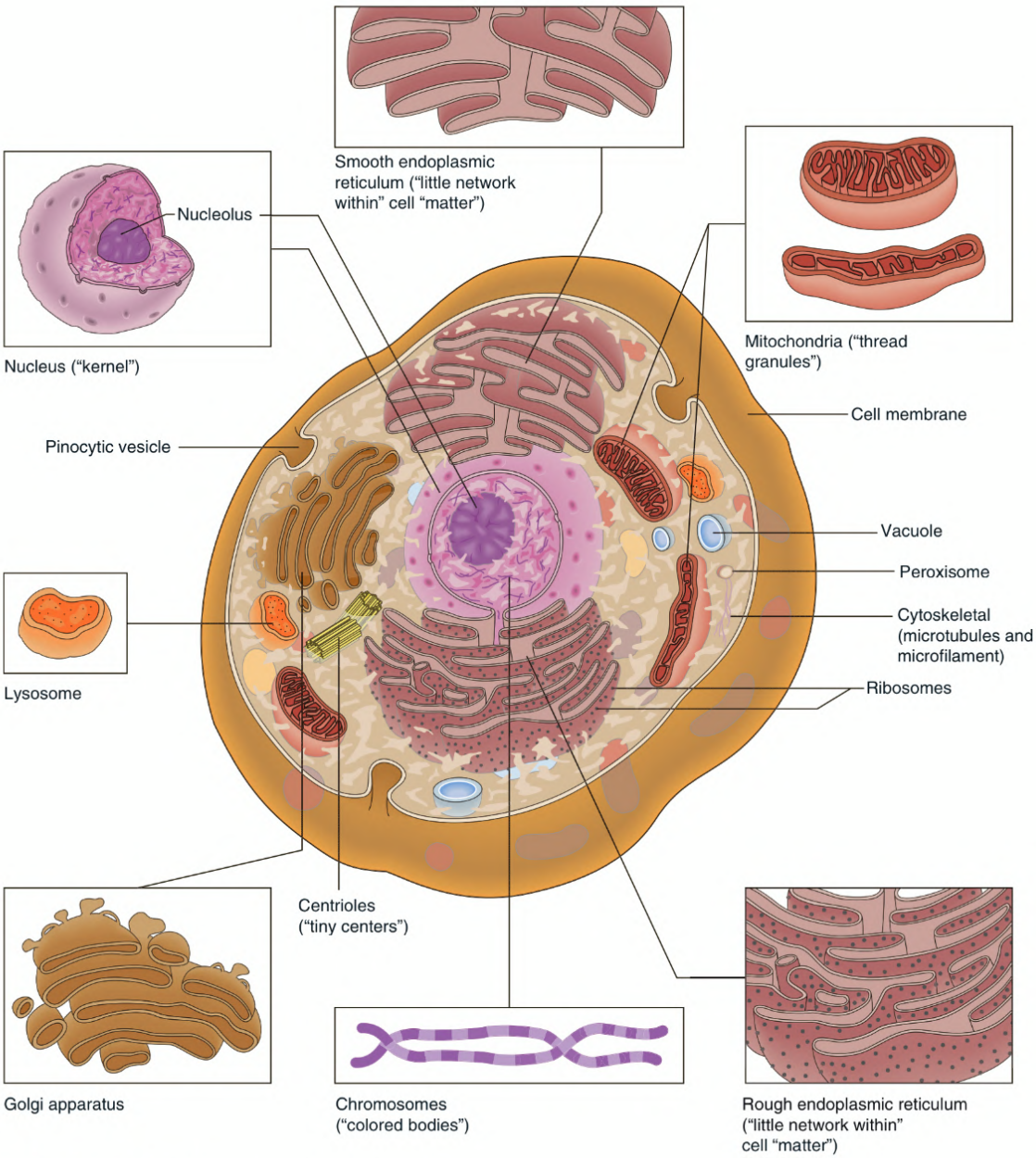
The basic unit of the human body is the cell. There are trillions of cells in the human body, forming everything from your skin to your heart. The cell is a complex system made up of a variety of parts (Figure 3.3). Every cell is surrounded by a cell membrane. This membrane gives the cell structure and separates it from other cells and the outside environment. The cell membrane is semipermeable and regulates the passage of certain molecules in and out of the cell. The semifluid inside the cell membrane is the **cytoplasm**. Embedded in the cytoplasm are organelles of various structures that help the cell function.

The **nucleus** is the most important organelle of the cell. The nucleus controls cell division and the activities of the cell. This is often seen as the "brain" of the cell. Within the nucleus are chromosomes that contain deoxyribonucleic acid (DNA). This DNA stores the hereditary information of the cell and is passed from one generation to another. Just like the cell has a membrane protecting it, the nucleus has a nuclear membrane that both protects the nucleus and allows material to pass through. The nuclear membrane is continuous with the **endoplasmic reticulum**. This tubular structure serves as a channel for the transport of material in and out of the nucleus. There is both a smooth endoplasmic reticulum and a rough endoplasmic reticulum. The rough endoplasmic reticulum contains ribosomes that help with protein synthesis. The smooth endoplasmic reticulum assists in cholesterol synthesis, fat metabolism, and detoxification of drugs.

In order to stay alive, the cell needs to breathe and produce energy. The **mitochondria** serve as sites for cell respiration and energy production. They also break down carbohydrates, fats, and protein molecules into energy to be stored in the cell as adenosine triphosphate (ATP).

Assisting the mitochondria in keeping the cell alive are the Golgi apparatus, also called Golgi bodies or the Golgi complex. The **Golgi apparatus** consist of layers of membranes that synthesize carbohydrates and combine them with protein molecules. These packages that are created are then secreted from the cell.

Lysosomes are spherical bodies in the cytoplasm that contain powerful digestive enzymes to break down complex cellular components into more usable sugars, amino acids, fatty acids, and glycerol. The lysosomes also expel all their enzymes directly into the cytoplasm of the cell to break down the cell itself when it is old or weak. This suicidal process is known as autolysis.



▲ FIGURE 3.3 Structure of a typical animal cell.

TISSUES

Cells that group together form the tissues of the body. There are four types of tissues:

- **Epithelial tissue**—Protects the body by covering internal and external surfaces. The skin is an epithelial tissue. Epithelial tissue can also absorb, as in the lining of the small intestine. Secretion in the body is through the epithelial tissue. All glands are composed of epithelial tissue, such as exocrine and endocrine glands.
- **Connective tissue**—Supports and connects organs and tissues of the body. Adipose tissue and areolar tissue, which are types of connective tissue, store fat and support both nerve cells and blood vessels. Ligaments, bone, cartilage, blood, and lymph fluid are also types of connective tissue.

- **Muscle tissue**—Muscle tissue has the ability to shorten, thicken, or contract. The three types of muscle tissue are cardiac, skeletal, and smooth muscle. Cardiac muscle makes up the walls of the heart. Skeletal muscle connects to the skeleton to provide movement. Smooth muscle makes up the walls of the digestive tract, genitourinary tract, respiratory tract, blood vessels, and lymphatic vessels.
- **Nervous tissue**—Consists of neurons (nerve cells) that have the ability to react. They are found in the brain, spinal cord, and nerves. This very organized tissue of the body allows us to control and coordinate body activities.

INTEGUMENTARY SYSTEM

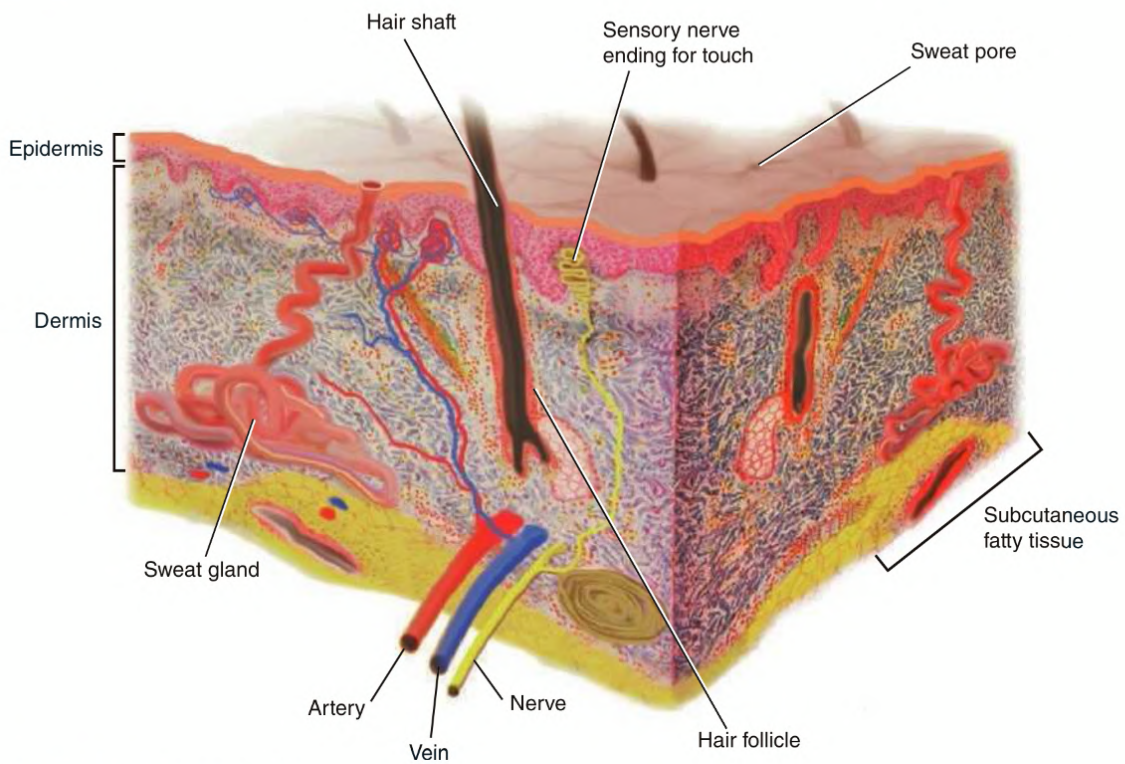
Helpful Hint

To avoid damaging an older patient's skin with the tourniquet, tie it over the patient's shirt sleeve. Since the elasticity of the veins is reduced in older patients, it is best to use an elastic wrap with a gauze pad to put pressure on the venipuncture site to prevent bleeding and bruising.

The skin of the body is called the integumentary system (Figure 3.4). It offers a protective covering; regulates body temperature; manufactures vitamin D; contains nerve endings; stores glucose, water, and salts; and has the ability to absorb certain drugs and chemical substances.

The skin consists of two layers. The **epidermis** is the outermost covering and has no blood vessels present (avascular). Below the epidermis is the dermis. The **dermis** layer is made up of connective tissue and contains blood vessels (vascular). The dermis layer is the layer of the skin that the phlebotomy needle enters for the purpose of blood collection. Puncturing the skin deeper than this for a venipuncture is unnecessary.

Age has the most dramatic effect on the integumentary system. As a person ages, the sebaceous glands secrete less lubrication and the skin becomes more fragile and dry. Loss of fat causes wrinkles, lines, and sagging of the skin. The elasticity of the skin is lost because the elastin fibers shrink, becoming more rigid. The dermal vascular network's ability to respond to heat and cold decreases, resulting in increased chances of hypothermia (low body



▲ FIGURE 3.4 Layers of skin.

temperature) and hyperthermia (increased body temperature). The skin also becomes more sensitive to ultraviolet radiation.

These are all factors to consider when performing venipuncture on an older patient. The tourniquet can tear the skin because the skin is more fragile. The patient will bruise more easily because the elasticity of the skin is reduced and the vein cannot reseal as quickly.

EXERCISE 1 Matching/Identification: Key Terms Review

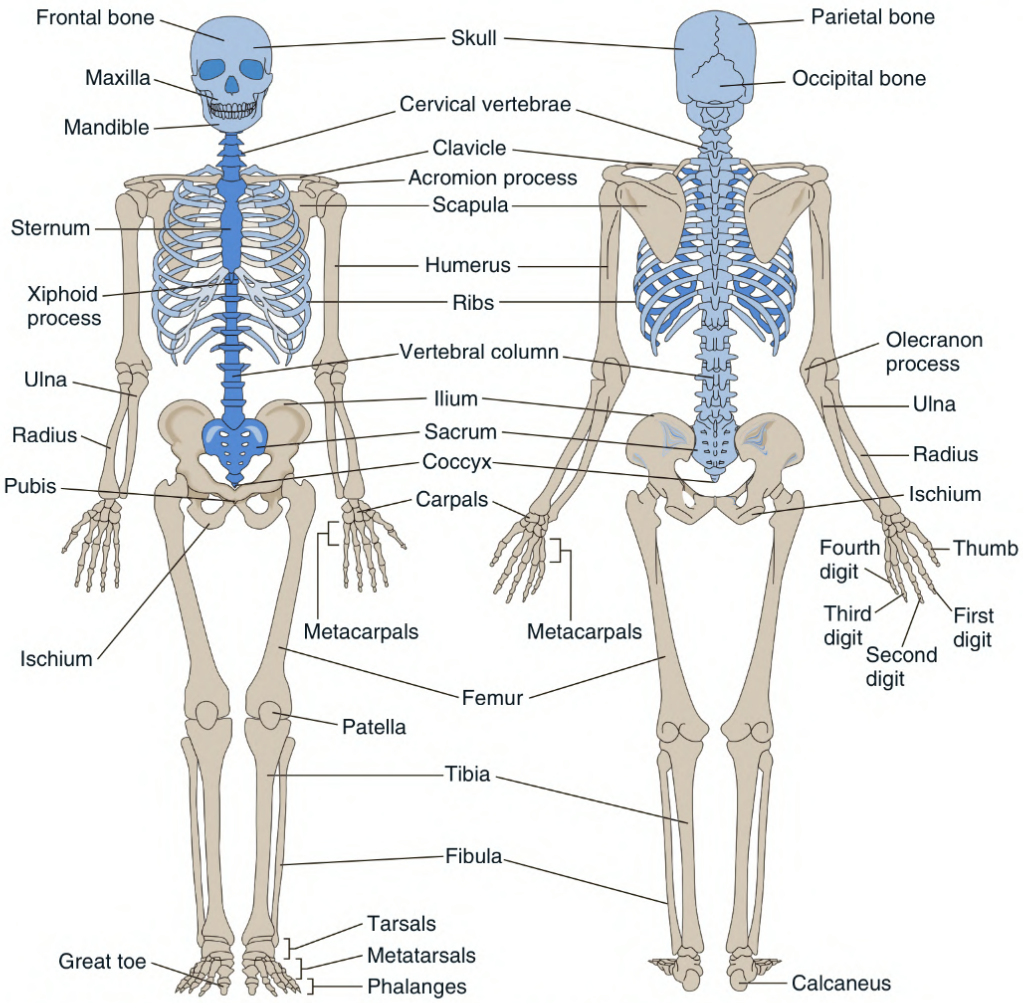
Directions: Identify the appropriate definition for each key term found in this chapter.

	Key Terms	Definitions
_	Cytoplasm	A. Serve as sites for cell respiration and energy production.
_	Dermis	B. Study of the function of each body part and how the functions of the various parts coordinate to form a living organism.
_	Endoplasmic Reticulum	C. Skin layer underneath the epidermis.
_	Golgi Apparatus	D. Channel for transport.
_	Homeostasis	E. Layers of membranes within a cell that synthesize carbohydrates and combine with protein molecules.
_	Lysosomes	F. All parts of the body working together to achieve a steady state.
_	Metabolism	G. Part of cell that controls the cell division and other activities of the cell.
_	Mitochondria	H. Spherical bodies in the cell cytoplasm that break down components.
_	Nucleus	I. Process in the body of making substances and breaking down substances so the body can function.
_	Physiology	J. Semifluid inside of cell membrane.

SKELETAL SYSTEM

The body's skeletal system supports movement. There are 206 bones in the human body that provide this support (Figure 3.5). Providing support and shape to the body is the main function of the skeletal system. The skeletal system provides protection to parts of the body. The cranium (skull) provides protection to the brain, inner ear, and eyes. The ribs and breastbone protect the lungs and heart. The spinal cord protects the vertebral (spinal) column. These are all part of the **axial skeleton**.

The **appendicular skeleton** provides an anchor for the muscles so that movement of the body can occur. Without the combination of muscles and bones, body movement would be impossible. Bone is the storehouse for minerals, especially calcium. When the body's calcium is below normal, the bone releases calcium into the bloodstream. Bone is also the production facility for the blood. Bone marrow is the site for blood production



▲ FIGURE 3.5 The axial skeleton (blue) and the appendicular skeleton.

(**hemopoiesis**, also known as **hematopoiesis**). The long bones, sternum, and ilia are locations of blood cell formation.

The health of the skeletal system can be analyzed by checking the patient's analytes, such as calcium and phosphate levels and synovial fluid.

MUSCULAR SYSTEM

The muscular system is responsible for both internal and external movement, body shape, and maintenance of body temperature. Muscles are described as either striated (spindle shaped) or nonstriated because they look this way under the microscope. **Skeletal muscles** are striated and are attached to the bone to help provide movement. Because this movement is voluntary, skeletal muscles are also called voluntary muscles. **Smooth muscles** are nonstriated and involuntary in movement. They are slower to react than skeletal muscles. Smooth muscle makes up the walls of the digestive tract, genitourinary tract, respiratory tract, blood vessels, and lymphatic vessels. Cardiac muscle is found only in the heart. Cardiac muscle is striated, with the purpose of moving blood through the circulatory system. Direct biopsy and muscle enzyme testing analyze the muscular system (Table 3.1).

TABLE 3.1 Basic Tests for Skeletal Muscle Damage

- Aldolase
- Alanine aminotransferase (ALT)
- Aspartate aminotransferase (AST)
- Creatine kinase (CK)
- CK-MM
- Myoglobin

Source: labtestsonline.org, accessed December 2015.

NERVOUS SYSTEM

The central nervous system provides the communication lines for the different systems and knows what each system needs. The central nervous system receives stimuli from all over the body. The brain interprets the message, responds to the message, and carries out an activity.

The peripheral nervous system consists of nerves that connect to the brain and spinal cord with sensory receptors, muscles, and glands. The autonomic nervous system carries impulses to involuntary muscles and glands. It supplies the heart muscle, smooth muscle, and glands with nervous impulses and does not require a command sent from the brain.

As a person ages, the blood supply to the brain tends to diminish. This results in loss of brain size and therefore slowed thinking, forgetfulness, and slower reaction time. These are factors to consider in the patient who comes to the laboratory for a venipuncture. The patient will not be able to answer questions as quickly and will react more slowly. See Table 3.2 for basic tests to determine disorders of the nervous system.

RESPIRATORY SYSTEM

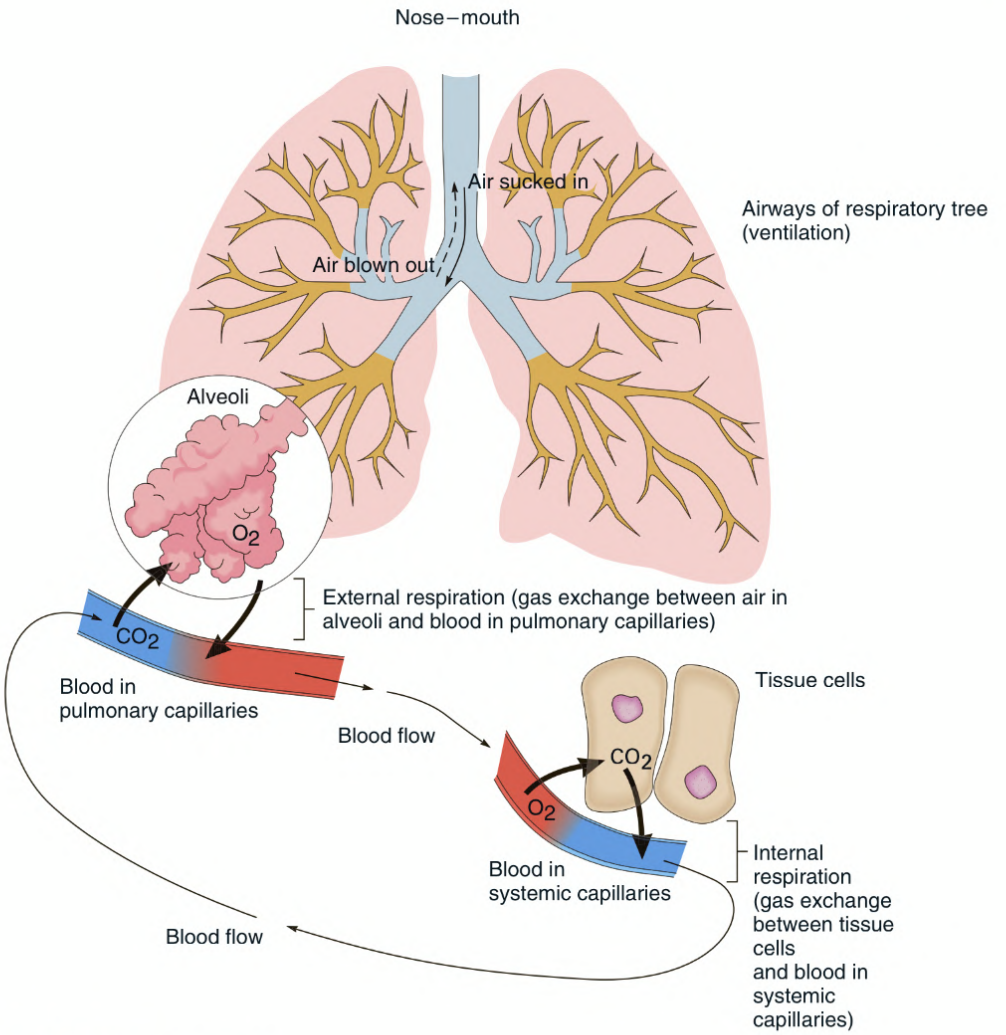
The respiratory system maintains the body's ability to exchange gases (Figure 3.6). External respiration is known as breathing or ventilation. The lungs take in oxygen and transfer it to red blood cells. At the same time the lungs expel the carbon dioxide that the red blood cells have brought back from all parts of the body. This is accomplished in the alveoli of the lungs, where the gases are exchanged between the alveoli and the blood in the pulmonary capillaries.

Internal respiration occurs when oxygen-rich blood diffuses the oxygen into the tissue cells. This is the exchange of gases between the tissue cells and the blood in the systemic capillaries. This circulation of blood and exchange of gases provides much needed oxygen to the tissue cells. Drawing arterial blood gases and having the blood gases analyzed in the laboratory is the method of testing the respiratory system.

TABLE 3.2 Basic Tests for Nervous System Disorders

- Cerebrospinal fluid (CSF) analysis (hematology, microbiology, and chemistry /serological testing)
- Serotonin

Source: labtestsonline.org, accessed December 2015.



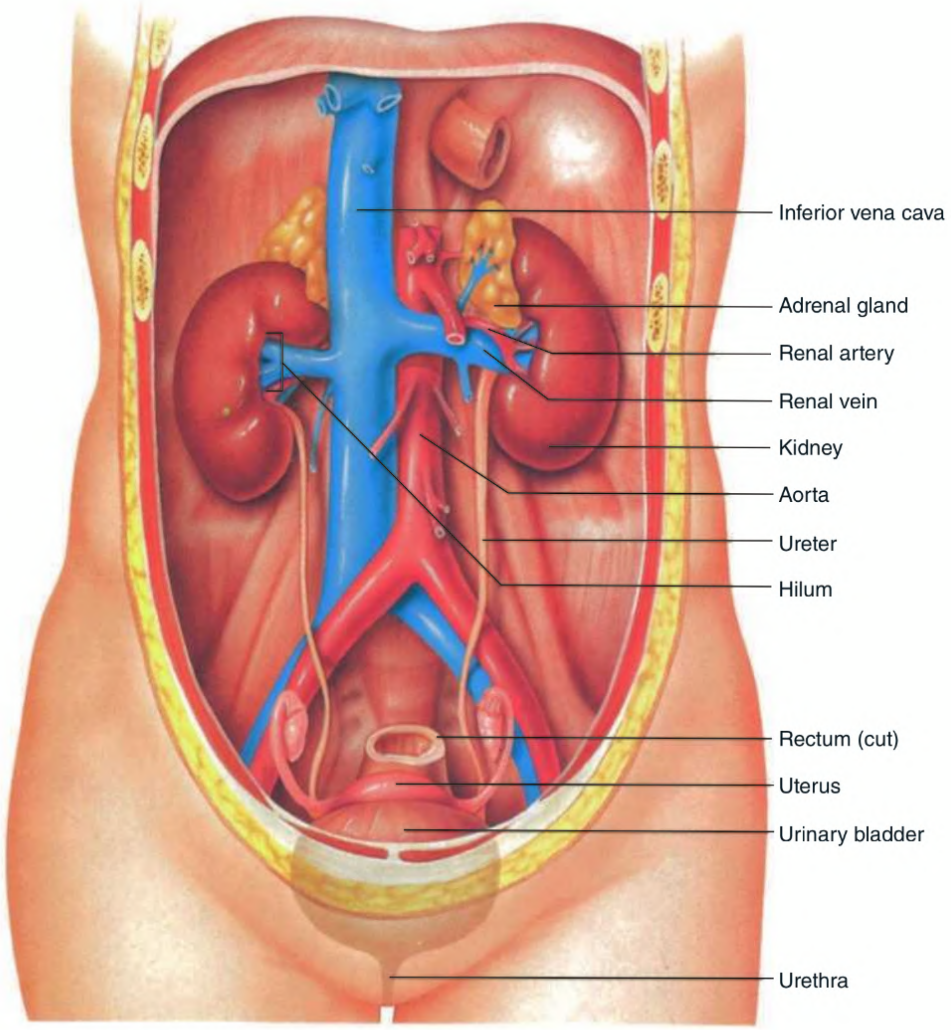
▲ FIGURE 3.6 Respiration.

URINARY SYSTEM

The urinary system's primary function is to eliminate fluids and wastes through the urine. The urinary system consists of two kidneys, two ureters, a bladder, and a urethra (Figure 3.7). The kidneys are the main part of this system and work to regulate the amount of water and solutes the body system expels. The kidneys filter large amounts of fluid from the bloodstream and eliminate wastes, drugs, and toxins from the body. The kidneys also reabsorb needed substances and return them to the bloodstream. This elimination and reabsorption regulates the volume and concentration of the blood. By controlling the amount of hydrogen ions in the blood, the pH of the blood is regulated. The urine contains the wastes that the body has expelled.

Several substances are produced by the kidneys. For example, renin is used to regulate blood pressure. The hormone erythropoietin stimulates red blood cell production in the bone marrow. The kidneys also convert vitamin D to its active form (calciferol). Vitamin D is used by the body for the development of teeth and bones, along with the control of calcium and phosphorous metabolism.

As urine passes out of the kidneys, it is carried from each kidney to the bladder through a ureter. The ureters have smooth muscle fibers that help push the urine into the bladder.



▲ FIGURE 3.7 The organs of the urinary system.

The bladder is a reservoir that can hold about 500 milliliters of urine. Contraction of muscles in the bladder pushes the urine through the urethra and out of the body.

Testing of the urine in the laboratory can determine how the urinary system is functioning. Various urine and blood tests, such as blood urea nitrogen (BUN) and creatinine, are used to analyze the function of the urinary system (Table 3.3). Urine can be collected as a random sample or for a 24-hour period. The random urine is like a snapshot of how the urinary system is performing at the time of collection. The 24-hour collection averages the cycles of the urinary system into one sample.

Helpful Hint

The patient on dialysis will often have blood collected during dialysis; therefore, venipuncture is not necessary.

The most common treatment for kidney failure is dialysis. **Hemodialysis** is a process for purifying blood by passing the blood through a dialyzer. The patient is connected to the dialysis unit by means of tubing that takes blood from the patient to the dialysis unit and returns it to the patient. The patient will require a fistula (opening between an artery and a vein) or a graft (a vein inserted between an artery and a vein) that has been surgically implanted in the his or her arm. The arm containing the fistula or graft must be avoided when performing a venipuncture. Attempting a venipuncture to the arm containing the fistula or graft can cause damage to the device.

TABLE 3.3 Basic Tests for Urinary Disorders

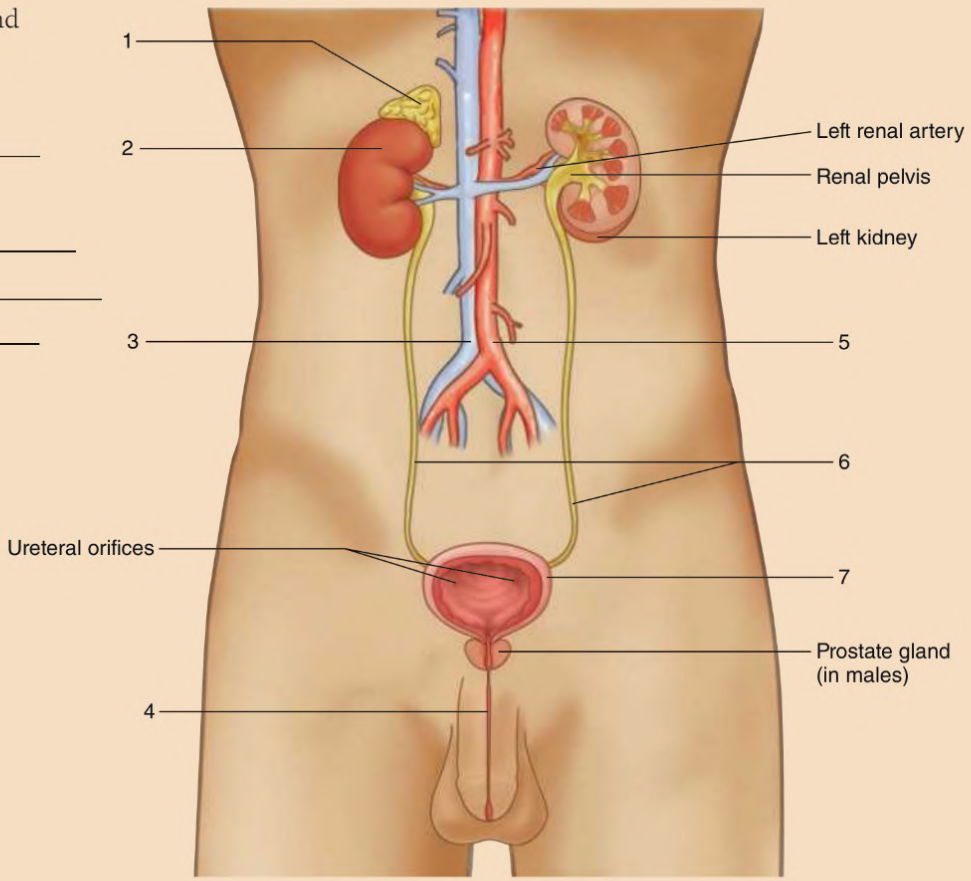
• Blood urea nitrogen (BUN)
• Creatinine
• Microalbumin
• Urinalysis
• Urine calcium
• Urine creatinine
• Urine culture
• Urine total protein

Source: labtestsonline.org, accessed December 2015.

EXERCISE 2 Image Labeling

Directions: Identify the numbered items on the accompanying figure of the urinary system.

1. _____ gland
2. exterior view of the right _____
3. inferior _____
4. _____
5. abdominal _____
6. right and left _____
7. urinary _____



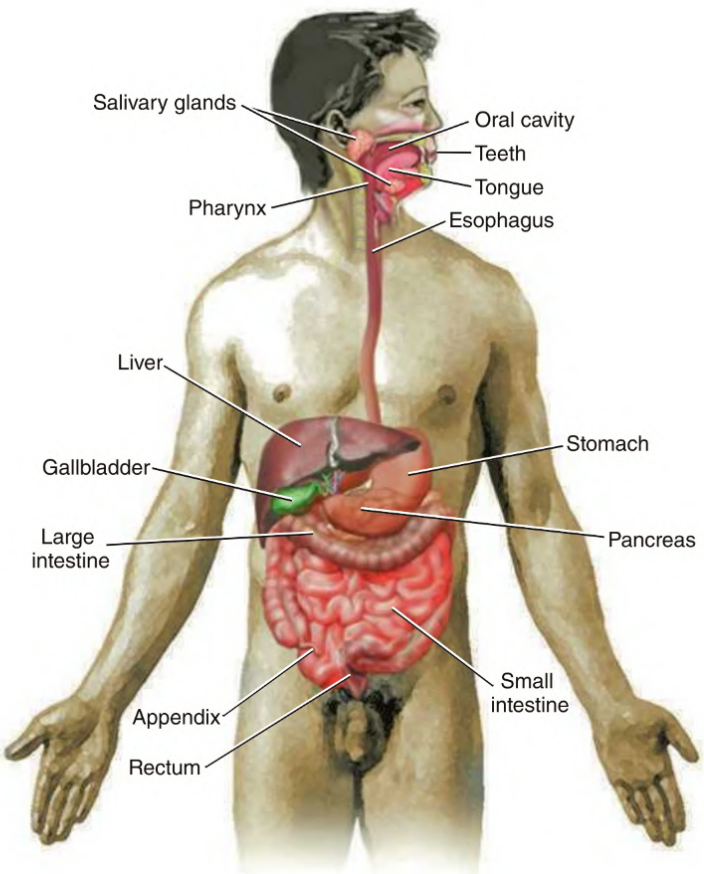
DIGESTIVE SYSTEM

The digestive system helps the body absorb food that the tissue cells need. The body uses this absorbed food in metabolism to generate energy and build substances. The digestive system follows several steps to process this food:

- Ingestion of the food takes place and the chewing of the food breaks down the food into smaller pieces.
- Peristalsis is the physical movement of the food along the digestive tract.
- Digestion is the breakdown of the food chemically by digestive juices into end products of fat, carbohydrates, and protein.
- Nutrients are absorbed into the blood capillaries as the food moves through the small intestine.
- Defecation eliminates the wastes from the body.

Many organs are needed to complete this digestive process (Figure 3.8). The food ingested passes from one organ to another until defecation occurs. The liver, gallbladder, and pancreas assist in this process by producing various enzymes and hormones, including glucagon, insulin, and bile, which accelerate the digestive process. Various laboratory tests can determine how the organs are functioning (Table 3.4).

Some peptic stomach ulcers and chronic active gastritis are the result of infection by the *Helicobacter pylori* microorganism. If such disorders are suspected, the patient will undergo a breath test or microbiological test; the breath sample or microbiological sample is examined in the laboratory to determine if the microorganism is present in the stomach.



▲ FIGURE 3.8 Structures of the digestive system.

TABLE 3.4 Basic Tests for Digestive System Disorders

• Complete blood count
• *Celiac difficile* toxin
• *Clostridium difficile* toxin
• D-xylose absorption
• Food allergy testing
• *Helicobacter pylori* tests
• Lactose intolerance test
• Ova and parasites

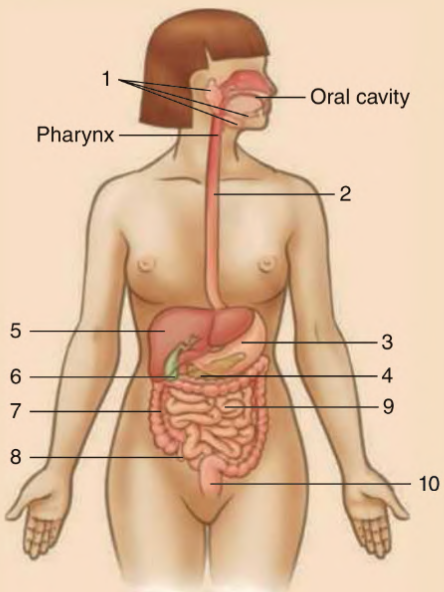
Source: labtestsonline.org, accessed December 2015.

A digestive disorder called celiac disease has symptoms such as diarrhea, abdominal pain, and weight loss. Generally this is caused by gluten-sensitive conditions. Allergy testing to determine if there are allergies to wheat, rye, or barley may be ordered.

EXERCISE 3 Image Labeling

Directions: Identify the numbered items on the accompanying figure of the digestive system.

1. _____ glands
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____ intestine
8. _____
9. _____ intestine
10. _____ and anus



ENDOCRINE SYSTEM

The endocrine system is composed of glands that manufacture and secrete hormones needed in the body. This system exerts chemical control of the body within certain narrow ranges. This ability to maintain control in a narrow range is called homeostasis. The endocrine glands release their products directly into the bloodstream. The endocrine system (Figure 3.9) includes the pituitary glands, thyroid and parathyroid glands, and pancreas.

TABLE 3.5 Basic Tests for Endocrine Disorders

- Adrenocorticotropic hormone (ACTH)
- Aldosterone
- Catecholamines, plasma and urine
- Cortisol
- Dehydroepiandrosterone sulfate (DHEAS)
- Electrolytes
- Estrogen
- Follicle-stimulating hormone (FSH)
- Human chorionic gonadotropin (HCG)
- Progesterone
- Triiodothyronine (T_3)
- Thyroxine (T_4)
- Testosterone
- Thyroid-stimulating hormon

Source: labtestsonline.org, accessed December 2015.

EXERCISE 4 Labeling

Directions: Indicate whether the test would be ordered by the physician for a skeletal system Disorder (S), nervous system disorder (N), urinary disorder (U), digestive system disorder (D), or endocrine disorder (E).

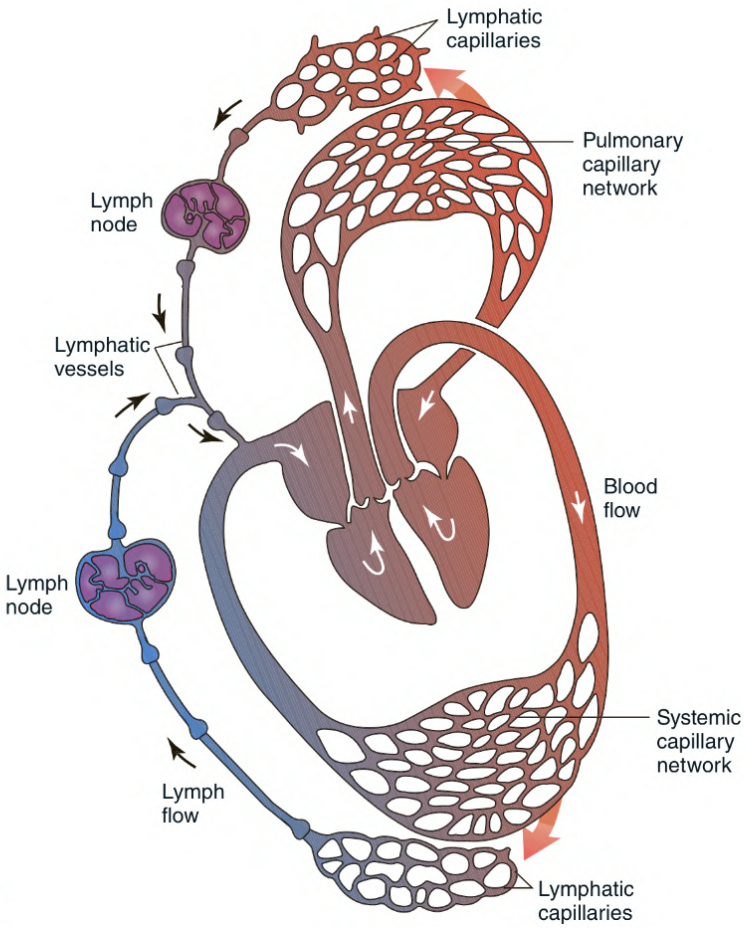
_____ Catecholamines, plasma, and urine
_____ Creatinine
_____ Aldolase
_____ Blood Urea Nitrogen (BUN)
_____ Creatine Kinase
_____ *Celiac difficile* toxin
_____ Urinalysis
_____ Microalbumin
_____ Cortisol
_____ Progesterone
_____ Urine calcium
_____ Myoglobulin
_____ *Helicobacter pylori* tests
_____ Serotonin
_____ Ova and parasites
_____ Urine total protein

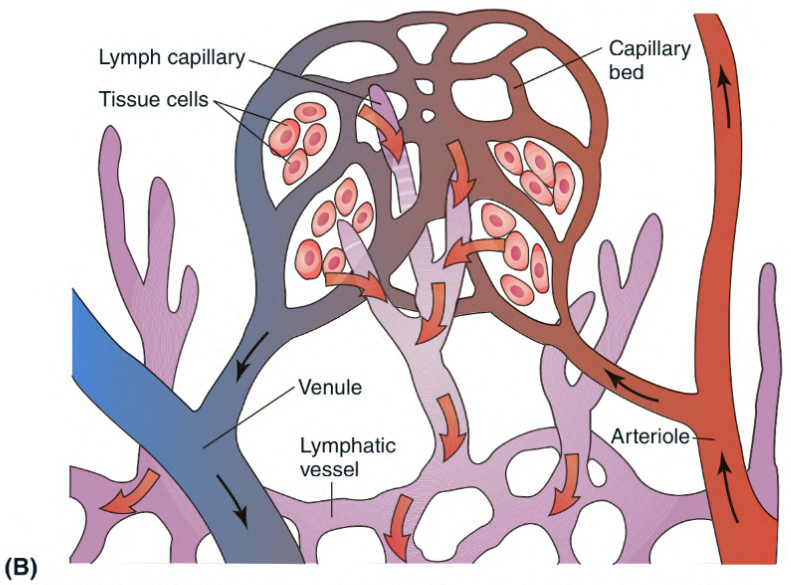
Infertility occurs when conception does not happen. Causes include low sperm count, fallopian tube damage, insufficient egg production, hormonal imbalance, and other disorders. Laboratory tests to determine the cause of infertility consist of semen analysis and hormonal testing.

Sexually transmitted diseases can cause infertility and other complications from bacterial, viral, or protozoan infection. Testing for sexually transmitted diseases is done through blood tests, vaginal or urethral culturing, and urine cultures. Common sexually transmitted diseases include syphilis, *Trichomonas vaginalis*, genital herpes, genital warts, human papilloma virus (HPV), *Chlamydia trachomatis* infection, *Neisseria gonorrhoeae* infection, and acquired immunodeficiency syndrome (AIDS). Many reproductive disorders are the result of hormonal imbalances. Therefore, many of the same tests used to diagnose endocrine disorders (see Table 3.5) are used to diagnose reproductive system disorders.

LYMPHATIC SYSTEM

The lymphatic system is closely associated with the circulatory system (Figure 3.10). The lymphatic system consists of lymph, lymph nodes, lymph vessels, the spleen, the thymus gland, lymphoid tissue in the intestines, and the tonsils. The primary function of this system





▲ FIGURE 3.10 (A) Diagrammatic view of lymphatics transporting fluid from intestinal spaces to the bloodstream. (B) Lymph capillaries begin as blind-end tubes next to tissue cells and blood capillaries.

is to drain protein-containing fluid that escapes from the blood capillaries. This lymph fluid that is moving between the tissue cells is also known as interstitial fluid. The capillaries reabsorb some of this lymph fluid, but the lymphatic capillaries remove the fluid that is not reabsorbed.

The functions of the lymphatic system are varied:

- Lymph fluid acts as a fluid between the blood in the capillaries and the tissue.
- Lymph vessels transport this fluid back into the blood capillaries.
- Lymph nodes produce white blood cell lymphocytes and filter out harmful bacteria and foreign matter.
- The spleen is a filter system for the blood, removing old red blood cells. Platelets and white blood cells are stored in the spleen, which acts as a holding chamber for blood in case of emergency.
- The thymus gland produces T-lymphocyte cells, which are a necessary part of maintaining immunity.

STUDY OF THE DIFFERENT BODY SYSTEMS

To properly diagnose and treat patients with illnesses associated with these different systems, many physicians study and specialize in a specific system or body area. This type of specialization is called a *–logy* (study of) the specific area. The terms for these most common specializations are shown in table 3.6.

TABLE 3.6 Study of the Different Body Systems

Physician Specialization	Area of Specialization
Cardiology	Study of the heart
Dermatology	Study of the skin
Endocrinology	Study of the endocrine glands
Gastroenterology	Study of the stomach and intestines
Gynecology	Study of female disease
Hematology	Study of the blood
Neurology	Study of the nerves and the brain and spinal cord
Oncology	Study of malignant diseases and cancer
Ophthalmology	Study of the eye
Pathology	Study of disease
Psychology	Study of the mind and mental disorders
Rheumatology	Study of joint diseases

EXERCISE 5 Matching/Identification: Key Terms Review

Directions: Identify the appropriate definition for each key term found in Chapter 3.

Key Terms	Definitions
_____ Anabolism	A. Muscles attached to the bone.
_____ Anatomy	B. Tissue consisting of neurons that have the ability to react.
_____ Appendicular Skeleton	C. Tissue that supports and connects organs and tissue of the body.
_____ Axial Skeleton	D. Process of the body using simple substances to build substances.
_____ Catabolism	E. Imaginary line equally dividing the right and left sides of the body.
_____ Connective Tissue	F. Process of producing energy by breaking down complex compounds into simple compounds.
_____ Epidermis	G. Skeletal system that provides an anchor for muscles.
_____ Epithelial Tissue	H. Muscles involved in involuntary movement.
_____ Hemodialysis	I. Tissue that has the ability to shorten, thicken, or contract
_____ Hemopoiesis (Hematopoiesis)	J. Formation of blood cells.
_____ Median Plane	K. Skeletal system that provides protection for parts of the body.
_____ Muscle Tissue	L. Study of the shape and structure of the body and the relationship of one body part to another.
_____ Nervous Tissue	M. Process for purifying blood by passing through a dialyzer.
_____ Skeletal Muscle	N. Tissue that protects the body by covering surfaces.
_____ Smooth Muscle	O. Outermost covering of the skin.

REVIEW QUESTIONS

Multiple Choice

Choose the one best answer.

1. Anatomy is the study of the
   a. shape and structure of the body.
   b. function of a body part.
   c. formation of a body part.
   d. formation of red blood cells.
2. The study of the function of each body part and how the functions coordinate is called
   a. hematology.
   b. chemistry.
   c. physiology.
   d. anatomy.
3. The part of the cell that controls the activities of the cell is the
   a. Golgi apparatus.
   b. nucleus.
   c. cell membrane.
   d. mitochondria.
4. The system responsible for body movement is the
   a. nervous system.
   b. circulatory system.
   c. lymphatic system.
   d. muscular system.
5. Skeletal muscle is also known as
   a. involuntary muscle.
   b. voluntary muscle.
   c. reactionary muscle.
   d. smooth muscle.

6. The process in which oxygen-rich blood diffuses into tissue cells is
   a. exhaling.
   b. external respiration.
   c. internal respiration.
   d. breathing.
7. Lymph fluid is also called
   a. interstitial fluid.
   b. serum.
   c. plasma.
   d. blood.
8. The most common disorder of the endocrine system is
   a. rheumatoid arthritis.
   b. diabetes mellitus.
   c. infertility.
   d. respiratory distress.
9. The axial skeleton is
   a. responsible for anchoring muscles.
   b. located in bones in the foot.
   c. located in bones in the arms.
   d. responsible for protection of parts of the body.
10. The part of the cell that contains enzymes that break down cellular components is the
    a. mitochondria.
    b. Golgi apparatus.
    c. lysosomes.
    d. endoplasmic reticulum.

CRITICAL THINKING

1. An older patient comes to you to have her blood drawn and complains that she bruises easily now and that every time she has her blood drawn she continues to bleed. What physically has changed in the patient to cause this problem?
2. Your grandfather says that he is getting forgetful and cannot think as fast as he used to. He says that his brain is changing. What could be the physical reason for this change?