INTRODUCTION

COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The submicroscopic particles that make up all substances are called ___(atoms)___.

2. These are arranged in specific patterns and structures called ___(molecules)___.

3. In the human organism, the basic unit of structure and function is the ___(cell)___.

4. These are organized into layers or groups called ___(tissues)___.

5. Groups of these form complex structures that perform certain functions. These structures are called ___(organs)___ and are arranged in ___(organ systems)___.

6. All living matter is composed of a colorless, jellylike substance called ___(protoplasm)___.

7. The cytoplasm contains a network of various membranes called ___(cytoplasmic organelles)___, which perform specific functions necessary for cell survival.

8. Cell reproduction is controlled by the ___(centrosome)___ and the ___(nucleus)___.
9. During the early developmental stages of an organism, the repeated division of the ovum results in many specialized cells that differ from one another in composition and function. This process is called **differentiation**.

10. In the human organism, as a cell matures and is nourished, it grows in size and eventually divides into two smaller cells. This form of cell division is called **mitosis**.

**SHORT ANSWER:** In the spaces provided, write short answers to the following questions.

1. Name four ways in which cells differ from one another.
   - a. **(size)**
   - b. **(shape)**
   - c. **(structure)**
   - d. **(function)**

2. Name the four principal parts of a cell.
   - a. **(cytoplasm)**
   - b. **(centrosome)**
   - c. **(nucleus)**
   - d. **(cell membrane)**

**MATCHING:** Match each term with its associated function. Write the letter of the appropriate term in the space provided.

A. cell membrane  
B. centrosome  
C. chromatin  
D. endoplasmic reticulum  
E. fibrils  
F. Golgi apparatus  
G. lysosome  
H. microtubules  
I. mitochondria  
J. nuclear membrane  
K. nucleolus  
L. nucleus  
M. ribosome  
N. vacuole

(I) 1. converts and releases energy for cell operation
(A) 2. contains cellular material and transports materials between the inside and outside of the cell
(D) 3. produce lipids or proteins for cell utilization and transport
(L) 4. supervises all cell activity
(F) 5. synthesizes carbohydrates and holds protein for secretion
(N) 6. involved in the rapid introduction or ejection of substances
(B) 7. divides and moves to opposite poles of the cell during mitosis
(J) 8. controls passage of substances between the nucleus and cytoplasm
(M) 9. composed of RNA and protein molecules that synthesize proteins
(C) 10. fibers of protein and DNA that contain the genes
IDENTIFICATION: Identify the structures indicated in Figure 5.1 by writing the letter of the structure next to the appropriate name in the space provided.

(C) 1. cell membrane (N) 8. nucleolus
(H) 2. chromatin (M) 9. nucleus
(A) 3. smooth endoplasmic reticulum (F) 10. ribosomes
(J) 4. Golgi apparatus (D) 11. vacuole
(K) 5. lysosome (G) 12. rough endoplasmic reticulum
(L) 6. pinocytic vesicle (E) 13. cytoplasm
(B) 7. mitochondria (I) 14. centrioles

Fig. 5.1 Structure of a typical animal cell.
**SHORT ANSWER:** The five phases of cell division are listed below. Number the phases from 1 to 5 to indicate the correct order in which they occur.

1. **metaphase**
2. **interphase**
3. **anaphase**
4. **telophase**
5. **prophase**

**MATCHING:** Match the term with the best description. Write the letter of the best description in the space provided.

1. **metaphase**
2. **telophase**
3. **interphase**
4. **prophase**
5. **anaphase**

A. Chromosomes become larger and can be seen as two coiled strands called **chromatids**.
B. This is the normal state of the cell during growth.
C. Cytoplasm divides into two cells.
D. Chromosomes arrange along the equatorial plane.
E. The chromatids are separated and are again called **chromosomes**.

**COMPLETION:** In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The chemical reactions within a cell that transform food into nutrients used for cell growth and operation are broadly termed **(cellular metabolism)**.
2. Two phases of metabolism are **(anabolism)** and **(catabolism)**.
3. The process of building up larger molecules from smaller ones is **(anabolism)**.
4. The process of breaking down larger substances or molecules into smaller ones is **(catabolism)**.
5. Protein substances that act as organic catalysts to initiate, accelerate, or control specific chemical reactions in the metabolic process are called **(enzymes)**.
6. Collections of similar cells that carry out specific functions of the body are called **(tissues)**.
SHORT ANSWER: In the spaces provided, list the four main categories of tissues.

1. (epithelial tissue)
2. (connective tissue)
3. (muscular tissue)
4. (nerve tissue)

IDENTIFICATION: In the space provided, write the name of the tissue type that best fits the description.

(Connective) 1. represented by blood and lymph

(Epithelial) 2. functions in the process of absorption, excretion, secretion, and protection

(Connective) 3. binds structures together and serves as a framework

(Nerve) 4. acts as a channel for the transmission of messages

(Epithelial) 5. forms the skin, the covering of the organs, and the inner lining of all the hollow organs

(Connective) 6. carries nutrients to the cells and carries away waste products

(Connective) 7. deep fascia, superficial fascia

(Nerve) 8. initiates, controls, and coordinates the body’s adaptation to its surroundings

(Muscle) 9. contracts and causes movement

(Epithelial) 10. always has a free surface that is exposed to outside influences

(Muscle) 11. responsible for the movement of food through the digestive tract, the constriction of blood vessels, and the emptying of the bladder

(Connective) 12. bones, cartilage, and ligaments

(Epithelial) 13. cells classified by shape as squamous, cuboidal, and columnar

(Connective) 15. provides support and protection

(Epithelial) 16. covers all the surfaces of the body

(Muscle) 17. responsible for pumping blood through the heart into the blood vessels
18. composed of neurons

19. makes up the major tissue of the glands

20. responsible for facial expression, speaking, and other voluntary movements

COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. Two categories of membranes are (epithelial) membranes and (fibrous connective tissue) membranes.

2. (Mucous membranes) produce a thick, sticky substance that acts as a protectant and lubricant.

3. (Serous membranes) produce a more watery, lubricating substance that lines the body cavities and sometimes forms the outermost surface of the organs contained in those cavities.

4. Three major serous membranes are the (pleura) that encases the lungs, the (pericardium) around the heart, and the (peritoneum) that lines the abdominal cavity.

SHORT ANSWER: In the spaces provided, write short answers to the following questions.

1. List three fascial membranes associated with the muscles.
   a. (endomysium)
   b. (perimysium)
   c. (epimysium)

2. Name three types of skeletal membrane and state where each is found.
   a. (periosteum—covering the bones)
   b. (perichondrium—covering cartilage)
   c. (synovial membrane—in cavities and capsules in and around joints)
MATCHING: Match the term with the best description. Write the letter of the best description in the space provided.

1. elastic cartilage
2. areolar tissue
3. osseous tissue
4. adipose tissue
5. ligaments
6. fibrocartilage
7. fibrous connective tissue
8. tendons
9. hyaline cartilage

A. impregnated with mineral salts, chiefly calcium phosphate and calcium carbonate
B. found between the vertebrae and in the pubic symphysis
C. found in the external ear and the larynx
D. found on the ends of bones and in movable joints
E. fibrous bands that connect bones to bones
F. composed of collagen and elastic fibers that are closely arranged
G. cords or bands that serve to attach muscle to bone
H. binds the skin to the underlying tissues and fills the spaces between the muscles
I. has an abundance of fat-containing cells

COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The three types of muscle tissue are ___(skeletal)___, ___(smooth)___, and ___(cardiac)___.

2. ____(Skeletal muscles or voluntary muscles)____ are usually attached to bone or other muscle by way of tendons, and they can be controlled by conscious effort.

3. Because these muscles have alternating light and dark cross markings, they are called ___(striated muscles)___.

4. Muscle tissue found in the hollow organs of the stomach, small intestine, colon, bladder, and the blood vessels does not have the cross markings and is called ___(nonstriated)___ or ___(smooth)___ muscle.

5. ____(Cardiac muscle tissue)___ is found only in the heart.
MULTIPLE CHOICE: Carefully read each statement. Choose the word or phrase that correctly completes the meaning and write the corresponding letter in the blank provided.

1. All substances are made from subatomic particles that form _______.
   a) molecules  c) atoms
   b) tissues     d) cells
   (c)

2. The basic structure in human organisms is the _______.
   a) organ        c) cell
   b) tissue       d) molecule
   (c)

3. Cell division, which produces new identical daughter cells, is called _______.
   a) mutation     c) amitosis
   b) mitosis      d) gestation
   (b)

4. The complex chemical and physical process that nourishes organisms is called _______.
   a) mitosis      c) homeostasis
   b) metabolism  d) nutrition
   (b)

5. Microscopic structures in the cytoplasm of the cell that produce energy needed for cellular work are called _______.
   a) lysosomes    c) Golgi bodies
   b) mitochondria d) endoplasmic reticulum
   (b)

6. Anabolism and catabolism are closely regulated to maintain _______.
   a) prophase     c) amitosis
   b) enzymes      d) homeostasis
   (d)

7. Which of the following is not one of the five main human tissue types?
   a) epithelial   c) nervous
   b) connective  d) skeletal
   (d)

8. A special molecule that stores energy for use in muscular activity is _______.
   a) adenosine triphosphate  c) glucose
   b) fatty acids             d) protein
   (a)

9. Bone, adipose tissue, epimysium, and hyaline cartilage are _______.
   a) areas of fat storage  c) skeletal structures
   b) kinds of connective tissue  d) common sites of inflammation
   (b)
10. The thin tissue layer that forms the skin, organ coverings, and inner lining of all the hollow organs is the _______.
   a) epithelial tissue c) muscular tissue
   b) connective tissue d) skin

11. Fibrous tissue between muscle bundles is called _______.
   a) cartilage c) muscular tissue
   b) fascia d) perichondrium

12. The _______ membrane lines the inner joint cavities.
   a) synovial c) mucous
   b) adipose d) serous

13. The bands that attach muscles to bone are _______.
   a) tendons c) cartilage
   b) ligaments d) aponeurosa

14. The tough, fibrous bands that connect bones to bones are _______.
   a) tendons c) cartilage
   b) ligaments d) fascia

15. Skeletal muscles are also known as _______.
   a) voluntary muscles c) tendonous muscles
   b) nonstriated muscles d) smooth muscle

16. Cardiac muscle tissue occurs only in the _______.
   a) liver c) heart
   b) blood vessels d) skeletal muscles

WORD REVIEW: The student is encouraged to write down the meaning of each of the following words. The list can be used as a study guide for this unit.

adipose tissue

(Adipose tissue is areolar tissue with an abundance of fat cells.)

amitosis

(Amitosis is a process of cell division.)
anabolism

*(Anabolism is the process of building up larger molecules from smaller ones.)*

anaphase

*(Anaphase is a stage in cell division.)*

anatomy

*(Anatomy is the study of the gross structure of the body and the interrelationship of its parts.)*

areolar tissue

*(Areolar tissue is loose connective tissue that binds the skin to the underlying tissues and fills the spaces between the muscles.)*

atoms

*(Atoms are subatomic particles of which all substances are composed.)*

cardiac muscle tissue

*(Cardiac muscle tissue occurs only in the heart and is responsible for pumping blood through the heart into the blood vessels.)*

catabolism

*(Catabolism is the metabolic breaking down of larger substances into smaller ones.)*

cell

*(Cells are basic functional units of all living matter.)*
cell membrane

(The cell membrane is the outer wall of the cell that permits soluble substances to enter and leave the protoplasm.)

cellular metabolism

(Cellular metabolism includes all chemical reactions within a cell that transform food for cell growth and operation.)

centrosome

(Centrosome is an organelle that consists of two rodlike structures that divide during mitosis and help to distribute the chromosomes during cell division.)

columnar

(Columnar refers to a type of epithelial tissue in which the cells are tall or rectangular.)

connective tissue membranes

(Connective tissue membranes include fascial and skeletal membranes that support and anchor body structures.)

cuboidal

(Cuboidal refers to a type of epithelial tissue in which the cells are small and cube shaped.)

cytoplasm

(Cytoplasm is the substance contained within the cell wall or membrane that contains the various cytoplasmic organelles.)

cytoplasmic organelles

(Cytoplasmic organelles are discrete structures within a cell that perform specialized functions necessary for the cell's survival.)
differentiation

(Differentiation is the repeated division of the ovum during early developmental stages, resulting in specialized cells that differ from one another.)

fibrocartilage

(Fibrocartilage is found between the vertebrae and in the pubic symphysis.)

fibrous connective tissue

(Fibrous connective tissue is composed of collagen and elastic fibers that are closely arranged to form tendons and ligaments.)

enzymes

(Enzymes are proteins that act as catalysts for chemical reactions in metabolism while remaining unchanged themselves.)

epithelial membranes

(Epithelial membranes have their outer surface covered with epithelium and include mucous and serous membranes.)

epithelial tissue

(Epithelial tissue is a protective layer that functions in the processes of absorption, excretion, secretion, and protection.)

fascia

(Fascia is the fibrous connective that forms a fibrous network that is continuous from the top of the skull to the tips of the toes and throughout the body.)

histology

(Histology is a branch of biology concerned with the microscopic structure of tissues of a living organism.)
Hyaline cartilage is found in the nose, trachea, and on the articulating ends of bones that contain little fibrous tissue, and it is made up of cells in a translucent matrix.

Interphase is a stage in cell division.

Ligaments are bands of fibrous tissue that connect bones to bones.

Metaphase is a stage in cell division.

Mitosis is the process of cell division where a cell divides into two identical cells.

Molecules are specific arrangements of atoms.

Mucous membranes are epithelial membranes that secrete a thick, sticky substance that acts as a lubricant and protectant.

Nerve tissue is composed of neurons, and it initiates, controls, and coordinates the body’s adaptation to its surroundings.
neurons

*(Neurons are the structural units of the nervous system.)*

nucleus

*(The nucleus is a cell organelle that contains the chromosomes that transmit heredity and also supervises cell activity.)*

organ system

*(An organ system is several organs working together to perform a bodily function.)*

organs

*(Organs are structures of the body made up of two or more different tissues that combine to accomplish a definite function.)*

perichondrium

*(The perichondrium is the membrane covering cartilage.)*

periosteum

*(The periosteum is a fibrous membrane that covers bone and that functions to protect the bone and serves as an attachment of tendons and ligaments.)*

physiology

*(Physiology is the science and study of the vital processes, mechanisms, and functions of an organ or system.)*

prophase

*(Prophase is a stage in cell division.)*
protoplasm

*(Protoplasm is a colorless, jelly-like substance within the cell in which food elements, such as protein, fats, carbohydrates, mineral salts, and water, are present.)*

reticular tissue

*(Reticular tissue is composed of fibers that form the framework of the liver and lymphoid organs.)*

serous membranes

*(Serous membranes line body cavities and sometimes the outer layer of organs. They produce a watery substance that acts as a lubricant.)*

skeletal muscle

*(Skeletal muscles are attached to bone by tendons and are responsible for moving the limbs, facial expression, speaking, and other voluntary movements.)*

smooth muscle

*(Smooth muscle lacks striations and cannot be stimulated to contract by conscious effort.)*

squamous

*(Squamous refers to a type of epithelial tissue in which the cells are rather flat.)*

striated muscles

*(Striated muscles are muscles that when viewed under magnification have alternating light and dark cross-markings called striations and include skeletal and cardiac muscles.)*

superficial fascia

*(Superficial fascia refers to the connecting layer between the skin and those structures underlying the skin.)*
synovial membrane

(Synovial membrane is a connective tissue membrane lining cavities and capsules in and around joints.)

telophase

(Telophase is a stage in cell division.)

tendons

(Tendons are bands of fibrous connective tissue that attach muscle to bone.)

tissues

(Tissues are collections of similar cells that carry out specific bodily functions.)

voluntary muscles

(Voluntary muscles are muscles that can be controlled by conscious effort and include skeletal muscles.)
THE ANATOMIC POSITION OF THE BODY

COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. In the anatomic position, the body (standing upright) with the palms of the hands facing (forward).

2. Anatomists divide the body with three imaginary planes called the (sagittal [vertical]), the (coronal [frontal]), and the (transverse [horizontal]) planes.

3. The (sagittal plane) divides the body into left and right parts by an imaginary line running vertically down the body.

4. The (coronal plane) is an imaginary line that divides the body into the anterior (front) or ventral half of the body and the posterior (back) or dorsal half of the body.

5. The (transverse plane) is an imaginary line that divides the body horizontally into an upper and lower portion.

6. (Midsagittal) refers to the plane that divides the body or an organ into right and left halves.

MATCHING: Match the term with the best description. Write the letter of the best description in the space provided.

1. cranial or superior aspect  A. situated in front of
2. caudal or inferior aspect  B. situated farther from the crown of the head
3. anterior or ventral aspect  C. farthest point from the origin of a structure or point of attachment
4. posterior or dorsal aspect  D. situated in back of
5. transverse plane  E. on the side, farther from the midline
6. sagittal plane  F. nearest the origin of a structure or point of attachment
7. coronal plane  G. situated toward the crown of the head
8. medial aspect  H. dividing the body into right and left sides
9. lateral aspect  I. the frontal plane dividing it into front and back halves
10. distal aspect  J. pertaining to the middle or nearer to the midline
11. proximal  K. a plane through a body part perpendicular to the axis
IDENTIFICATION: Identify the indicated cavities in Figure 5.2 (a diagram of the various body cavities) by writing the correct names in the numbered space that corresponds to the number on the figure.

1. (cranial cavity)

2. (spinal cavity)

3. (thoracic cavity)

4. (abdominal cavity)

5. (pelvic cavity)
MATCHING: Match the term with the best description. Write the letter of the best description in the space provided.

(H)  1. hypogastric  A. region of the temples
(K)  2. inguinal  B. region of the neck
(A)  3. temporal  C. region of the shoulder joint and deltoid muscle
(R)  4. scapular  D. region of the armpit
(T)  5. frontal  E. region between the elbow and shoulder
(E)  6. brachial  F. region of the abdomen lateral to the epigastric region
(B)  7. cervical  G. region of the navel
(C)  8. deltoid  H. region inferior to the umbilical region
(G)  9. umbilical  I. region of the kneecap
(M) 10. epigastric  J. region of the thigh
(L) 11. lumbar  K. region of the groin
(Q) 12. gluteal  L. region of the lower back
(I) 13. patellar  M. region of the abdomen
(S) 14. popliteal  N. region of the breast and chest
(N) 15. pectoral  O. region of the head, posterior to the frontal region and anterior to the occipital region
(O) 16. parietal  P. region of the temporal bone behind the ear
(D) 17. axillary  Q. region of the muscles of the buttocks
(J) 18. femoral  R. region of the back of the shoulder or shoulder blade
(P) 19. mastoid  S. an area behind the knee joint
(F) 20. hypochondrium  T. region of the forehead
IDENTIFICATION: Identify the anatomic areas indicated in Figures 5.3 and 5.4 by writing the letter of the anatomic area next to the appropriate term in the space provided.

1. axillary  
2. brachial  
3. cervical  
4. epigastric  
5. femoral  
6. frontal  
7. gluteal  
8. hypochondrium  
9. hypogastric  
10. inguinal  
11. lumbar  
12. occipital  
13. parietal  
14. patellar  
15. pectoral  
16. popliteal  
17. sacral  
18. scapular  
19. temporal  
20. umbilical

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Fig. 5.3 Regions of the body, anterior view.  
Fig. 5.4 Regions of the body, posterior view.
COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The dorsal cavities include the [(cranial)] cavity and the [(vertebral or spinal)] cavity.

2. The ventral cavities are the [(thoracic)] cavity and [(abdominal)] cavity.

3. The liver, stomach, spleen, pancreas, and small and large intestines are located in the [(abdominal)] cavity.

4. The [(pelvic cavity)] contains the bladder, rectum, and some of the reproductive organs.

5. The four main anatomic parts of the body are [(the head)], [(spine)], [(trunk)], and [(extremities)].

6. Body structures containing two or more different tissues that combine to perform a definite function are called [(organs)].

7. When several organs work together to perform a body function, they constitute an [(organ system)].

SHORT ANSWER: In the spaces provided, list ten organ systems.

1. [(integumentary system [skin]])

2. [(skeletal system)]

3. [(muscular system)]

4. [(circulatory system [blood vascular/lymph vascular])]  

5. [(nervous system)]

6. [(endocrine system)]

7. [(digestive system)]

8. [(respiratory system)]

9. [(excretory system [including the urinary system])]  

10. [(reproductive system)]
IDENTIFICATION: In the spaces provided, write the name of the related major body system.

1. carries oxygen and nutrients to all parts of the body (circulatory)
2. is damaged with a scratch or burn (integumentary)
3. provides a rigid structure and attachment for muscles (skeletal)
4. breaks down food into absorbable particles (digestive)
5. includes the pituitary, thyroid, and ovaries (endocrine)
6. produces heat and movement (muscular)
7. removes uric acid from the system (excretory)
8. provides for continuation of the species (reproductive)
9. allows for the absorption of oxygen into the body (respiratory)
10. includes the liver, lungs, kidneys, and colon (excretory)
11. provides information about where the body is in the environment (nervous)
12. produces hormones (endocrine)

MULTIPLE CHOICE: Carefully read each statement. Choose the word or phrase that correctly completes the meaning and write the corresponding letter in the blank provided.

1. The imaginary line that divides the body into front and back halves is the _______.
   a) coronal plane  
   b) sagittal plane

2. The liver and stomach are contained in the _______.
   a) dorsal cavity  
   b) pelvic cavity

3. The elbow is _______ to the wrist.
   a) proximal  
   b) medial

4. The ribs are lateral to the _______.
   a) arms  
   b) scapula
5. Lumbar refers to the region of the _______.
   a) temple  c) lower back
   b) skull  d) pelvis

6. The epigastric area is _______.
   a) the location of the bladder  c) the region of the tongue
   b) inferior to the diaphragm  d) anterior to the scapula

7. The human body has _______ important organ systems.
   a) two  c) ten
   b) five  d) twenty

8. The axillary region of the body is _______.
   a) at the bend of the elbow  c) near the groin
   b) the armpit  d) on the head

9. The _______ region of the body is behind the knee.
   a) patellar  c) popliteal
   b) parietal  d) femoral

10. A sagittal cut through an organ or body divides it into _______.
    a) right and left portions  c) dorsal and ventral portions
    b) superior and inferior portions  d) three or four lateral portions

11. The bladder is located in the _______.
    a) dorsal cavity  c) abdominal cavity
    b) cranium/cavity  d) pelvic cavity

12. A transverse section in the parietal area would show _______.
    a) the inside of the knee  c) both sides of the brain
    b) one side of the brain  d) both lungs
**WORD REVIEW:** The student is encouraged to write down the meaning of each of the following words. This list can be used as a study guide for this unit.

**Abdominal cavity**

*(The abdominal cavity is part of the ventral cavities, situated below the diaphragm, and contains the liver, stomach, spleen, pancreas, small intestine, and part of the large intestine.)*

**Anatomic position**

*(Anatomic position shows a body in an upright position, with the hands facing palms forward.)*

**Anterior**

*(Anterior means situated in front of.)*

**Circulatory system**

*(Circulatory system is the network of vessels through which blood and lymph circulate.)*

**Coronal plane**

*(The coronal plane divides the body into the front and back.)*

**Cranial cavity**

*(The cranial cavity is located in the skull and contains the brain.)*

**Digestive system**

*(The digestive system consists of the mouth, stomach, intestines, salivary, and gastric glands.)*
(Distal is the point farther from the origin of a structure or attachment.)

dorsal cavities

(Dorsal cavities include the cranial and spinal or vertebral cavities.)

endocrine system

(The endocrine system consists of a group of specialized glands that affect the growth, development, sexual activity, and health of the entire body.)

excretory system

(The excretory system includes the skin, kidneys, bladder, liver, lungs, and large intestines, all of which eliminate waste products from the body.)

inferior

(Inferior means situated lower or farther from the head.)

integumentary system

(The integumentary system is composed of the skin, hair, and nails.)

lateral

(Lateral means toward the side, farther from the midline.)

medial

(Medial means toward the center, nearer to the midline.)
muscular system

(Muscular system is made up of voluntary and involuntary muscles that are necessary for movement.)

nervous system

(The nervous system controls and coordinates all the body systems and includes the nerves, spinal cord, and the brain.)

organ system

(An organ system is several organs working together to perform a bodily function.)

pelvic cavity

(The pelvic cavity is the lower third of the abdominal cavity and contains the bladder, rectum, and some of the reproductive organs.)

posterior

(Posterior means situated behind or in back of.)

proximal

(Proximal means nearer the origin of a structure or point of attachment.)

respiratory system

(Respiratory system includes the lungs, air passages, nose, mouth, pharynx, trachea, and bronchial tubes.)

sagittal plane

(Sagittal plane divides the body into left and right parts.)
skeletal system

*(Skeletal system is the bony framework of the body, composed of bones, cartilage, and ligaments.)*

superior

*(Superior is situated higher or nearer the head.)*

thoracic cavity

*(The thoracic cavity is a ventral cavity located above the diaphragm, containing the heart and lungs.)*

transverse plane

*(The transverse plane divides the body horizontally into an upper and lower portion.)*

ventral cavities

*(Ventral cavities are located in the anterior aspect of the body and include the thoracic and abdominal cavities.)*

vertebral cavity

*(Vertebral cavity or the spinal cavity contains the spinal cord.)*
SYSTEM ONE: THE INTEGUMENTARY SYSTEM—THE SKIN

SHORT ANSWER: In the spaces provided, list six functions of the skin.

1. (protection)
2. (heat regulation)
3. (secretion and excretion)
4. (sensation)
5. (absorption)
6. (respiration)

MATCHING: Match the term with the best description. Write the letter of the appropriate term in the space provided.

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. papillary layer</td>
<td>1. the deepest layer of the epidermis</td>
</tr>
<tr>
<td>B. reticular layer</td>
<td>2. contains fat cells, sweat and oil glands, and hair follicles</td>
</tr>
<tr>
<td>C. subcutaneous tissue</td>
<td>3. contains conelike projections made of fine strands of elastic tissue extending upward into the epidermis</td>
</tr>
<tr>
<td>D. stratum corneum</td>
<td>4. site of keratin formation</td>
</tr>
<tr>
<td>E. stratum spinosum</td>
<td>5. contains blood and lymph vessels and nerve endings</td>
</tr>
<tr>
<td>F. stratum germinativum</td>
<td>6. serves as a protective cushion for the upper skin layers</td>
</tr>
<tr>
<td>G. dermis as a whole</td>
<td>7. contains melanocytes that produce the pigment melanin</td>
</tr>
<tr>
<td>H. epidermis as a whole</td>
<td>8. contains collagen, reticulum, and elastin fibers</td>
</tr>
<tr>
<td>I. consists of cells containing melanin</td>
<td>9. consists of cells containing melanin</td>
</tr>
</tbody>
</table>

IDENTIFICATION: Identify the structures indicated in Figure 5.5 (a cross-section of skin) by writing the letter of the structure next to the appropriate name in the space provided.

1. arrector pili muscle
2. dermis
3. epidermis
4. sebaceous gland
5. stratum corneum
6. stratum germinativum
Fig. 5.5 The integumentary system (showing skin and hair).
TRUE OR FALSE: If the following statements are true, write true in the space provided. If they are false, replace the italicized word with one that makes the statement true.

1. There is a fine network of blood and lymph capillaries in the epidermis.  
   (subcutaneous layer)  
   true

2. As people age, the collagen of the skin tends to lose its elasticity.  
   (true)

3. Pliability of the skin depends on the elasticity of the fibers in the subcutaneous layer.  
   (dermis)

4. Healthy skin possesses a slightly acid reaction.  
   (true)

5. The color of the skin depends on the thickness and the blood supply.  
   (melanin)

SHORT ANSWER: Circle the term that does not belong in each of the following groups (groups flow from left to right).

stratum germinativum; reticular layer; stratum malpighian; stratum granulosum  
melanin; collagen; keratin; cuticle  
pacinian corpuscle; ruffini corpuscle; arrector pili; Meissner corpuscle  
scar; pustule; crust; fissure  
seborrhea; leukoderma; lentigines; nevus

COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. There are two clearly defined divisions of the skin. The outer layer is the (epidermis) and the inner layer is the (dermis).  
   (epidermis) (dermis)

2. There are two kinds of duct glands in the skin. (Sudoriferous glands) produce sweat and (sebaceous) glands produce oil.  
   (Sudoriferous glands) (sebaceous)

3. Sweat glands are under the control of the (autonomic) nervous system.  
   (autonomic)

4. Two appendages of the skin are (hair) and (nails).  
   (hair) (nails)

5. The appendages of the skin referred to in the previous question are composed of (hard keratin).  
   (hard keratin)
6. The \textit{arrector pili} muscle is connected to the base of the hair follicle.

7. When the muscle referred to in the previous question contracts, it results in a reaction commonly called \textit{(goose bumps)}.

8. A structural change in the tissues caused by injury or disease is a \textit{(lesion)}.

9. A structural change in the tissues that develops in the later stages of disease is called \textit{(secondary lesions)}.

10. Small masses of hardened, discolored sebum that appear most frequently on the face, shoulders, chest, and back are called \textit{(blackheads)}.

**MATCHING:** Match the term with the best description. Write the letter of the best description in the space provided.

\begin{tabular}{ll}
(G) & 1. scar \quad A. an accumulation of epidermal flakes such as excessive dandruff  \\
(J) & 2. macule \quad B. an itchy, swollen lesion that lasts only a few hours  \\
(H) & 3. pustule \quad C. an open lesion on the skin accompanied by loss of skin depth  \\
(A) & 4. scale \quad D. a small, elevated pimple in the skin  \\
(I) & 5. tumor \quad E. a crack in the skin such as in chapped hands or lips  \\
(L) & 6. vesicle \quad F. the scab on a sore  \\
(K) & 7. bulla \quad G. likely to form during the healing of an injury  \\
(C) & 8. ulcer \quad H. an elevation of the skin having an inflamed base and containing pus  \\
(B) & 9. wheal \quad I. an external swelling, varying in size, shape, and color  \\
(D) & 10. papule \quad J. a small, discolored spot or patch such as freckles  \\
(F) & 11. crust \quad K. a blister similar to but larger than a vesicle  \\
(E) & 12. fissure \quad L. a blister with clear fluid in it
\end{tabular}
**COMPLETION:** In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. A skin inflammation caused by outside agents or chemicals is **(contact dermatitis)**.
2. The most common type of skin cancer is **(basal cell carcinoma)**.
3. The most dangerous type of skin cancer is **(malignant melanoma)**.
4. A mass of connected boils is a **(carbuncle)**.
5. Three types of warts are **(common)**, **(plantar)**, and **(venereal)**.
6. Three kinds of skin cancer are **(basal cell carcinoma)**, **(squamous cell carcinoma)**, and **(malignant melanoma)**.
7. The A-B-C-D-E signs for skin cancer are:

   *(Asymmetry of any pigmented lesion)*

   *(Borders that are irregular or notched)*

   *(Color that is widely variable ([black, brown, red, blue, or white]))*

   *(Diameter larger than a pencil eraser)*

   *(Elevation above the skin)*

8. **(Psoriasis)** is a chronic, inflammatory skin condition characterized by round, dry patches covered with coarse, silvery scales.
9. **(Impetigo)** is a highly contagious, bacterial skin infection that is most common in children.
10. Another name for furuncle is **(boil)**.

**MULTIPLE CHOICE:** Carefully read each statement. Choose the word or phrase that correctly completes the meaning and write the corresponding letter in the blank provided.

1. The largest organ of the body is the ________.
   a) muscular system  
   b) skin  
   c) liver  
   d) stomach

2. Protection, heat regulation, secretion, excretion, and absorption are functions of the ________.
   a) endocrine system  
   b) skin  
   c) muscles  
   d) brain
3. Exposure to ultraviolet light causes the skin to darken by stimulating the production of _______.
   a) melanin  c) fibroblasts
   b) carotene  d) hemoglobin

4. Collagen, reticulum, and elastin are the fibers in the cells of the _______.
   a) epidermis  c) dermis
   b) lymph  d) blood

5. The skin gets its strength, form, and flexibility from _______.
   a) collagen  c) the muscles
   b) elastin  d) subcutaneous tissue

6. A small discolored spot on the skin is a _______.
   a) macule  c) tumor
   b) bulla  d) vesicle

7. An elevation of the skin having an inflamed base and containing pus is a _______.
   a) papule  c) pustule
   b) pimple  d) wheal

8. A crack in the skin penetrating into the dermis is called a _______.
   a) fissure  c) scab
   b) crust  d) cut

9. Skin disorders are an area that massage therapists should be able to _______.
   a) treat successfully  c) recognize and refer
   b) use vibration on  d) apply antibiotic creams to

10. A generalized term for a structural change in tissue from disease or injury is _______.
    a) fracture  c) hematoma
    b) lesion  d) laceration

11. As cells are pushed from the deeper portion of the epidermis toward the surface _______.
    a) they tend to die  c) they divide continually
    b) they become dermal cells  d) their supply of nutrients improve
12. The subcutaneous layer consists of ________.
   a) epithelial tissue  
   b) epithelium and loose connective tissue 
   c) loose connective tissue and adipose tissue 
   d) adipose tissue and skeletal muscle tissue 
   __ (c) __

13. A thickening in the skin caused by repeated or continued pressure is a ________.
   a) macule  
   b) wheal  
   c) bulla  
   d) callus  
   __ (d) __

14. An itchy swollen lesion that lasts only a few hours is a ________.
   a) tumor  
   b) papule  
   c) bulla  
   d) wheal  
   __ (d) __

15. Another name for skin is ________ membrane.
   a) synovial  
   b) cutaneous  
   c) mucous  
   d) serous  
   __ (b) __

16. "Goose bumps" are the result of ________.
   a) a nervous irritation  
   b) contracting arrector pili muscles  
   c) body heat loss  
   d) oxygen depletion  
   __ (b) __

17. The ________ is a semi-solid part of the skin made up of a mixture of fibers, water and 'ground substance'.
   a) eccrine  
   b) melanin  
   c) dermis  
   d) epidermis  
   __ (c) __

18. The ________ comprises almost a solid sheet of cells at the outermost layers of the skin.
   a) dermis  
   b) epidermis  
   c) graft  
   d) subcutaneous tissue  
   __ (b) __

19. When a body lies in one position too long, decreased circulation can result in ________, or "bedsores."
   a) decubitus ulcers  
   b) apocrine  
   c) acne rosacea  
   d) hematomas  
   __ (a) __
**Word Review:** The student is encouraged to write down the meaning of each of the following words. The list can be used as a study guide for this unit.

- **collagen**
  
  *(Collagen is a protein consisting of inelastic, white fibers that help to make up connective tissue.)*

- **dermis**
  
  *(The dermis is the deeper layer of the skin that extends to form the subcutaneous tissue.)*

- **epidermis**
  
  *(The epidermis is the outermost layer of the skin.)*

- **integument**
  
  *(Integument refers to the outer covering or the skin.)*

- **keratin**
  
  *(Keratin is a protein in the skin that makes up the hair and nails.)*

- **melanin**
  
  *(Melanin is the coloring matter of the skin produced in the stratum germinativum and located in the stratum spinosum that helps to protect sensitive cells from strong light.)*

- **reticular layer**
  
  *(The reticular layer of the skin contains fat cells, blood and lymph vessels, sweat and oil glands, hair follicles, and nerve endings.)*
sebaceous

*(Sebaceous refers to the oil glands in the skin.)*

stratum germinativum

*(The stratum germinativum is the deepest layer of the epidermis, where cells undergo mitosis, pushing other cells closer to the surface.)*

stratum granulosum

*(The stratum granulosum is the granular layer of the skin, where nearly dead cells undergo changes to be the more superficial layers.)*

stratum spinosum

*(The stratum spinosum, also called the stratum mucosum, contains melanin, the coloring matter of the skin that helps to protect sensitive cells from strong light.)*

subcutaneous tissue

*(Subcutaneous tissue is regarded as a continuation of the dermis and is also called the superficial fascia.)*

sudoriferous

*(Sudoriferous glands are the sweat glands located in the dermis layer of skin.)*

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**SYSTEM TWO: THE SKELETAL SYSTEM**

**SHORT ANSWER:** In the spaces provided, list the five main functions of the skeletal system.

1. *(to offer a framework that supports body structures and gives shape to the body)*
2. *(to protect delicate internal organs and tissues)*
3. *(to provide attachments for muscles and act as levers in conjunction with muscles to produce movement)*
4. *(to manufacture blood cells in the red bone marrow)*
5. *(to store minerals such as calcium phosphate, calcium carbonate, magnesium, and sodium)*
**KEY CHOICES:** Bones are classified in one of four major bone categories. Put the appropriate key letter for each of the following bone classifications in the space provided.

S = Short bones  I = Irregular bones  
L = Long bones  F = Flat bones

1. tibia  7. axis  
2. ilium  8. femur  
3. phalange  9. talus  
4. ulna  10. metacarpal  
5. occiput  11. scapula  
6. calcaneus  12. rib

**COMPLETION:** In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The skeletal system is composed of ____ (bones)__, ____ (cartilage)__, and ____ (ligaments)__ .

2. The inorganic mineral matter of bone consists mainly of ____ (calcium phosphate)__ and ____ (calcium carbonate)__ .

3. The fibrous membrane covering bone that serves as an attachment for tendons and ligaments is the ____ (periosteum)__ .

4. The spongy bone tissue in flat bones and at the ends of long bones is filled with ____ (red bone marrow)__ and is the site of production for ____ (blood cells)__ .

5. The hollow chamber formed in the shaft of long bones that is filled with yellow bone marrow is the ____ (medullary cavity)__ .
**IDENTIFICATION:** Identify the structures indicated in Figure 5.6 (a diagram of a typical long bone) by writing the correct letter in the space provided.

1. proximal epiphysis  
2. compact bone  
3. diaphysis (shaft of bone)  
4. red marrow  
5. distal epiphysis  
6. medullary cavity (site of yellow bone marrow in adults)  
7. periosteum (covering of bone)  
8. spongy bone  
9. articular cartilage

![Fig. 5.6 Structure of long bone.](image-url)
1. The two main parts of the skeleton are the \textit{(axial skeleton)} and the \textit{(appendicular skeleton)}.

2. The bones of the skull, thorax, vertebral column, and the hyoid bone make up the \textit{(axial skeleton)}.

3. The bones of the shoulder, upper extremities, hips, and lower extremities make up the \textit{(appendicular skeleton)}.

4. In the human adult, the skeleton consists of \textit{(206)} bones.

5. The spine consists of \textit{(24)} vertebra.

6. There are \textit{(7)} cervical vertebra.

7. There are \textit{(12)} thoracic vertebra.

8. There are \textit{(5)} lumbar vertebra.

9. There are \textit{(8)} carpals in each wrist.

10. There are \textit{(7)} tarsals in each ankle.

11. There are \textit{(14)} phalanges in each hand.

12. The connection where two bones come together is called a \textit{(joint)} or an \textit{(articulation)}.

13. The cranium is composed of \textit{(8)} bones.

14. The face is composed of \textit{(14)} bones.
**KEY CHOICES:** Joints are classified according to their structure and their function. In the first column of spaces provided, place the appropriate key letter indicating the structural classification next to the corresponding terms. In the second column, place the appropriate key letter indicating the functional classification next to the corresponding terms.

- **F** = fibrous joints
- **C** = cartilaginous joints
- **N** = synovial joints
- **A** = amphiarthrotic joints
- **D** = diarthrotic joints
- **S** = synarthrotic joints

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<th>Structural Classification</th>
<th>Functional Classification</th>
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1. symphysis pubis
2. glenohumeral joint
3. sagittal suture
4. elbow joint
5. bones united by fibrous connective tissue
6. hip joint
7. essentially immovable
8. sacroiliac joint
9. joint capsule with synovial fluid
10. intervertebral joints
11. articular cartilage on bones
12. joint between sphenoid and temporal bones
13. freely movable
14. allows limited movement
KEY CHOICE: Put the appropriate key letter for each of the following types of joints in the space provided. Movable joints in the body are classified descriptively.

A. pivot joints        D. gliding joints        F. condyloid ellipsoid
B. ball-and-socket joints   E. saddle joints       G. symphysis
C. hinge joints

1. joint between ulna and humerus  (C)
2. hip joint  (B)
3. knee joint  (C)
4. joint between the first metacarpal and the trapezium  (E)
5. joints between radius and carpals  (F)
6. glenohumeral joint  (B)
7. joint between axis and atlas  (A)
8. joint between radius and ulna near elbow  (A)
9. intervertebral joints  (D)
10. interphalangeal joints  (C)
11. joint between the tibia and the talus  (C)
12. between right and left pubis  (G)
IDENTIFICATION: Identify the bones in Figure 5.7 by writing the correct label in the numbered space that corresponds to the number on the figure.

1. (mandible) 16. (rib)
2. (sternum) 17. (lumbar vertebrae)
3. (xiphoid process) 18. (ilium)
4. (ulna) 19. (sacrum)
5. (radius) 20. (coccyx)
6. (greater trochanter or femur) 21. (carpals)
7. (phalanges [finger bones]) 22. (metacarpals)
8. (ischium) 23. (femur)
9. (cranium) 24. (patella)
10. (cervical vertebrae) 25. (tibia)
11. (clavicle) 26. (fibula)
12. (acromion process) 27. (tarsals)
13. (coracoid process) 28. (metatarsals)
14. (scapula) 29. (phalanges [toe bones])
15. (humerus)
Fig. 5.7 Skeletal system, anterior view.
IDENTIFICATION: Identify the bony landmarks in Figures 5.8a and 5.8b by writing the correct name in the lettered space that corresponds to the letter in the figures.

A. (ramus of the mandible)  N. (acromion process)
B. (sternal notch)  O. (crest of the ilium)
C. (coricoid process)  P. (greater trochanter of the femur)
D. (bicipital groove or tuberosity of the humerus)  Q. (medial epicondyle of the femur)
E. (xiphoid process)  R. (lateral epicondyle of the femur)
F. (medial epicondyle of the humerus)  S. (head of the fibula)
G. (lateral epicondyle of the humerus)  T. (lateral malleolus)
H. (ASIS; anterior superior iliac spine)  U. (calcaneus)
I. (pubic arch)  V. (mastoid process)
J. (patella)  W. (spine of the scapula)
K. (medial malleolus)  X. (olecranon process)
L. (supraorbital ridge)  Y. (PSIS; posterior superior iliac spine)
M. (zygomatic arch)  Z. (ischial tuberosity)
Fig. 5.8a Major bony landmarks on the body, anterior view.

Fig. 5.8b Major bony landmarks on the body, posterior view.
IDENTIFICATION: Identify the bones and sutures in Figure 5.9 by writing the number of the bone next to the appropriate term in the space provided.

(9) A. ethmoid  (11) F. nasal  (12) K. zygomatic arch
(6) B. frontal  (1) G. occipital  (5) L. coronal suture
(10) C. lacrimal  (3) H. parietal  (2) M. lambdoidal suture
(14) D. mandible  (8) I. sphenoid  (4) N. squamosal suture
(13) E. maxilla  (7) J. temporal

MATCHING: Match the bone names listed above with the best descriptions listed below. Write the letter of the bone name in the space provided. Note that some descriptions apply to more than one bone.

(K)  1. cheekbone
(E)  2. holds the upper teeth
(G)  3. contains the foramen magnum
(B)  4. forms the supraorbital ridge
(A,B,E,J)  5. four bones containing the paranasal sinuses
(H)  6. forms the sagittal suture
(B,H)  7. forms the coronal suture
(H,J)  8. forms the squamosal suture
(G,H)  9. forms the lambdoidal suture
(J)  10. forms the mastoid process
(D)  11. forms the chin
(I)  12. connects with all other cranial bones
(D)  13. connected to the skull with a diarthrotic joint
(C)  14. contain openings for tear ducts
Fig. 5.9 Skeletal structures of the cranium, neck, and face.
IDENTIFICATION: Identify the parts of the spine in Figure 5.10 by writing the letter of the part next to the corresponding label in the space provided.

(A) 1. atlas, axis  
(B) 2. cervical vertebrae  
(F) 3. coccyx

(D) 4. lumbar vertebrae  
(E) 5. sacrum  
(C) 6. thoracic vertebrae

Fig. 5.10 Vertebral column.
MATCHING: Match the term with the best description. Write the letter of the best description in the space provided.

1. fossa  (F)  A. a less prominent ridge of a bone than a crest
2. trochanter  (C)  B. a rounded articulating process at the end of a bone
3. foramen  (K)  C. a large process for muscle attachment
4. sinus  (H)  D. a sharp slender projection
5. process  (M)  E. a tubelike passage
6. condyle  (I)  F. a depression or hollow
7. line  (A)  G. a ridge
8. tuberosity  (L)  H. a cavity within a bone
9. meatus  (E)  I. a rounded knuckle-like prominence usually at a point of articulation
10. tubercle  (J)  J. a small rounded process
11. head  (B)  K. a hole
12. spine  (D)  L. a large rounded process
13. crest  (G)  M. a bone prominence or projection

SHORT ANSWER: Circle the term that does not belong in each of the following groups (groups flow from left to right).

tibia  patella  femur  fibula
elbow  knee  finger  hip
axis/atlas  sacroiliac  intervertebral  pubic symphysis
tubercle  fossa  tuberosity  condyle
cranium  rib  vertebra  scapula
MATCHING: Match the skeletal disorders with the best description. Write the letter of the appropriate skeletal disorder in the space provided.

A. dislocation  C. osteoarthritis  E. fracture  G. bursitis
B. sprain  D. osteoporosis  F. rheumatoid arthritis

(G) 1. an inflammation of the small fluid-filled sacs located near the joints

(E) 2. a break or rupture in a bone

(F) 3. an inflammation causing the articular cartilage to erode and the joints to calcify and eventually become immovable

(D) 4. increased porosity of the bone that causes a thinning of bone tissue

(A) 5. displacement of a bone within a joint

(F) 6. a chronic inflammatory disease, that first affects the synovial membrane lining the joints

(B) 7. stretching or tearing of ligaments

(C) 8. a chronic disease that accompanies aging, usually affecting joints that have experienced a great deal of wear and tear or trauma

IDENTIFICATION: Identify each of the spinal curves in Figure 5.11 by writing the correct label in the space provided.

A. (scoliosis)  B. (lordosis)  C. (kyphosis)

Fig. 5.11 Abnormal curvatures of the spine.
MULTIPLE CHOICE: Carefully read each statement. Choose the word or phrase that correctly completes the meaning and write the corresponding letter in the blank provided.

1. Flat bones are found in the _______.
   a) knee  
   b) skull  
   c) leg  
   d) spine

2. The number of bones in the human adult skeleton is _______.
   a) 101  
   b) 206  
   c) 310  
   d) 502

3. The bones of the upper and lower extremities form the _______.
   a) axial skeleton  
   b) spine  
   c) skull  
   d) appendicular skeleton

4. White blood cells are produced by the _______.
   a) yellow bone marrow  
   b) lymphocytes  
   c) osteoclasts  
   d) red bone marrow

5. A fracture in the shaft of the bone would be a break in the _______.
   a) epiphysis  
   b) epiphyseal plate  
   c) diaphysis  
   d) articular cartilage

6. Muscle tendon fibers attach to bone by interlacing with _______.
   a) compact bone  
   b) ligaments  
   c) periosteum  
   d) endosteum

7. Which of following is NOT a bone of the cranium?
   a) temporal  
   b) sphenoid  
   c) zygomatic  
   d) parietal

8. The coracoid process is located _______.
   a) on the scapula  
   b) behind the ear  
   c) on the pelvis  
   d) at the proximal end of the ulna

9. Immovable joints are called _______.
   a) amphiarthrotic  
   b) articulations  
   c) synarthrotic  
   d) synovial

10. The range of motion of amphiarthrotic joints is _______.
    a) 360 degrees  
    b) limited  
    c) freely moving  
    d) in a single plane
11. An example of a diarthrotic joint is _______.
   a) knee c) intervertebral  
   b) skull d) the teeth  

12. The greatest range of movement is found in _______.
   a) pivot joints c) ball-and-socket joints  
   b) hinge joints d) saddle joints  

13. A stretched ligament with some discomfort and minimal loss of function is a _______.
   a) Class I strain c) Class I sprain  
   b) Class II sprain d) Class III sprain  

14. The major purpose of the epiphyseal plate is _______.
   a) mending of fractures c) providing strength in long bones  
   b) enlarging the epiphyses d) lengthening long bones  

15. Lateral curvature of the spine is called _______.
   a) lordosis c) convexity  
   b) scoliosis d) kyphosis  

16. Degenerative joint disease is generally known as _______.
   a) osteoporosis c) osteoarthritis  
   b) rheumatoid arthritis d) osteomyelitis  

17. Which of following is NOT a part of the pelvis?
   a) ischium c) zygomatic  
   b) pubis d) ilium  

18. The part of the long bone that is soft and contains the “growth line” is referred to as the _______.
   a) epiphysis c) bone shaft  
   b) diaphysis d) bone marrow  

19. The “ankle bone” that protrudes on the inside of the leg is the _______.
   a) medial malleolus c) medial epicondyle  
   b) fibula d) lesser trochanter
20. The knee joint is an example of a _______.
   a) synarthrotic joint c) amphiarthrotic joint
   b) hinge joint d) saddle joint

21. Which of the following is NOT found in the axial skeleton?
   a) the cranium c) the sacrum
   b) the scapula d) the sternum

22. The medial malleolus is on the _______.
   a) elbow c) knee
   b) wrist d) ankle

**WORD REVIEW:** The student is encouraged to write down the meaning of each of the following words. The list can be used as a study guide for this unit.

amphiarthrotic

*Amphiarthrotic joints, such as the symphysis pubis, have limited motion.*

appendicular skeleton

*(The appendicular skeleton is made up of the bones of the shoulder, upper extremities, hips, and lower extremities.)*

arthritis

*(Arthritis is an inflammatory condition of the joints.)*

articular cartilage

*(Articular cartilage is a layer of hyaline cartilage covering the end surface of the epiphysis.)*

articulation

*(Articulation is the movable joint between two bones.)*
axial skeleton

(The axial skeleton is made up of bones of the skull, thorax, vertebral column, and the hyoid bone.)

bursa

(Bursae are fibrous sacks lined with synovial membrane and lubricated with synovial fluid, functioning as a cushion in areas of pressure.)

cartilage

(Cartilage, or gristle, is a firm, tough, elastic substance that cushions the bones, prevents jarring between bones in motion, and gives shape to the nose and ears.)

compact bone tissue

(Compact bone tissue forms the hard bone found in the shafts of long bones and along the outside of flat bones.)

cranium

(The cranium consists of the eight bones of the skull that contain the brain.)

diaphysis

(The diaphysis is the bone shaft between the epiphyses.)

diarthrotic joint

(Diarthrotic joints are freely movable.)

epiphysis

(The epiphysis is an enlarged area on the ends of long bones that articulates with other bones.)
Joint capsule

(Joint capsule is the fibrous enclosure around a diarthrotic articulation.)

Kyphosis

(Kyphosis is an abnormally exaggerated convex curve of the spine.)

Ligament

(Ligaments are bands of fibrous tissue that connect bones to bones.)

Lordosis

(Lordosis is concave curvature of the spine.)

Marrow

(Marrow is the connective tissue filling in the cavities of bones that forms red and white blood cells.)

Medullary cavity

(The medullary cavity is a hollow chamber formed in the shaft of long bones that is filled with yellow bone marrow.)

Periosteum

(The periosteum is a fibrous membrane that functions to protect the bone and serves as an attachment of tendons and ligaments.)

Osteoporosis

(Osteoporosis is a condition in which increased reabsorption of calcium into the blood causes a thinning of bone tissue, leaving it prone to fracture.)
scoliosis

(Scoliosis is lateral curvature of the spine.)

sprain

(A sprain is an injury to a joint, resulting in stretching or tearing of the ligaments.)

synarthrotic

(Synarthrotic joints, such as those of the skull, are immovable.)

synovial fluid

(Synovial fluid lubricates the surfaces of joints.)

synovial membrane

(The synovial membrane is a connective tissue membrane lining cavities and capsules in and around joints.)

vertebra

(A vertebra is one of the 24 bones that make up the spine.)
KEY CHOICES: There are three classifications of muscles. Put the appropriate key letter(s) for each of the following muscle types in the spaces provided.

A = skeletal  B = smooth  C = cardiac

(A,C)  1. contains striations

(A)  2. shapes and contours the body

(B,C)  3. forms the hollow organs

(B,C)  4. involved with transport of materials in the body

(C)  5. found only in the heart

(B)  6. spindle shaped

(A)  7. multinucleated

(B)  8. controlled by the autonomic nervous system

(C)  9. quadrangular in shape, joined end to end

(C)  10. contracts without direct nerve action

(A)  11. referred to as the muscular system

(C)  12. coordinates activity to act as a pump

COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The main organ of the muscle system is (muscle) .

2. Muscle cells have the unique ability to (change their length) .

3. Muscle comprises approximately (40 to 60) percent of a person’s body weight.

4. The characteristics that enable muscles to perform their functions of contraction and movement are (irritability) , (contractility) , and (elasticity) .

5. The ability to return to its original shape after being stretched is (elasticity) .

6. The capacity of muscles to receive and react to stimuli is (irritability) .

7. The ability to contract or shorten and thereby exert force is (contractility) .
STRUCTURE OF SKELETAL MUSCLES

COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The functional unit of a muscle is the (muscle cell) or (muscle fiber).

2. The cell membrane of the muscle cell is the (sarcolemma).

3. The connective tissue covering of the muscle cell is the (endomysium).

4. Each muscle cell contains hundreds or even thousands of parallel (myofibrils).

5. The interaction of (actin) and (myosin) filaments gives muscle its unique contractile ability.

6. The arrangement of (actin) and (myosin) gives skeletal muscles a striated or striped appearance.

7. The site where the muscle fiber and nerve fiber meet is called the (neuromuscular junction) or (myoneural junction).

8. A motor neuron and all the muscle fibers that it controls constitute a (motor unit).

9. When a nerve impulse reaches the end of the nerve fiber, a chemical neurotransmitter called (acetylcholine) is released.

10. The energy for muscle contraction comes from the breakdown of the (adenosine triphosphate [ATP] molecule).
11. A metabolic process known as the (Krebs cycle) or the (citric acid cycle) takes place, resulting in the synthesis of ATP and the production of carbon dioxide, water, and energy in the form of heat.

12. When sufficient oxygen is available, ATP is synthesized through (aerobic) respiration.

13. When the oxygen supply is depleted, ATP is synthesized through (anaerobic) respiration.

14. During strenuous activity, heavy breathing and accelerated heart rate are indications of (oxygen debt).

15. Rapid or prolonged muscle contractions, to the point that oxygen debt becomes extreme and the muscle ceases to respond, causes (muscle fatigue).

16. The most stationary attachment of a muscle is the (origin).

17. The muscle attachment that creates the action of the structure is the (insertion).

18. A(n) (isometric) contraction occurs when a muscle contracts and the ends of the muscle do not move.

19. The glistening cord that connects the muscle with its attachment is a (tendon).
IDENTIFICATION: Identify each skeletal muscle part in Figure 5.12 by writing the number of the part next to the appropriate term in the space provided.

(12) A. actin filament  (11) E. myofilament  (4) I. perimysium
(6) B. endomysium  (9) F. myofibril  (7) J. sarcolemma
(2) C. epimysium  (10) G. myosin filament  (8) K. sarcoplasm
(3) D. fascicle  (5) H. muscle fiber  (1) L. tendon

Fig. 5.12 Structure of skeletal muscle.
**MATCHING:** Match the skeletal muscle part listed above with the best description listed below. Write the letter of the skeletal muscle part in the space provided.

- **(L)** 1. connective tissue projecting beyond the end of the muscle
- **(C)** 2. connective tissue covering the entire muscle
- **(I)** 3. separates muscles into bundles of fibers
- **(B)** 4. connective tissue covering of each muscle cell
- **(D)** 5. bundle of muscle fibers
- **(H)** 6. contractile unit of muscle tissue
- **(E)** 7. one of the microscopic threads that can be rendered visible in a muscle fiber
- **(J)** 8. the muscle cell membrane
- **(F)** 9. structure of the muscle cell containing actin and myosin
- **(K)** 10. the muscle cell intercellular fluid

**IDENTIFICATION:** Identify each part of the muscle cell sarcomere in Figure 5.13 by writing the appropriate letter next to the correct term in the space provided.

- **(B)** 1. A band
- **(E)** 2. actin filament
- **(C)** 3. H zone
- **(A)** 4. I band
- **(G)** 5. M line
- **(F)** 6. myosin filament
- **(H)** 7. sarcomere
- **(I)** 8. Z line
- **(D)** 9. zone of overlap

---

**Fig. 5.13** Parts of the muscle cell.
MATCHING: Match the term with the best description. Write the letter of the appropriate term in the space provided.

A. Type I muscle fibers   B. Type II muscle fibers

1. able to sustain low-level muscle contractions  (A)
2. darker red color  (A)
3. depend on anaerobic metabolism  (B)
4. fast twitch fibers  (B)
5. fatigue easily  (B)
6. have fewer mitochondria  (B)
7. high capacity to generate ATP  (A)
8. high resistance to fatigue  (A)
9. high number of mitochondria  (A)
10. larger fibers with more actin and myosin filaments  (B)
11. lighter color  (B)
12. more prominent in phasic muscles  (B)
13. more prominent in postural muscles  (A)
14. produce powerful, fast contractions  (B)
15. rich capillary supply  (A)
16. slow twitch fibers  (A)
17. tend to tighten and shorten when stressed  (A)
18. uses aerobic metabolism  (A)
19. vulnerable to muscle strains and tendonitis  (B)

IDENTIFICATION: On the following list of muscles, identify the postural muscles by placing a “P” in the space provided.

1. adductor longus and magnus  (P)
2. anterior neck flexors
3. deltoid
14. piriformis  (P)
15. quadratus lumborum  (P)
16. rectus abdominis
4. gluteals 17. rectus femoris
5. iliopsoas 18. rhomboids
6. latissimus dorsi 19. sacrospinalis
7. levator scapulae 20. scalenii
8. lower pectorals 21. serratus anterior
9. lumbar erector spinae 22. sternocleidomastoid
10. middle and lower trapezius 23. tensor fascia lata
11. oblique abdominals 24. triceps
12. pectoralis minor 25. upper trapezius
13. peroneals 26. vastus muscles

TRUE OR FALSE: If the following statements are true, write true in the space provided. If they are false, replace the italicized word with one that makes the statement true.

1. Muscle fibers are attached to bone by connective tissue called ligaments.
2. Each motor nerve attaches to one muscle cell.
3. The release of calcium ions by the sarcoplasmic reticulum results in a muscle contraction.
4. A skeletal muscle by definition has both ends attached to bone.
5. Only enough ATP is stored in muscle to sustain a muscle contraction for a few minutes.
6. ATP is produced by the mitochondria.
7. An eccentric contraction is an isotonic contraction.

COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. A(n) **eccentric** contraction occurs when a muscle is contracted and the ends of the muscle move further apart.
2. A(n) **concentric** contraction occurs when a muscle is contracted and the ends of the muscle move closer together.
3. Eccentric and concentric muscle contractions are both **isotonic** contractions.
4. When an action occurs, the muscle that is responsible for that action is the

(\textit{prime mover or the agonist}).

5. When an action occurs, the muscle that is responsible for the opposite action is the

(\textit{antagonist}).

6. Muscles that assist the primary muscle of an action are called (\textit{synergists}).

7. When discussing the dynamics of the movement of the body, the three components of motion are (\textit{flexion/extension}), (\textit{abduction/adduction}), and (\textit{rotation}).

\textbf{MATCHING}: Match the term with the best description. Write the letter of the best description in the space provided.

\begin{tabular}{ll}
\textbf{(H)} & 1. posterior \hspace{2cm} A. that which presses or draws down \\
\textbf{(M)} & 2. dilator \hspace{2cm} B. behind or in back of \\
\textbf{(E)} & 3. inferior \hspace{2cm} C. pertaining to the middle or center \\
\textbf{(J)} & 4. anguli \hspace{2cm} D. before or in front of \\
\textbf{(G)} & 5. levator \hspace{2cm} E. situated lower \\
\textbf{(B)} & 6. dorsal \hspace{2cm} F. to straighten \\
\textbf{(L)} & 7. superior \hspace{2cm} G. that which lifts \\
\textbf{(C)} & 8. medial \hspace{2cm} H. behind or in back of \\
\textbf{(K)} & 9. distal \hspace{2cm} I. nearer to the center or medial line \\
\textbf{(A)} & 10. depressor \hspace{2cm} J. at an angle \\
\textbf{(I)} & 11. proximal \hspace{2cm} K. farther from the center or medial line \\
\textbf{(D)} & 12. anterior \hspace{2cm} L. situated above \\
\textbf{(F)} & 13. extensor \hspace{2cm} M. that which expands or enlarges \\
\end{tabular}
MATCHING: Match the term with the best description. Write the letter of the appropriate term in the space provided.

1. raise the shoulders toward the ears  
2. action of the neck when looking at the ceiling  
3. action of the hip when standing up out of a seated position  
4. action of the toes when standing on tiptoes  
5. turning the hand palm up  
6. action of the foot when pointing toes  
7. action of elbow during eccentric contraction of bicep  
8. bringing the knees together  
9. action of knee during concentric contraction of biceps femoris  
10. turning the sole of the foot medially  
11. action of the femur when turning the feet outward  
12. action of the hip when bringing the knee toward the chest  
13. turning the palm of the hand downward  
14. action of the foot when pointing the toes up toward the knee

A. flexion  
B. extension  
C. dorsiflexion  
D. plantar flexion  
E. adduction  
F. abduction  
G. pronation  
H. supination  
I. medial rotation  
J. lateral rotation  
K. circumduction  
L. hyperextension  
M. inversion  
N. eversion  
O. elevation  
P. depression
IDENTIFICATION: Identify the muscles in Figure 5.14 by writing the correct name in the numbered space that corresponds to the number in the figure.

The Muscular System—Anterior View

1. (extensor digitorum longus)  
2. (tibialis anterior)  
3. (adductors)  
4. (flexors of the wrist)  
5. (pronator)  
6. (biceps brachii)  
7. (pectoralis major)  
8. (platysma)  
9. (sternocleidomastoid)  
10. (temporalis)  
11. (trapezius)  
12. (deltoid)  
13. (serratus anterior)  
14. (rectus abdominis)  
15. (external oblique)  
16. (internal oblique)  
17. (transverse abdominis)  
18. (brachioradialis)  
19. (flexor carpi radialis)  
20. (tensor fascia latae)  
21. (sartorius)  
22. (rectus femoris)  
23. (vastus lateralis)  
24. (vastus medialis)  
25. (gastrocnemius)  
26. (peroneus longus)  
27. (soleus)
Fig. 5.14 The muscular system, anterior view.
**IDENTIFICATION:** Identify the muscles in Figure 5.15 by writing the correct name in the numbered space that corresponds to the number in the figure.

The Muscular System—Posterior View

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>(Achilles' tendon)</td>
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<tr>
<td>2.</td>
<td>(biceps femoris)</td>
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<tr>
<td>3.</td>
<td>(semitendinosus)</td>
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<tr>
<td>4.</td>
<td>(semimembranosus)</td>
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<tr>
<td>5.</td>
<td>(gracilis)</td>
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<tr>
<td>6.</td>
<td>(external oblique)</td>
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<tr>
<td>7.</td>
<td>(latissimus dorsi)</td>
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<tr>
<td>8.</td>
<td>(rhomboids)</td>
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<tr>
<td>9.</td>
<td>(trapezius)</td>
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<td>10.</td>
<td>(splenius capitis)</td>
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<td>11.</td>
<td>(levator scapuli)</td>
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<td>12.</td>
<td>(supraspinatus)</td>
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<td>13.</td>
<td>(infraspinatus)</td>
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<td>14.</td>
<td>(deltoid)</td>
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<td>15.</td>
<td>(teres minor)</td>
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<td>16.</td>
<td>(teres major)</td>
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<td>17.</td>
<td>(triceps)</td>
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<td>18.</td>
<td>(erector spinae)</td>
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<td>19.</td>
<td>(posterior serratus inferior)</td>
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<td>20.</td>
<td>(extensors)</td>
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<td>21.</td>
<td>(gluteus medius)</td>
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<td>22.</td>
<td>(gluteus maximus)</td>
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<tr>
<td>23.</td>
<td>(gastrocnemius)</td>
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<tr>
<td>24.</td>
<td>(soleus)</td>
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</tbody>
</table>
Fig. 5.15 The muscular system, posterior view.
**MATCHING:** In the first answer column, identify the body part the muscle acts on. Write the correct letter in the answer blank. In the second answer column, indicate the action the muscle causes when it contracts. Write the correct letter in the answer blank.

<table>
<thead>
<tr>
<th>Body part</th>
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<td>(A)</td>
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<td>(D)</td>
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</table>

1. gluteus medius    A. Flexes
2. triceps brachii   B. Extends
3. upper trapezius   C. Adducts
4. deltoid (medial)  D. Abducts
5. gastrocnemius     E. Elevates
6. gluteus maximus   F. Plantar flexes
7. adductor magnus   G. Dorsal flexes
8. latissimus dorsi  H. Big toe
9. biceps femoris    I. Elbow
10. tibialis anterior J. Thumb
11. peroneus longus  K. Hip
12. gracilis         L. Ankle
13. rectus femoris   M. Knee
14. vastus lateralis N. Scapula
15. biceps brachii   O. Wrist
16. pectoralis major P. Neck
17. sternocleidomastoid Q. Shoulder
18. palmaris longus  R. Finger
19. sartorius        20. tensor fascia lata
21. abductor pollicis longus 22. extensor hallucis longus
23. brachioradialis  24. extensor indicis
25. soleus           26. iliopsoas
27. supraspinatus    28. supraspinatus
COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. A sudden involuntary contraction of a muscle or a group of muscles is a \textbf{(muscle spasm)}.\textcolor{red}{\textbf{muscle spasm}}

2. An enlargement of the breadth of a muscle as a result of repeated forceful muscle activity is called \textbf{(hypertrophy)}.\textcolor{red}{\textbf{hypertrophy}}

3. When the muscle tissue degenerates and begins to waste away, the process is called \textbf{(atrophy)}.\textcolor{red}{\textbf{atrophy}}

4. The process by which muscle tissue is replaced by fibrous connective tissue is \textbf{(myofibrosis)}.\textcolor{red}{\textbf{myofibrosis}}

5. Two inflammatory conditions of the white fibrous tissue that cause pain and stiffness (especially the fascial tissues of the muscular system) are \textbf{(fibrositis)} and \textbf{(myofibrositis)}.\textcolor{red}{\textbf{fibrositis}} \textcolor{red}{\textbf{myofibrositis}}

6. A group of related diseases that seems to be genetically inherited and that causes a progressive degeneration of the voluntary muscular system is \textbf{(muscular dystrophy)}.\textcolor{red}{\textbf{muscular dystrophy}}

7. \textbf{(Fibromyalgia)} is characterized by pain, fatigue, and stiffness in the connective tissue of the muscles, tendons, and ligaments. It is associated with stress and poor sleep habits and is most prevalent in women.

8. An inflammation of the tendon often occurring at the musculotendinous junction is \textbf{(tendinosis)}.\textcolor{red}{\textbf{tendinosis}}

9. An inflammation of the tendon sheath that is often accompanied by pain and swelling is called \textbf{(tenosynovitis)}.\textcolor{red}{\textbf{tenosynovitis}}

SHORT ANSWER: Circle the term that does not belong in each of the following groups (groups flow from left to right).

111
**IDENTIFICATION:** On the skeleton diagrams in Figures 5.16a through 5.17b, draw by shading the indicated muscles. Be as accurate as possible, paying close attention to muscle attachments. Draw the muscles on the indicated sides to minimize overlap.

Note that the right hand of all of the diagrams is supinated.

**Right-hand Side**
A. tibialis anterior  
B. gracilis  
C. adductor longus  
D. pectineus  
E. tensor fascia latae  
F. flexor carpi ulnaris  
G. external obliques  
H. biceps brachii  
I. serratus anterior

**Left-hand Side**
J. pectoralis minor  
K. coracobrachialis  
L. rectus abdominis  
M. flexor digitorum profundus  
N. adductor brevis  
O. adductor magnus  
P. extensor digitorum longus

**Fig. 5.16a** The skeletal system, anterior view.
Right-hand Side
A. peroneus brevis
B. extensor hallucis longus
C. vastus lateralis
D. vastus medialis
E. flexor digitorum superficialis
F. iliacus
G. psoas
H. pectoralis major
I. sternocleidomastoid

Left-hand Side
J. deltoid
K. brachialis
L. quadratus lumborum
M. flexor carpi radialis
N. rectus femoris
O. peroneus longus

Fig. 5.16b The skeletal system, anterior view.
**Left-hand Side**

A. flexor digitorum longus  
B. biceps femoris  
C. semimembranosus  
D. gluteus medius  
E. brachioradialis  
F. latissimus dorsi  
G. rhomboids  
H. levator scapulae  

**Right-hand Side**

I. trapezius  
J. teres major  
K. extensor carpi radialis brevis  
L. extensor carpi ulnaris  
M. gluteus minimus  
N. piriformis  
O. semitendinosus  
P. popliteus  
Q. posterior tibialis  

**Fig. 5.17a** The skeletal system, posterior view.
Left-hand Side
A. gastrocnemius
B. quadratus femoris
C. extensor carpi radialis longus
D. triceps
E. infraspinatus
F. supraspinatus
G. erector spini

Right-hand Side
H. spleneus capitis
I. teres minor
J. extensor digitorum
K. gluteus maximus
L. iliotibial band
M. soleus

Fig. 5.17b The skeletal system, posterior view.
MULTIPLE CHOICE: Carefully read each statement. Choose the word or phrase that correctly completes the meaning and write the corresponding letter in the blank provided.

1. The ability of muscle to return to its original shape after being stretched is called _______.
   a) contractility   c) elasticity
   b) resizing       d) shortening

2. The layer of connective tissue that covers an individual muscle is called the _______.
   a) fascicle       c) periosteum
   b) epimysium      d) endomysium

3. Each muscle fiber within a fascicle is covered by tissue called _______.
   a) epimysium      c) endomysium
   b) periosteum     d) perimysium

4. Muscle’s contractile ability is a result of the interaction between two filaments, myosin and _______.
   a) actin          c) adenosine
   b) elastin        d) reticulin

5. Which type of muscle tissue is found in the heart wall?
   a) nonstriated    c) smooth
   b) cardiac        d) skeletal

6. The cell membrane of a muscle fiber is called the _______.
   a) endomysium     c) sarcoplasmic reticulum
   b) sarcolemma     d) fascia

7. The striated appearance of skeletal muscles results from the _______.
   a) sarcoplasmic reticulum network c) sarcomere arrangement
   b) transverse tubule pattern      d) aerobic conversion

8. The strength of a muscle contraction is varied by changing the _______.
   a) number of motor units stimulated c) number of fibers contracting within each motor unit
   b) strength that each individual fiber contracts d) the intensity of the nerve impulse

9. The transmission of the stimulus of muscle contraction is aided by _______.
   a) myosin          c) brain waves
   b) actin          d) transverse tubules

(c) (b) (c) (a) (b)
10. Energy for muscle contractions comes from ________.
   a) ATF  c) ADP  
   b) CPA  d) ATP  

11. ________ is found in the gap between the end of the motor nerve and the muscle fiber.
   a) Mitochondria  c) Acetylcholine 
   b) Adenosine triphosphate  d) Creatine phosphate  

12. The condition in which muscles cease to respond because of lack of oxygen and/or buildup of waste products is called ________.
   a) muscle fatigue  c) lactic acid 
   b) oxygen deficiency  d) anaerobic respiration  

13. A muscle contraction in which the body part affected by the muscle does not move is called ________.
   a) isotonic  c) eccentric 
   b) isometric  d) concentric  

14. A muscle contraction in which the distance between the ends of the muscle changes is called ________.
   a) isotonic  c) dynamic 
   b) resistant  d) isometric  

15. The muscle that originates on the coracoid process and flexes the elbow is the ________.
   a) brachioradialis  c) biceps brachii 
   b) brachialis  d) coracobrachialis  

16. A muscle that flexes the neck or turns the head to the opposite side is the ________.
   a) splenius capitus  c) sternocleidomastoid 
   b) scalenus posterior  d) all of the above  

17. A muscle strain that involves a partial tear of 10 percent to 50 percent of the muscle fibers is classified ________.
   a) Grade I  c) Grade III 
   b) Grade I  d) parietal  

18. A group of related genetic diseases that cause progressive degeneration of the voluntary muscular system is called ________.
   a) muscular dystrophy  c) fibrosis 
   b) myofibrosis  d) atrophy  

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Chapter 5 Human Anatomy and Physiology
19. Aerobic cellular respiration to replenish ATP takes place in the _______. 
   a) liver  c) mitochondria  (c) 
   b) bloodstream  d) cell nucleus

**WORD REVIEW:** The student is encouraged to write down the meaning of each of the following words. The list can be used as a study guide for this unit.

**abduction**

*(Abduction is moving a body part away from the midline.)*

**actin**

*(Actin is the protein filament that interacts with the myosin filaments that give muscle tissue its unique ability to contract.)*

**adduction**

*(Adduction is bringing the body part toward the midline.)*

**antagonist**

*(Antagonist refers to a muscle that acts in direct opposition to the prime mover agonist.)*

**aponeurosis**

*(An aponeurosis is a broad, flat tendon sheath.)*

**cardiac muscle**

*(Cardiac muscle occurs only in the heart and is responsible for pumping blood through the heart into the blood vessels.)*

**contractility**

*(Contractility is the ability of a muscle to contract or shorten and thereby exert force.)*
(Elasticity refers to the tissue’s ability to return to normal resting length when a stress that has been placed on it is removed.)

Elasticity

Extensibility

(Extensibility is the ability of a muscle to stretch.)

Extension

(Extension is straightening or increasing the angle of a joint.)

Fascia

(Fascia is the fibrous connective tissue between muscle bundles or between muscle fibers that support nerves and blood vessels.)

Flexion

(Flexion is bending or decreasing the angle of a joint.)

Insertion

(Insertion is the more mobile attachment of a muscle to bone.)

Motor neuron

(A motor neuron carries nerve impulses from the brain to the effectors.)

Motor unit

(A motor unit consists of a motor neuron and all the muscle fibers that it controls.)
muscle belly

(The muscle belly is the main or central part of a muscle.)

muscle fatigue

(Muscle fatigue is a condition in which the muscle ceases to respond because of oxygen debt from rapid or prolonged muscle contractions.)

myofibril

(Myofibril is a microscopic part of the muscle fiber that contains the actin and myosin filaments.)

myosin

(Myosin is the protein filament that interacts with the actin filaments that give muscle tissue its unique ability to contract.)

origin

(Origin is the point where the end of a muscle is anchored to an immovable section of the skeleton.)

oxygen debt

(Oxygen debt occurs when the respiratory system cannot supply adequate oxygen to the muscular system to carry on strenuous activity, resulting in anaerobic respiration and the production of lactic and pyruvic acid.)

prime mover

(The prime mover is the agonist or muscle responsible for a movement.)
Pronation

(Pronation is rotating a body part downward.)

Skeletal muscle

(Skeletal muscles are attached to bone by tendons and are responsible for moving the limbs, facial expression, speaking, and other voluntary movements.)

Smooth muscle

(Smooth muscle lacks striations and cannot be stimulated to contract by conscious effort.)

Striated

( striated refers to the light and dark stripes in skeletal and cardiac muscle when viewed under a microscope.)

Supination

(Supination is rotating a body part upward.)

Synergist

(Synergist refers to a muscle that assists a prime mover agonis.)

Tendon

(Tendons are bands that attach muscle to bone.)
COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The two divisions to the vascular system are the **blood-vascular system or cardiovascular system** and **the lymph-vascular system**.

2. The double-layered membrane that covers the heart is the **pericardium**.

3. The normal heart rate for an adult is **60-80** beats per minute.

4. The blood vessels that carry blood away from the heart are the **arteries** and **arterioles**.

5. The blood vessels that carry blood back toward the heart are the **veins** and **venules**.

6. The largest artery in the body is the **aorta**.

7. The smallest, microscopic, thin-walled blood vessels are called **capillaries**.

8. The two circulation systems in the blood-vascular system are **pulmonary circulation** and **general or systemic circulation**.
IDENTIFICATION: Identify the parts indicated in Figure 5.18 (a cross-section of a portion of the heart wall, including the pericardium) by writing the letter of the part next to the appropriate term in the space provided.

(C) 1. epicardium  \hspace{1cm} (E) 4. parietal pericardium

(B) 2. myocardium  \hspace{1cm} (D) 5. pericardial cavity

(A) 3. endocardium  \hspace{1cm} (C) 6. visceral pericardium

Fig. 5.18 Cross-section of wall of heart.
**IDENTIFICATION:** Identify the structures of the heart indicated in Figure 5.19 (a diagram of the frontal structure of the heart) by writing the letter next to the appropriate term in the space provided.

**Fig. 5.19** Frontal section of the heart.

1. **(C)** aorta  
2. **(I)** aortic semilunar valve  
3. **(T)** inferior vena cava  
4. **(G)** left atrium  
5. **(J)** left ventricle  
6. **(H)** mitral (bicuspid) valve  
7. **(E)** left pulmonary artery  
8. **(N)** pulmonary semilunar valve  
9. **(F,M)** pulmonary veins  
10. **(O)** right atrium  
11. **(R)** right ventricle  
12. **(L)** septum  
13. **(B)** superior vena cava  
14. **(Q)** tricuspid valve  
15. **(A)** right pulmonary artery  
16. **(S)** endocardium  
17. **(P)** pericardium  
18. **(D)** pulmonary trunk  
19. **(K)** myocardium
TRUE OR FALSE: If the following statements are true, write true in the space provided. If they are false, replace the italicized word with one that makes the statement true.

1. Impulses from the sympathetic portion of the autonomic nervous system cause vasodilation. True or False: True

2. Substances move through the capillary walls mostly by osmosis. True or False: False, replace with filtration

3. Blood moves through the arterioles to the capillaries and then to the venules. True or False: True

4. Diffusion is a process in which substances move from an area of higher pressure to lower pressure. True or False: True

5. In pulmonary circulation, veins contain oxygen-rich blood. True or False: True

MATCHING: Match the term with the best description. Write the letter of the appropriate term in the space provided.

A. arteriosclerosis    C. embolus    E. atherosclerosis
B. phlebitis    D. varicose veins    F. edema

1. protruding, bulbous, distended superficial veins D

2. an inflammation of a vein B

3. a condition of excess fluid in the interstitial spaces F

4. the walls of affected arteries tend to thicken, become fibrous, and lose their elasticity A

5. an accumulation of fatty deposits on the inner walls of the arteries E

6. a clot that breaks loose and floats in the bloodstream C
TRUE OR FALSE: If the following statements are true, write true in the space provided. If they are false, replace the italicized word with one that makes the statement true.

1. The cardiovascular system of the average adult male contains about four liters of blood.

2. Blood has a slightly acid reaction.

3. Plasma accounts for 75 percent of the blood's volume.

4. White blood cells constitute as much as 98 percent of all blood cells.

5. Red blood cells and white blood cells are produced in the red bone marrow.

SHORT ANSWER: Five functions of the blood are listed below. In the spaces provided, briefly describe how the blood performs these functions.

1. Blood provides nutrients to the cells.

   (It circulates oxygen, water, food, and secretions to all parts of the body.)


   (It collects metabolic waste and other cellular debris and carries it through the blood vessels to the eliminative organs.)


   (It controls the circulation between the interior and the periphery to protect the body from extreme heat or cold.)

4. Blood protects against infection.

   (White blood cells circulate in the blood to battle invading bacteria and other infectious agents.)

5. Blood prevents hemorrhaging.

   (The coagulating ability of the blood seals wounds and prevents excessive bleeding.)
1. Red blood cells are also called *(erythrocytes)*.

2. Red blood cells are colored with an oxygen-carrying substance called *(hemoglobin)*.

3. The process in which leukocytes actually engulf and digest harmful bacteria is called *(phagocytosis)*.

4. The small irregularly shaped particles in the blood that play an important role in clotting are *(blood platelets)* or *(thrombocytes)*.

5. A disease characterized by extremely slow clotting of blood and excessive bleeding from even very slight cuts is *(hemophilia)*.

6. A condition in which there is a rapid loss or inadequate production of red blood cells is *(anemia)*.

7. A form of cancer in which there is an uncontrolled production of white blood cells is known as *(leukemia)*.
Fig. 5.20 Circulatory system.
**IDENTIFICATION:** Identify the numbered blood vessels in Figure 5.20 (a diagram of the major blood vessels of the body) by writing the correct term in the numbered space that corresponds to the number on the figure. (The arteries are indicated on the left side of the body as unshaded vessels. The veins are indicated on the right side of the body as shaded vessels.)

1. **(peroneal artery)**
2. **(posterior tibial artery)**
3. **(anterior tibial artery)**
4. **(femoral artery)**
5. **(common iliac artery)**
6. **(ulnar artery)**
7. **(radial artery)**
8. **(inferior vena cava)**
9. **(brachial artery)**
10. **(superior vena cava)**
11. **(subclavian artery)**
12. **(common carotid artery)**
13. **(int. and ext. jugular veins)**
14. **(subclavian vein)**
15. **(cephalic vein)**
16. **(brachial vein)**
17. **(aorta)**
18. **(basilic vein)**
19. **(common iliac vein)**
20. **(superficial vein)**
21. **(great saphenous vein)**

**SHORT ANSWER:** Circle the term that does not belong in the following groups (groups flow from left to right).

- spleen
- lacteal
- swelling
- lymphocytes
- **lymph capillaries**
- liver
- thoracic duct
- nausea
- monocytes
- capillary beds
- tonsils
- lymphatic
- pain
- platelets
- redness
- lymphocytes
- venule
- thymus
- closed system
- leukocytes
- continuous flow
- **filtered**

**TRUE OR FALSE:** If the following statements are true, write *true* in the space provided. If they are false, replace the italicized word with one that makes the statement true.

1. Lymph is derived from the interstitial fluid and is *produced* by the lymph nodes.
2. Lymphoid tissue produces a kind of white blood cell called a *lymphocyte*.
3. All lymph eventually flows into the bloodstream.
4. The right lymphatic duct collects lymph from the right half of the body.

5. Lymph is moved through the lymph system by a pumping action of the lymph nodes.

COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. Specialized white blood cells called (lymphocytes) play a major role in the immune response.

2. White blood cells originate in (bone marrow).

3. White blood cells specialize into T-cells in the (thymus).

4. The agent that triggers an immune response is a(n) (antigen).

5. White blood cells are transported throughout the body by (blood) and (lymph).

6. The production of antibodies is the responsibility of the (B-cells).

7. When the immune system mistakenly attacks itself, the result is (autoimmune disease).

8. (Killer T-cells) attack and destroy antigens directly.

9. The cell that is destroyed by the HIV virus in AIDS is the (helper T-cells).

10. The process of specialized cells engulfing and digesting neutralized antigens and debris is (phagocytosis).

MATCHING: Match the terms with the best description. Write the letter of the appropriate term in the space provided.

A. acquired immunity B. immunity C. allergen
D. memory cells E. vaccines F. allergy
G. innate immunity H. autoimmune diseases

1. (E) stimulate an immune response without causing the accompanying illness

2. (B) all the physiologic mechanisms used by the body as protection against foreign substances

3. (G) is present from before birth

4. (C) allergy-causing substance

5. (A) specialized form of immunity that is the result of an encounter with a new substance
6. overreaction by the immune system to an otherwise harmless substance
7. when the body makes antibodies and T-cells directed against its own cells
8. provide immunity for years or even a lifetime

TRUE OR FALSE: If the following statements are true, write true in the space provided. If they are false, replace the italicized word with one that makes the statement true.

1. Acquired immunodeficiency syndrome (AIDS) disease occurs when the human immunodeficiency virus (HIV) enters a person's body. **(true)**
2. An HIV-infected person is clinically said to have AIDS when their CD4+ T-cell blood count falls below 500 per cubic millimeter of blood. **(200)**
3. HIV is spread most commonly by sexual contact with an infected partner or through contact with infected blood. **(true)**
4. Massage is contraindicated for people infected with HIV or AIDS. **(is not)**
5. Health care workers can reduce their risk of becoming HIV infected in their practice by following safe sex precautions. **(universal)**

MULTIPLE CHOICE: Carefully read each statement. Choose the word or phrase that correctly completes the meaning and write the corresponding letter in the blank provided.

1. Supplying the body with nutrients and carrying away waste products is the function of the _______. **(b)**
   a) lungs       c) kidneys
   b) circulatory system  d) muscles

2. The two-way diffusion of substances between the blood and tissue fluids surrounding cells is the function of the _______. **(c)**
   a) arteries       c) capillaries
   b) veins          d) lymph

3. Waste-laden blood returns to the heart through the _______. **(a)**
   a) veins      c) capillaries
   b) arteries     d) lymphatics

4. Blood platelets are important to proper _______. **(b)**
   a) nutrition      c) immunity
   b) clotting      d) circulation

5. Macrophages are large cells (WBCs) that destroy foreign bacteria by the process of_______. **(c)**
   a) osmosis      c) phagocytosis
   b) mitosis      d) enzymatic action
6. The process in which substances move from an area of higher concentration to an area of lower concentration is _________.
   a) diffusion        c) filtration
   b) osmosis          d) saturation

7. Blood is supplied to the small finger side of the hand by the _________.
   a) ulnar artery     c) parietal artery
   b) popliteal artery d) radial artery

8. The right atrium receives blood directly from _________.
   a) the superior and inferior vena cava c) the pulmonary veins
   b) the right ventricle                  d) the coronary vein

9. The liquid that surrounds tissue cells is called _________.
   a) lymph            c) plasma
   b) interstitial fluid d) blood

10. Toxic molecules are filtered by the _________.
    a) lymphatic system          c) muscular system
    b) spleen                    d) bone marrow

11. Lymph reenters the blood-vascular system through the _________.
    a) lymph capillaries         c) spleen
    b) lymph nodes               d) subclavian vein

12. Approximately how much of the fluid that leaves the blood-vascular system is absorbed by the lymph-vascular system?
    a) 5 percent                c) 20 percent
    b) 10 percent               d) 40 percent

13. A condition in which there is an inadequate population of erythrocytes is _________.
    a) hemophilia              c) edema
    b) anemia                   d) leukemia

14. Which of the following is not a branch of the aorta?
    a) right coronary artery    c) brachiocephalic artery
    b) pulmonary artery         d) left subclavian artery

15. Blood from the face and scalp is drained by the _________.
    a) external jugular vein    c) inferior vena cava
    b) subclavian vein           d) cephalic veins
16. The thickest part of the heart muscle is near _____.
   a) the semilunar valve  c) the right atrium  
   b) the right ventricle  d) the left ventricle

17. The inside membrane lining the heart and the valves is called _____.
   a) the endocardium  c) the pericardium  
   b) the myocardium  d) the epicardium

18. The semilunar valve prevents the backflow of blood into _____.
   a) the lung  c) the right ventricle  
   b) the right atrium  d) the left atrium

19. An erythrocyte _____.
   a) manufactures antibodies  c) contains hemoglobin  
   b) releases serotonin  d) performs phagocytosis

20. Which of the following are white blood cells?
   a) leukocytes  c) lymphocytes  
   b) monocytes  d) all of the above

21. A free-floating blood clot is called _____.
   a) an embolism  c) phlebitis  
   b) thrombosis  d) an embolus

WORD REVIEW: The student is encouraged to write down the meaning of each of the following words. The list can be used as a study guide for this unit.

anemia
(Anemia refers to several conditions in which there is an inadequate production of red blood cells.)

aorta
(The aorta is the main artery of the body.)

arteriole
(Arteriole is one of the small vessels between the arteries and the capillaries.)
arteriosclerosis

(Artiosclerosis is a condition in which the walls of the arteries thicken and lose their elasticity.)

artery

(Arteries are thick-walled muscular and elastic vessels that transport oxygenated blood from the heart.)

atrium

(The atrium is one of the upper chambers of the heart.)

auricle

(The auricle is one of the upper chambers of the heart.)

blood-vascular system

(The blood-vascular system, or cardiovascular system, includes the blood, heart, and blood vessels.)

capillary

(Capillaries are the smallest blood vessels and connect arterioles with the venules.)

cardiovascular

(The term cardiovascular refers to the heart and blood vessels.)

diffusion

(Diffusion is a process in which substances move from an area of higher concentration to an area of lower concentration.)
edema

(Edema is an excess of fluids in the tissues.)

embolus

(An embolus is a piece of a clot that loosens and floats in the blood.)

decardium

(The endocardium is the thin, innermost layer of the heart.)

epicardium

(The epicardium is the protective outer layer of the heart.)

erthrocytes

(Erythrocytes are red blood cells.)

filtration

(Filtration is a process in which blood pressure pushes fluids and substances through the capillary wall and into the tissue spaces.)

hemoglobin

(Hemoglobin is a compound in red blood cells that carries oxygen from the lungs to the cells and carbon dioxide from the cells to the lungs.)

interstitial

(Interstitial means to be between cells, as in interstitial fluid.)
lacteal

(Lacteals are lymphatic capillaries located in the villi of the small intestine.)

leukemia

(Leukemia is a form of cancer in which there is an uncontrolled production of white blood cells.)

leukocytes

(Leukocytes are white blood cells.)

lymph

(Lymph is a straw-colored fluid derived from interstitial fluid that is absorbed into the lymphatic system.)

lymph-vascular system

(The lymph-vascular system consists of lymph, lymph nodes, and lymphatics through which the lymph circulates.)

lymphatic pump

(A lymphatic pump is the action of external forces and smooth muscle in the larger lymphatics that propels lymph through the lymphatic system.)

lymphatics

(Lymphatics are lymph-collecting vessels.)

mitral valve

(The mitral valve is the heart valve between the left atrium and left ventricle.)
myocardium

(The myocardium is the cardiac muscle.)

pericardial cavity

(The pericardial cavity is a space within the pericardium that contains a serous fluid that cushions the heart.)

pericardium

(The pericardium is a double-layered membrane that encloses the heart.)

phagocytosis

(Phagocytosis is a process in which leukocytes engulf and digest harmful bacteria and other tissue debris.)

phlebitis

(Phlebitis is an inflammation of a vein accompanied by pain and swelling.)

plasma

(Plasma is the fluid part of the blood.)

platelets

(Platelets, or thrombocytes, are small, irregular bodies found in the blood that play an important role in the clotting of blood over a wound.)

pulmonary circulation

(Pulmonary circulation is the blood circulation from the heart to the lungs and back again to the heart.)
semilunar valves

(The pulmonary semilunar valve is between the right ventricle and the pulmonary artery. The aortic semilunar valve is between the left ventricle and the aorta.)

serotonin

(Serotonin is a neurotransmitter that helps to regulate nerve impulses and influences mood, behavior, appetite, blood pressure, temperature regulation, memory, and learning ability.)

systemic circulation

(Systemic circulation is the circulation of blood from the left side of the heart, through the body, and back to the heart.)

thoracic duct

(The thoracic duct is the largest lymph vessel in the body, extending from the cisterna chyli in the abdomen to where lymph reenters the blood, at the junction of the left subclavian vein and the left jugular vein.)

thrombocytes

(Thrombocytes are red blood cells.)

tricuspid valve

(The tricuspid valve of the heart allows blood to flow from the right atrium into the right ventricle.)

vasoconstriction

(Vasoconstriction is the contraction of the arterial walls.)

vasodilation

(Vasodilation is the relaxation and enlargement of the arterial walls.)
vasomotor nerves

(Vasomotor nerves are nerves from the sympathetic nervous system that supply the smooth muscle tissue in the walls of the arteries and arterioles.)

vein

(Veins are thinner-walled blood vessels that carry deoxygenated blood and waste-laden blood from capillaries back to the heart.)

vena cava

(The vena cava is the largest vein that returns blood to the heart.)

ventricle

(A ventricle is one of the lower, more muscular chambers of the heart that pumps blood out of the heart.)

venule

(Venules are microscopic vessels that continue from the capillaries and merge to form veins.)
COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The major parts of the nervous system are the **brain**, **spinal cord**, and **(peripheral nerves)**.
2. The structural unit of the nervous system is the **(neuron)** or **(nerve cell)**.
3. There are two types of nerve fibers. **(Dendrites)** connect with other neurons to receive information and a single **(axon)** conducts impulses away from the cell body.
4. Impulses are passed from one neuron to another at a junction called a **(synapse)**.
5. Two characteristics of a neuron are **(irritability)** and **(conductivity)**.
6. Neurons that originate in the periphery and carry information toward the central nervous system (CNS) are **(sensory)** or **(afferent)** neurons.
7. Neurons that carry impulses from the brain to the muscles or glands that they control are **(motor)** or **(effector)** neurons.
8. Neurons located in the brain and spinal cord that carry impulses from one neuron to another are **(internuncial neurons or interneurons)**.
9. The portion of the nervous system that is surrounded by bone is the **(central nervous system)**, which consists of the **(brain)** and the **(spinal cord)**.
10. The CNS is covered by a special connective tissue membrane called the **(meninges)**, which has three layers: the **(dura mater)**, the **(pia mater)**, and the **(arachnoid mater)**.
11. The fluid that surrounds and supports the brain and spinal cord is **(cerebrospinal fluid)**.
12. The largest portion making up the front and top of the brain is the **(cerebrum)**.
13. The smaller part of the brain that helps to maintain the body's balance and coordinates voluntary muscles is the **(cerebellum)**.
14. The three parts of the brain stem are the **(midbrain)**, the **(pons)**, and the **(medulla oblongata)**.
15. The two divisions of the peripheral nervous system are the **(autonomic nervous system)**, which involves the nerves to the visceral organs, glands, and blood vessels, and the **(somatic nervous system)**, which involves the nerves to the muscles and skin.
IDENTIFICATION: Identify the structures indicated in Figure 5.21 (a diagram of a nerve cell) by writing the letter of the structure next to the correct term in the space provided.

1. axon
2. cell body
3. dendrites
4. beads of myelin
5. nucleus

MATCHING: Match the term with the best description. Write the letter of the appropriate term in the space provided.

A. afferent neuron  B. axon  C. dendrite  D. efferent neuron  E. ganglion  F. interneuron  G. nerve  H. stimuli  I. synapse

1. the conducting portion of a neuron
2. junction point between neurons
3. bundle of axons in the peripheral nervous system
4. collection of nerve bodies located outside the CNS
5. changes that activate the nervous system
6. receptive structure of the neuron
7. carries sensory information toward the CNS
8. transmits information from one neuron to another
TRUE OR FALSE: If the following statements are true, write true in the space provided. If they are false, replace the italicized word with one that makes the statement true.

1. The spinal cord extends from the medulla oblongata to the sacrum. (true)
2. Control centers in the pons regulate movements of the heart and control vasoconstriction of the arteries. (true)
3. The midbrain relays impulses from the cerebrum to the cerebellum. (true)
4. Spinal nerves are numbered according to the level where they exit the spine. (true)
5. There are thirty-one pairs of spinal nerves. (true)
6. All of the nerves outside the brain and spinal cord are considered to be the peripheral nervous system. (true)

CRANIAL NERVES

IDENTIFICATION AND MATCHING: Number the cranial nerves according to the order in which they arise from the brain. In the first column of answer blanks, write the Roman numeral that corresponds to the cranial nerve. Then, select the best description of the function of the cranial nerve from the list below the table, and write the appropriate letter in the second column of answer blanks.

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A. speaking, shoulder, and neck muscles
B. sensations of the face and movement of the jaw and tongue
C. moves eyeball down and out
D. sensation and movement related to talking, heart rate, breathing, and digestion
E. sense of smell
F. moves eyeball up, down, and in; constricts pupil; raises eyelid
G. tongue movement and swallowing
H. movements of the face and salivary glands
I. moves eyeball outward
J. tongue movement, swallowing, sense of taste
K. sense of sight
L. sense of hearing

**SHORT ANSWER:** In the spaces provided, write the answers to the following questions.

1. How many pairs of cervical nerves are there?  **(8)**
2. How many pairs of thoracic nerves are there?  **(12)**
3. How many pairs of lumbar nerves are there?  **(5)**
4. How many pairs of sacral nerves are there?  **(5)**

**MATCHING:** Match the term with the best description. Write the letter of the appropriate term in the space provided.

A. mechanoreceptors  
B. thermoreceptors  
C. photoreceptors  
D. chemoreceptors  
E. nociceptors

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<thead>
<tr>
<th></th>
<th>1. detect heat and cold</th>
<th>2. detect light</th>
<th>3. detect pain</th>
<th>4. proprioceptors</th>
<th>5. respond to tissue damage and extreme stimuli</th>
<th>6. Ruffini end organs and Merkel disks</th>
<th>7. rods and cones in the retina</th>
<th>8. sense pressure, vibration</th>
<th>9. sense smell and taste</th>
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IDENTIFICATION: Identify the major parts of the nervous system in Figure 5.22 by writing the letter of the part next to the appropriate term in the space provided.

(N) 1. autonomic chain of ganglia  
(B) 2. brachial plexus  
(J) 3. brain  
(H) 10. peroneal nerve  
(P) 11. radial nerve  
(E) 12. sacral plexus
MATCHING: Match the term with the best description. Write the letter of the term in the space provided.

A. central nervous system
B. peripheral nervous system
C. somatic nervous system
D. autonomic nervous system
E. sympathetic nervous system
F. parasympathetic nervous system

1. Stimulation causes increased respiration, dilated pupils, increased heart rate, and cardiac output.
2. Consists of motor nerves, sensory nerves, and mixed nerves.
3. Is completely housed and protected in a bony covering.
4. General function is to conserve energy.
5. Is composed of the sympathetic and parasympathetic nervous system.
6. Includes the autonomic and somatic nervous system.
7. Nerve fibers arise from the second, third, and fourth sacral spinal nerves and the III, VII, IX, and X (vagus nerve) cranial nerves.
8. Is composed of cranial nerves, spinal nerves, and nerve ganglia.
9. Is composed of the brain and spinal cord.
10. Prepares the organism for energy-expending, stressful, or emergency situations.
11. Regulates smooth muscle, the heart, and other involuntary functions.
12. Interprets incoming information and issues orders.
13. Carries information to and from all parts of the body.
14. Carries information to and from the skeletal muscles and skin.
15. Involves a chain of ganglia located along the spine.
COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The simplest form of nervous activity that includes a sensory and motor nerve and few, if any, interneurons is called a   (reflex)  .

2. The nerve pathway of the simplest form of nervous activity is called a   (reflex arc)  .

IDENTIFICATION: Identify the structures indicated in Figure 5.23 (a diagram of a simple reflex arc) by writing the letter of the structure next to the appropriate term in the space provided. (Note the arrows that indicate the direction of the nerve impulse.)

(A) 1. sensory neuron  
(C) 2. dorsal root  
(E) 3. motor neuron  
(D) 4. connecting neuron  
(I) 5. sensory nerve receptor  
(G) 6. spinal cord  
(B) 7. spinal ganglion  
(F) 8. ventral root  
(H) 9. muscle (effector)

Fig. 5.23 Simple reflex arc.
COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. Sensory nerves that record conscious sensations such as heat, cold, pain, and pressure are termed (exteroceptors).
2. Sensory nerves that respond to the unconscious inner sense of position and movement of the body are termed (proprioceptors).
3. The system of sensory and motor nerve activity that provides information as to the position and rate of movement of different body parts is (proprioception).
4. (Spindle cells) sense the length and stretch of the muscle as well as how far and fast the muscle is moving.
5. (Spindle cells) consist of intrafusal muscle fibers, annulospiral, and flower-type nerve receptors.
6. (Golgi tendon organs) are multibranched sensory nerve endings located in tendons in the area where muscle fibers attach to tendon tissue.
7. (Golgi tendon organs) measure the amount of tension produced in muscle cells that occurs as a result of the muscle's stretching and contracting.

MATCHING: Match the term with the best description. Write the letter of the appropriate term in the space provided.

A. amyotrophic lateral sclerosis  
B. encephalitis  
C. epilepsy  
D. hemiplegia  
E. meningitis  
F. multiple sclerosis  
G. nerve compression  
H. nerve entrapment  
I. neuritis  
J. paraplegia  
K. Parkinson's disease  
L. poliomyelitis  
M. quadriplegia  
N. shingles  
O. spinal cord injury  
P. stroke

(F) 1. the result of the breakdown of the myelin sheath, which inhibits nerve conduction
(K) 2. characterized by tremors and shaking, especially in the hands
(A) 3. a degenerative neurologic condition affecting the motor nerves of the brain, causing weakness, spasticity, and atrophy of the voluntary muscles
(N) 4. an acute inflammation of a nerve trunk and the dendrites at the end of the sensory neurons, caused by the herpes zoster virus
(J) 5. paralysis of the lower part of the body
(M) 6. paralysis affecting the arms and the legs
7. paralysis affecting one side of the body

8. the inflammation of a nerve that is usually a symptom of some other condition

9. the result of a blood clot or ruptured blood vessel in or around the brain

10. abnormal electrical activity in the CNS characterized by seizures

11. caused by soft tissue, such as muscle, fascia, tendon, or ligament, that puts pressure against a nerve

12. a crippling or even deadly disease that affects the motor neurons of the medulla oblongata and spinal cord, resulting in paralysis

13. caused by disease or trauma to the vertebral column, resulting in loss of sensation and movement to the body below the site of injury

14. a viral disease causing inflammation of the brain and meninges

15. an acute inflammation of the pia and arachnoid mater around the brain and spinal cord

16. caused by bone or cartilage pressing against the nerve

**MULTIPLE CHOICE:** Carefully read each statement. Choose the word or phrase that correctly completes the meaning and write the corresponding letter in the blank provided.

1. The junction at which impulses are passed from one neuron to another is called a/an _______.
   a) axon
   b) neuromuscular junction
   c) synapse
   d) dendrite

2. The central nervous system consists of the spinal cord and the ________.
   a) motor neurons
   b) afferent nerves
   c) mixed nerves
   d) brain

3. A motor neuron is also called a/an ________.
   a) efferent neuron
   b) interneuron
   c) nerve cell
   d) afferent neuron

4. The three types of neurons are ________.
   a) sympathetic, parasympathetic, peripheral
   b) afferent, efferent, connecting
   c) sensory, motor, interneuron
   d) receptors, effectors, conductors
5. Body balance and voluntary muscle movement are controlled by the _______.
   a) cerebellum     c) brain stem
   b) cerebrum       d) midbrain

6. The spinal cord has ______ pairs of spinal nerves:
   a) 25           c) 42
   b) 31           d) 36

7. Movement of head, neck, and shoulders is controlled by the _______.
   a) cervical plexus c) brachial plexus
   b) somatic system  d) cranial nerves

8. All thought, association, and judgment take place in the _______.
   a) cerebellum               c) cerebral cortex
   b) thalamus                 d) medulla oblongata

9. The largest and longest nerve in the body is the ______ nerve.
   a) brachial           c) lumbar
   b) vagus             d) sciatic

10. Damage to the ______ nerve could cause inability of the diaphragm to function.
    a) phrenic          c) hypoglossal
    b) axillary        d) pneumogastric

11. Nerves from the fifth, sixth, and seventh cervical vertebrae form the _______.
    a) radial nerve     c) brachial plexus
    b) cervical plexus  d) ulnar nerve

12. Specialized nerve endings that sense the amount of tension produced in muscle cells are called _______.
    a) spindle cells    c) exteroceptors
    b) Golgi tendon organs d) Ruffini end organs

13. Which of the following are considered peripheral nerves?
    a) cranial nerves   c) sympathetic nerves
    b) spinal nerves    d) all of the above
14. The parasympathetic and sympathetic nervous systems constitute the _______.
   a) central nervous system  c) autonomic nervous system
   b) peripheral nervous system  d) none of the above

15. The axon is a nerve fiber _______.
   a) carrying the impulse toward the cell body  c) carrying the impulse away from the cell body
   b) that is the body’s communication center  d) with sensory function only

16. Annulospiral receptors and Golgi tendon organs are parts of the _______.
   a) proprioceptors  c) exteroceptors
   b) autonomic nervous system  d) central nervous system

17. The three brain coverings are collectively known as the _______.
   a) thalamus  c) meninges
   b) motor cortex  d) convolutions

18. The pons, midbrain, and medulla oblongata form the _______.
   a) cerebral hemispheres  c) brain stem
   b) cerebellum  d) cerebral cortex

19. _______ serves as the insulating sheath covering the axon.
   a) cerebrospinal fluid  c) pia mater
   b) myelin  d) meninges

20. A condition in which there is an inflammation of one or more peripheral nerves is _______.
   a) meningitis  c) neuralgia
   b) neuritis  d) encephalitis

21. Often a stroke causes a type of paralysis called _______.
   a) cerebrovascular accident  c) quadriplegia
   b) paraplegia  d) hemiplegia
WORD REVIEW: The student is encouraged to write down the meaning of each of the following words. The list can be used as a study guide for this unit.

afferent nerve

(An afferent nerve is one or a group of sensory neurons that carry sensory impulses from a variety of sensory receptors toward the brain or spinal cord.)

afferent neuron

(An afferent neuron is a sensory nerve.)

arachnoid mater

(Arachnoid mater is the middle space of the meninges.)

autonomic nervous system

(The autonomic nervous system is part of the peripheral nervous system that regulates the action of the glands, smooth muscles, and the heart.)

axon

(Axons conduct impulses away from the nerve cell body.)

brachial plexus

(The brachial plexus is composed of four lower cervical nerves and the first pair of thoracic nerves that control arm movements.)

brain

(The brain is the principal nerve center and the largest, most complex nerve tissue of the body.)
brain stem

(The brain stem is at the base of the brain and consists of three parts: the midbrain, the pons, and the medulla oblongata.)

central nervous system

(The central nervous system consists of the brain and spinal cord.)

cerebellum

(The cerebellum is the small part of the brain that controls muscular movement and balance.)

cerebrospinal fluid

(The cerebrospinal fluid’s main function is to act as a shock absorber for the brain and spinal cord and to distribute nutrients.)
cerebrovascular accident

(A cerebrovascular accident, or stroke, is caused by a blood clot or ruptured blood vessel in or around the brain that subsequently destroys nerve tissue.)
cerebrum

(The cerebrum is the front and top of the brain and the center of mental activities, sensation, communication, memory, emotions, will, and reasoning.)
cervical plexus

(The cervical plexus consists of the four upper cervical nerves that supply the skin and control the movement of the head, neck, and shoulders.)
cranial nerves

(The cranial nerves connect directly to the brain and pass through openings on the side or bottom of the cranium.)
Dendrites connect with other neurons to receive information.

The dura mater is the outer layer of the meninges covering the brain and spinal cord.

An efferent nerve is one or a group of motor neurons that carry impulses from the brain or spinal cord to muscles or glands.

An efferent neuron is a motor nerve.

Epilepsy is a neurologic condition in which there is abnormal electrical activity in the CNS without apparent tissue abnormalities.

Ganglia are a mass of neurons.

Golgi tendon organs are multibranched sensory nerve endings located in tendons.

Hemiplegia is unilateral paralysis caused by a stroke.
interneuron

(An interneuron carries impulses from one neuron to another.)

kinesthesia

(Kinesthesia is the sense of body movement or position.)

lumbar plexus

(The lumbar plexus is formed from the first four lumbar nerves.)

medulla oblongata

(The medulla oblongata is an enlarged continuation of the spinal cord that connects it to the brain.)

meninges

(The meninges are a connective tissue membrane that covers the brain and spinal cord, made up of the dura mater, arachnoid mater, and the pia mater.)

mixed nerve

(Mixed nerves contain both sensory and motor fibers.)

motor nerve

(Motor nerves, or efferent nerves, carry impulses from the brain or spinal cord to the muscles or glands.)

motor neuron

(A motor neuron carries nerve impulses from the brain to the effectors.)
muscle spindle cells

(Muscle spindle cells are proprioceptive sensory organs located in muscles that alert the central nervous system to the length and stretch of the muscle, as well as how far and fast the muscle is moving.)

nerve

(Nerves are bundles of signal-carrying fibers held together by connective tissue that originates in the brain and spinal cord and distributes branches all over the body.)

nerve cell

(A nerve cell is the structural unit of the nervous system.)

nerve fibers

(Nerve fibers are cytoplasmic projections of the nerve cell that conduct impulses toward or away from the cell.)

neuralgia

(Neuralgia is the pain associated with neuritis.)

neuritis

(Neuritis is an inflammation of a nerve.)

neuron

(A neuron is the structural unit of the nervous system.)

neurotransmitter

(A neurotransmitter is a chemical that allows impulses to move from one neuron to the next or to the receiving organ.)
paraplegia

(Paraplegia is paralysis of the legs, usually caused by spinal cord injury or disease.)

parasympathetic nervous system

(The parasympathetic nervous system functions to conserve energy and reverse the action of the sympathetic division.)

peripheral nervous system

(The peripheral nervous system consists of all of the nerves that connect the CNS to the rest of the body.)

pia mater

(The pia mater is the innermost layer of the meninges surrounding the brain and spinal cord.)

pons

(The pons, located between the midbrain and medulla oblongata, relays impulses between the cerebrum and the medulla or between the cerebrum and the spinal cord.)

proprioception

(Proprioception is a system of sensory and motor nerve activity that provides information on the position and rate of movement of body parts to the CNS.)

proprioceptors

(Proprioceptors are nerve fibers that sense where the body is and how it moves.)

quadriplegia

(Quadriplegia is paralysis of the arms and legs caused by a stroke, disease or spinal cord injury.)
reflex

(A reflex is the simplest form of nervous activity, which includes a sensory and motor nerve.)

reflex arc

(The reflex arc is the nerve pathway of a reflex.)

sacral plexus

(The sacral plexus is formed from the fourth and fifth lumbar nerves, and the first four sacral nerves.)

sciatic nerve

(The sciatic nerve is the largest and longest nerve in the body.)

sciatica

(Sciatica is neuralgia caused by injury to or pressure on the sciatic nerve.)

sensory nerve

(Sensory nerves, or afferent nerves, carry sensory impulses toward the brain or spinal cord.)

sensory neuron

(A sensory neuron carries impulses from sense organs to the brain.)

somatic nervous system

(The somatic nervous system involves the nerves of the peripheral nervous system that connect the CNS with the voluntary muscles and skin.)
spinal cord

(The spinal cord functions as a conduction pathway for nerve impulses to and from the brain.)

spinal cord injury

(Spinal cord injury results in paralysis of the parts of the body controlled by the spinal nerves that exit the spinal cord below the injury site.)

stroke

(Stroke, or a cerebrovascular accident, is the result of a blood clot or ruptured blood vessel in or around the brain and the subsequent destruction of nerve tissue.)

sympathetic nervous system

(The sympathetic nervous system supplies the glands, involuntary muscles of internal organs, and walls of blood vessels with nerves.)

synapse

(The synapse is the connecting space between one neuron and another.)
SYSTEM SIX: THE ENDOCRINE SYSTEM

COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. Glands that have tubes or ducts that carry their secretions to a particular part of the body are ____(exocrine)____ or ____(duct glands)____.

2. Glands that depend on the blood and lymph to carry their secretions to various affected tissues are ____(endocrine)____ glands.

3. The chemical substances manufactured by the endocrine glands are known as ____(hormones)____.

IDENTIFICATION: Identify the hormone-producing organs in Figure 5.24 by writing the correct term in the numbered space that corresponds to the number on the figure. Also name the hormone-producing organs described in numbers 10, 11, and 12.

A.

1. ____(testes)____
2. ____(adrenal gland)____
3. ____(parathyroid glands)____
4. ____(thyroid)____
5. ____(pineal)____
6. ____(pituitary)____
7. ____(thymus)____
8. ____(pancreas)____
9. ____(ovary)____

B.

____(hypothalamus)____ 10. The posterior and anterior pituitaries hang from the bottom of this hormone-producing organ.

____(placenta)____ 11. This is present only in pregnant women.

____(parathyroids)____ 12. These are the four small glands attached to the thyroid.
Fig. 5.24 The endocrine system.
MATCHING: Using the following list of organs, match the organ with the hormone(s) that it produces or releases. Write the letter of the organ(s) in the space provided.

A. adrenal gland (cortex)  E. ovaries  I. thyroid
B. adrenal gland (medulla)  F. testes  J. parathyroid
C. pituitary (anterior lobe)  G. pancreas  K. pineal
D. pituitary (posterior lobe)  H. thymus

Hormones

(C)  1. prolactin
(A)  2. aldosterone
(G)  3. insulin
(I)  4. thyroxin
(E)  5. estrogen
(A)  6. cortisol
(I)  7. calcitonin
(J)  8. parathormone
(C)  9. adrenocorticotropic hormone (ACTH)
(A)  10. hydrocortisone
(C)  11. gonadotropic hormones
(G)  12. glucagon
(I)  13. triiodothyronine
(D)  14. oxytocin
(E)  15. progesterone
(A)  16. mineralocorticoids
(B)  17. epinephrine
(C)  18. thyroid-stimulating hormone (TSH)
(F)  19. testosterone
(B)  20. norepinephrine
(C)  21. growth hormone
(A)  22. corticosteroids
(D)  23. antidiuretic hormone
MATCHING: Match the term with the best description. Write the letter of the appropriate term in the space provided.

A. adrenocorticotropin  
B. aldosterone  
C. calcitonin  
D. cortisol  
E. estrogens  
F. follicle-stimulating hormone  
G. glucagon  
H. insulin  
I. lactogenic hormone  
J. luteinizing hormone  
K. oxytocin  
L. parathormone  
M. progesterone  
N. TSH

1. antagonistic to insulin, produced by the same gland  
2. promotes the lining of the uterus to thicken in preparation for fertilization  
3. anterior pituitary hormones that regulate the female cycle  
4. stimulates development of secretory parts of mammary glands  
5. directly regulate the menstrual cycle  
6. stimulates thyroid to produce thyroxin  
7. decreases calcium in the blood  
8. increases calcium level in the blood  
9. stimulates mammary glands to secrete milk  
10. helps protect the body during stress; stimulates the adrenal cortex  
11. necessary for glucose to be taken up by cells

IDENTIFICATION: The following list of conditions are usually the result of hyper- or hypoactivity of an endocrine gland's production of a particular hormone. In the first answer column, indicate whether the condition is caused by hyper- or hypoactivity. In the second answer column, write the name of the hormone involved.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hormone</th>
</tr>
</thead>
<tbody>
<tr>
<td>(hyper)</td>
<td>(growth hormone)</td>
</tr>
<tr>
<td>(hyper)</td>
<td>(thyroxin)</td>
</tr>
<tr>
<td>(hyper)</td>
<td>(testosterone)</td>
</tr>
<tr>
<td>(hyper)</td>
<td>(parathormone)</td>
</tr>
<tr>
<td>(hypo)</td>
<td>(cortisol and aldosterone)</td>
</tr>
</tbody>
</table>
6. slow heart rate, sluggish physical and mental activity
7. spontaneous abortion
8. acromegaly in an adult
9. decalcification of bones, making them brittle and prone to fracture
10. high blood glucose; glucose in the urine
11. Cushing's syndrome
12. dwarfed stature and mental retardation (cretinism)
13. failure of the reproductive organs to mature

MULTIPLE CHOICE: Carefully read each statement. Choose the word or phrase that correctly completes the meaning and write the corresponding letter in the blank provided.

1. Various skin and intestinal glands belong to the _______.
   a) endocrine group
   b) exocrine group
   c) dermis
   d) digestive system

2. Glands that depend on blood and lymph to carry their secretions belong to the _______.
   a) endocrine group
   b) exocrine group
   c) neuron group
   d) messenger group

3. Insulin causes _______.
   a) a decrease in the level of blood glucose
   b) an increase in the production of glucose from glycogen
   c) a decrease in the permeability of cell membranes to glucose
   d) none of the above

4. Endocrine glands secrete chemicals called _______.
   a) lymph
   b) neurotransmitters
   c) hormones
   d) enzymes

5. The gland that has both exocrine and endocrine qualities is the _______.
   a) thyroid
   b) pancreas
   c) adrenal gland
   d) kidney
6. The body's metabolism is regulated by the ______ gland.
   a) thyroid  
   b) pituitary  
   c) thymus  
   d) adrenal  

   (a) 

7. The hormone that represses or resolves conditions of inflammation is _______.
   a) estrogen  
   b) thyroxin  
   c) adrenaline  
   d) cortisol  

   (d) 

8. The pituitary gland is called the master gland because it _______.
   a) maintains the blood pressure  
   b) is situated at the base of the brain  
   c) maintains the body's fluid balance  
   d) regulates and coordinates the functions of all other glands  

   (d) 

9. It is known that the action of the thymus hormone is related to _______.
   a) ovulation  
   b) antibody production  
   c) carbohydrate metabolism  
   d) distribution of hair over the body  

   (b) 

10. A deficiency in the hormone from the parathyroid gland will produce _______.
    a) dwarfism  
    b) cretinism  
    c) decrease of potassium in the blood  
    d) imbalance in the calcium level of the body  

    (d) 

11. A person having an increase in the production of thyroxin would be most likely to have _______.
    a) an increase in the level of blood sugar  
    b) a decrease in blood pressure  
    c) an increase in metabolic rate  
    d) an increase in physical growth and a decrease in mental ability  

    (c) 

12. The two hormones secreted by the ovaries are important in the _______.
    a) regulation of the metabolic rate  
    b) transmission of sex-linked genetic traits  
    c) maintenance of water balance in the body  
    d) development of secondary sex characteristics and normal menstruation  

    (d)
13. As a rule, most hormone concentrations in the blood are controlled by 
   a) nerve impulses   c) positive feedback mechanisms
   b) cellular demands   d) negative feedback mechanisms

14. There are four small ______ located on the back of the thyroid gland.
   a) adrenal glands   c) parathyroid glands
   b) islets of Langerhans   d) follicles

15. The anterior pituitary produces ATCH, which in turn stimulates the 
   a) adrenal glands   c) heart
   b) thyroid gland   d) sex glands

16. ______ are hormones that are secreted from the outer layer of the adrenal cortex.
   a) Mineralocorticoids   c) Sex hormones
   b) Glucocorticoids   d) Growth hormones

17. The thyroid gland has the ability to remove ______ from the blood, which is used in the synthesis of thyroxin and triiodothyronine.
   a) glucagons   c) cortisol
   b) iodine   d) glucose

18. One category of the steroids, called mineralocorticoids, ______.
   a) constrict the superficial blood vessels   c) regulate fluid and electrolyte balance
   b) depress kidney action   d) relax the smooth muscles of the intestines

19. The female counterpart to testosterone is ______.
   a) prolactin   c) estrogen
   b) progesterone   d) luteinizing hormone

20. A person born without a functioning thyroid gland will suffer from ______.
   a) giantism   c) diabetes
   b) dwarfism   d) cretinism
**WORD REVIEW:** The student is encouraged to write down the meaning of each of the following words. The list can be used as a study guide for this unit.

adrenal glands

(Adrenal glands, situated on the top of each kidney, produce epinephrine, norepinephrine, and corticosteroids.)

ACTH

(ACTH is adrenocorticotropic, a hormone from the anterior pituitary that aids in protecting the body in stressful or painful situations.)

aldosterone

(Aldosterone regulates the sodium/potassium balance in the extracellular fluid and in the blood.)

antidiuretic hormone (ADH)

(Antidiuretic hormone stimulates the kidneys to reabsorb more water, which reduces urine output.)

calcitonin

(Calcitonin is a hormone that controls the level of calcium in the blood.)

cortisol

(Cortisol is a hormone from the adrenal cortex that aids in the metabolism of carbohydrates, proteins, and fats, and is active during stress.)

diabetes mellitus

(Diabetes mellitus is caused by decreased output of insulin by the pancreas.)

ducts

(Ducts are tubes leading from exocrine glands to a particular part of the body.)
(Endocrine or ductless glands depend on the blood and lymph to carry their secretions to various affected tissues.)

epinephrine

(Epinephrine is the “fight-or-flight” hormone produced in the adrenal glands that prepares the body to respond to emergencies.)

estrogen

(Estrogen is a female hormone responsible for development of secondary sexual characteristics.)

exocrine glands

(Exocrine or duct glands possess tubes or ducts leading from the gland to a particular part of the body.)

glucagon

(Glucagon, produced by the islets of Langerhans, increases the glucose level in the blood.)

glucocorticoids

(Glucocorticoids are hormones produced in the adrenal cortex that affect carbohydrate, protein, and fat metabolism.)

goiter

(Goiter is an enlargement of the thyroid gland.)

gonadotropic hormones

(Gonadotropic hormones regulate the development and function of the reproductive systems in women and men.)
gonads

(A gonad is a sex gland that produces the reproductive cell.)

growth hormone

(Growth hormone is a hormone from the anterior pituitary that promotes the growth of all tissues.)

hormones

(Hormones are chemical substances manufactured in the endocrine glands that act as chemical messengers on specific target tissues or organs or influence certain processes in the body.)

hyperactive

(Hyperactive means overactive.)

hypoactive

(Hypoactive means underactive.)

insulin

(Insulin is a hormone produced in the Islets of Langerhans in the pancreas that regulates the movement of glucose across the cell membrane and plays a role in protein and fat transport and metabolism.)

islets of Langerhans

(Islets of Langerhans, found in the pancreas, produce insulin and glucagon.)

master gland

(The master gland is the pituitary gland.)
mineralocorticoids

(Mineralocorticoids are a group of hormones produced in the adrenal cortex.)

norepinephrine

(Norepinephrine is the “fight-or-flight” hormone that prepares the body to respond to emergencies.)

ovaries

(Ovaries are glandular organs in the pelvis that produce the ovum and female sex hormones.)

oxytocin

(Oxytocin causes the uterus to contract and causes the letdown of breast milk.)

pancreas

(The pancreas is located behind the stomach and produces digestive enzymes and the hormones insulin and glucagon.)

parathormone

(Parathormone regulates the blood level of calcium.)

parathyroid glands

(Parathyroid glands come in two pairs situated on each lobe of and behind the thyroid and produce parathormone.)

pituitary gland

(The pituitary gland is a small gland, often called the master gland, because the hormones that it secretes stimulate or regulate other glands.)
prolactin

*(Prolactin stimulates the production of milk in a woman’s breast.)*

---

target organs

*(Target organs are tissues that receive hormones.)*

---

testes

*(The testes are two small, egg-shaped glands that produce the spermatozoa.)*

---

testosterone

*(Testosterone is a male hormone responsible for development of secondary sexual characteristics.)*

---

tetany

*(Tetany is a sustained muscle contraction usually affecting the hands or feet, often the result of hypoparathyroidism.)*

---

thyroid gland

*(The thyroid gland is situated on either side of the trachea and produces thyroxin, triiodothyronine, and calcitonin.)*

---

TSH

*(TSH is thyroid stimulating hormone, a hormone from the anterior pituitary that stimulates the thyroid to produce thyroxin.)*

---

thyroxin

*(Thyroxin stimulates the metabolic rate of the body.)*

---

triiodothyronine

*(Triiodothyronine stimulates the metabolic rate of the body.)*
IDENTIFICATION: Identify the structures indicated in Figure 5.25 by writing the letter of the structure next to the appropriate term in the space provided.

Fig. 5.25 Respiratory organs and structures.

(L) 1. bronchus  (K) 6. lung  (A) 11. sinuses
(C) 2. roof of mouth  (B) 7. nasal passage  (I) 12. pharynx
(F) 3. lower jawbone  (D) 8. oral cavity  (N) 13. pulmonary artery
(G) 4. epiglottis  (E) 9. tongue  (J) 14. trachea
(H) 5. larynx  (M) 10. pulmonary vein
**COMPLETION:** In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The exchange of oxygen and carbon dioxide that takes place in the body is called **respiration**.
2. The exchange between the external environment and the blood that takes place in the lungs is termed **external respiration**.
3. The gaseous exchange between the blood and the cells of the body is termed **internal respiration**.
4. The oxidation that occurs within the cell is termed **cellular respiration**.
5. Air enters the nasal cavity through the **nose**.
6. The function of the mucosa of the nasal cavity is to **warm**, **moisten**, and **filter** the air.
7. The passageway common to the digestive system and the respiratory system that is also referred to as the throat is called the **pharynx**.
8. The air passes through the voice box or the **larynx**.
9. In the chest, the windpipe or **trachea** divides into two **bronchi**.
10. The entire system of multibranched air passages is called the **bronchial tree**.
11. The air passages terminate in clusters of air sacs called **alveoli**.
12. The act of ventilation is accomplished by **breathing**.

**TRUE OR FALSE:** If the following statements are true, write **true** in the space provided. If they are false, replace the italicized word with one that makes the statement true.

1. The blood in the pulmonary arteries has a high concentration of **oxygen**.
2. Oxygen moves from the lungs to the blood by **diffusion**.
3. The by-products of **internal respiration** are water, carbon dioxide, and energy.
4. **Carbon dioxide** is carried by the red blood cells in the blood.
5. When the diaphragm contracts, it causes a person to **exhale**.
MULTIPLE CHOICE: Carefully read each statement. Choose the word or phrase that correctly completes the meaning and write the corresponding letter in the blank provided.

1. Exchange of carbon dioxide and oxygen is called _______.
   a) respiration  
   b) relaxation  
   c) oxidation  
   d) ventilation  
   (a)

2. Internal respiration occurs between the blood and the _______.
   a) cells  
   b) air  
   c) lymph  
   d) lungs  
   (a)

3. Oxygen is carried from the lungs to body cells by linking (chemically bonding) with _______.
   a) carbaminohemoglobin  
   b) hydrogen ions  
   c) hemoglobin  
   d) carbonic acid  
   (c)

4. Normal adult respiration occurs this many times per minute:
   a) 10 to 15  
   b) 25 to 30  
   c) 14 to 20  
   d) 40 to 50  
   (c)

5. The largest respiratory muscle/muscles is/are the _______.
   a) diaphragm  
   b) intercostals  
   c) scalenus  
   d) posterior serratus  
   (a)

6. The functions of the nose include _______.
   a) assisting in speech  
   b) serving as the organ of smell  
   c) filtering, warming, and moistening the incoming air  
   d) all of the above  
   (d)

7. The walls of the alveoli are composed of _______.
   a) ciliated epithelium cells  
   b) single epithelium cells  
   c) stratified epithelium  
   d) loose connective tissue  
   (b)

8. When the diaphragm contracts, it _______.
   a) pushes upward against the lungs and causes them to deflate  
   b) flattens out, allowing the lungs to expand and fill with air  
   c) causes the intercostal muscles to relax and expand the chest wall  
   d) pushes downward and inward, causing the lungs to deflate and expel air  
   (b)
9. Which of the following describes the bronchi?
   a) resemble the trachea in structure  c) furnish a passageway by
   b) are structured into two primary air ways  which air can reach the lungs
   d) all of the above

10. The cartilaginous structure at the base of the tongue that helps to prevent food and liquid from entering the trachea is the ________.
    a) pharynx c) epiglottis
    b) uvula d) soft palate

11. The layer of serous membrane that is firmly attached to the surface of a lung is called ________.
    a) visceral pleura c) parietal pleura
    b) mucosa d) cilia

12. A flexible cylindrical tube, the ________, is supported by C-shaped pieces of hyaline cartilage arranged one above the other.
    a) larynx c) pharynx
    b) trachea d) bronchioles

13. The functions of the pharynx include ________.
    a) aiding in phonation c) serving the digestive tracts
    b) furnishing open passageway for air going to and from the lungs. d) all of the above

14. The ________ is /are soft, spongy, cone shaped organ(s) located in the thoracic cavity.
    a) pharynx c) the trachea
    b) larynx d) lungs

15. Also commonly called the throat, the ________ is located behind the mouth cavity and between the nasal cavity and the larynx. Part of its function is to provide a passageway for food traveling from the oral cavity to the esophagus.
    a) glottis c) soft palate
    b) mucous membrane d) pharynx

16. A ________ lines the nasal cavity and includes an extensive network of blood vessels. Heat leaves the blood and warms the incoming air as it passes over this.
    a) bronchial tree c) mucous membrane
    b) glottis d) bronchi
17. Although the ______ function(s) mainly to reduce the weight of the skull, it/they also serve(s) as a resonant chamber that affects the quality of the voice.
   a) nasal cavity          c) nose
   b) pharynx              d) sinuses

18. The ______ is an enlargement in the airway at the top of the trachea that serves as a passageway for air moving in and out of the trachea, as well as providing a mechanism for sound production.
   a) larynx               c) epiglottis
   b) pharynx              d) bronchi

19. The main way in which gas exchange happens through the respiratory membrane is by ______.
   a) infusion             c) diffusion
   b) evaporation           d) radiation

20. A by-product of cellular respiration is ______.
   a) carbon dioxide       c) water
   b) heat                 d) all of the above

**WORD REVIEW:** The student is encouraged to write down the meaning of each of the following words. The list can be used as a study guide for this unit.

alveoli

*(Alveoli are microscopic air sacs in the lungs.)*

cellular respiration

*(Cellular respiration, or oxidation, takes place within the cell.)*

diaphragm

*(The diaphragm is a muscular dome situated below the lungs that contracts to cause inhalation.)*

exhalation

*(Exhalation is the act of expelling air from the lungs.)*
external respiration

(External respiration is the exchange that takes place in the lungs between the external environment and the blood.)

inhalation

(Inhalation is the act of drawing air into the lungs.)

internal respiration

/Internal respiration is the gaseous exchange that takes place between the blood and the cells/)

larynx

(The larynx is part of the airway to the lungs located in the throat that contains the voice box.)

nasal cavity

(The nasal cavity is part of the airway just inside the nose and above the palate.)

pharynx

(The pharynx is the air passage at the back of the throat between the nasal cavity and the larynx.)

respiration

(Respiration is the exchange of carbon dioxide and oxygen that takes place in the lungs, between the blood and cells, and within the cell.)

trachea

(The trachea is the air passage from the larynx to the bronchus of the lung.)

ventilation

(Ventilation is also called external respiration or breathing.)
COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The process of converting food into substances capable of nourishing cells is ___________.

2. The process in which the digested nutrients are transferred from the intestines to the blood or lymph vessels to be transported to the cells is ___________.

3. The muscular tube that goes from the lips to the anus is the ___________ or the ___________.

4. Organs that aid digestion but are located outside the digestive tract are known as ___________ digestive organs.

5. The physical activity of digestion that takes place in the mouth is called ___________.

6. The chemical digestive activity that takes place in the mouth is from secretions by the ___________.

7. The physical or mechanical activity in the alimentary canal is from the action of the ___________.
IDENTIFICATION: Identify the structures indicated in Figure 5.26 by writing the correct terms in the numbered space that corresponds to the number on the figure.

1. (vermiform appendix) 7. (esophagus)
2. (gallbladder) 8. (stomach)
3. (liver) 9. (pancreas)
4. (trachea) 10. (small intestine)
5. (mouth) 11. (large intestine)
6. (parotid gland) 12. (rectum)

Fig. 5.26 The digestive system.
**MATCHING:** Match the term with the best description. Write the letter of the appropriate term in the space provided.

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. bolus</td>
<td>a soft food ball that is swallowed</td>
</tr>
<tr>
<td>G. ileocecal valve</td>
<td>prevents movement from the large intestine to the small intestine</td>
</tr>
<tr>
<td>M. pyloric valve</td>
<td>outer covering of the intestine that is continuous with the peritoneum lining the abdominal cavity</td>
</tr>
<tr>
<td>B. cardiac sphincter</td>
<td>beginning of the large intestine</td>
</tr>
<tr>
<td>H. ileum</td>
<td>contains enzymes that begin to break down carbohydrates</td>
</tr>
<tr>
<td>I. lacteals</td>
<td>a mixture of digestive juices, mucus, and food material</td>
</tr>
<tr>
<td>D. chyme</td>
<td>a soft food ball that is swallowed</td>
</tr>
<tr>
<td>J. mucosa</td>
<td>rhythmic, wavelike, muscular motion</td>
</tr>
<tr>
<td>C. cecum</td>
<td>opening at the top of the stomach</td>
</tr>
<tr>
<td>K. oral cavity</td>
<td>opening at the end of the stomach</td>
</tr>
<tr>
<td>E. colon</td>
<td>temporary storage of solid waste</td>
</tr>
<tr>
<td>N. rectum</td>
<td>a membrane made up of epithelial cells that carry on secretion and absorption</td>
</tr>
<tr>
<td>F. duodenum</td>
<td>where food is masticated</td>
</tr>
<tr>
<td>L. peristalsis</td>
<td>plays an important role in determining how long food is held in the stomach</td>
</tr>
<tr>
<td>(C) 1.</td>
<td>7. rhythmic, wavelike, muscular motion</td>
</tr>
<tr>
<td>(O) 2.</td>
<td>8. opening at the top of the stomach</td>
</tr>
<tr>
<td>(D) 3.</td>
<td>9. temporary storage of solid waste</td>
</tr>
<tr>
<td>(A) 4.</td>
<td>10. opening at the end of the stomach</td>
</tr>
<tr>
<td>(G) 5.</td>
<td>11. a membrane made up of epithelial cells that carry on secretion and absorption</td>
</tr>
<tr>
<td>(P) 6.</td>
<td>12. where food is masticated</td>
</tr>
<tr>
<td>(L) 7.</td>
<td>13. plays an important role in determining how long food is held in the stomach</td>
</tr>
<tr>
<td>(B) 8.</td>
<td>14. first section of the small intestine</td>
</tr>
<tr>
<td>(N) 9.</td>
<td>15. stores, forms, and excretes waste products; regulates the body’s water balance</td>
</tr>
<tr>
<td>(M) 10.</td>
<td>16. finger-like projections that increase the surface area of small intestines</td>
</tr>
<tr>
<td>(J) 11.</td>
<td>17. organ that receives bile and pancreatic juices</td>
</tr>
<tr>
<td>(K) 12.</td>
<td>18. lymph capillaries in the small intestine</td>
</tr>
<tr>
<td>(M) 13.</td>
<td>19. serves to nourish the surrounding tissues and carry away the absorbed material</td>
</tr>
<tr>
<td>(F) 14.</td>
<td>20. last section of the small intestine</td>
</tr>
<tr>
<td>(E) 15.</td>
<td>21. organ responsible for water absorption and feces formation</td>
</tr>
<tr>
<td>(I) 16.</td>
<td></td>
</tr>
</tbody>
</table>
MULTIPLE CHOICE: Carefully read each statement. Choose the word or phrase that correctly completes the meaning and write the corresponding letter in the blank provided.

1. The alimentary canal includes (not counting any accessory organs) ________.
   a) mouth, teeth, throat, stomach, and large intestines
   b) mouth, throat, pancreas, gallbladder, and large intestines
   c) mouth, pharynx, esophagus, stomach, small and large intestines
   d) mouth, pharynx, pancreas, vermiform appendix, small and large intestines

2. Transfer of nutrients from the intestines to the blood or lymph is called ________.
   a) absorption
   b) digestion
   c) nutrition
   d) osmosis

3. Metabolism is a series of chemical reactions that take place in the tissue cells. These reactions are necessary for ________.
   a) building tissue and storing fat
   b) using nutritive elements to provide energy
   c) providing for elimination of waste products
   d) building and repairing tissue and releasing heat and energy

4. The small intestine consists of three parts that, beginning at the stomach, appear in the following order: ________.
   a) ileum, duodenum, jejunum
   b) duodenum, jejunum, ileum
   c) jejunum, ileum, duodenum
   d) duodenum, ileum, jejunum

5. The total length of the adult alimentary canal is about ________.
   a) five yards
   b) 25 to 30 feet
   c) 50 feet
   d) twice as long as a person’s height

6. The wavelike muscular movement that propels material through the alimentary canal is ________.
   a) initiated by swallowing
   b) a reflexive action caused by the presence of material in the canal
   c) called peristalsis
   d) all of the above

7. The complete process of digestion changes sugars and starches to ________.
   a) maltose
   b) glucose
   c) glycogen
   d) glycerol
8. Bile is important in digestion because it _______.
   a) digests simple fats
   b) changes complex sugars to glucose
   c) dissolves meat fibers and makes them easiest to digest
   d) breaks down fat globules so that they can be more easily digested by enzymes

9. The functions of the gallbladder include _______.
   a) filtering bile from the blood
   b) the manufacture of bile
   c) beta cells secreting important enzymes used to control metabolism
   d) contracting and ejecting bile into the duodenum while digestion is going on in the stomach and intestines

10. The sphincter between the esophagus and the stomach is called the _______.
    a) pyloric sphincter
    b) cardiac sphincter
    c) ileocecal sphincter
    d) anal sphincter

11. The structure at the junction of the large and small intestines that controls the passage of feces is the _______.
    a) jejunum
    b) appendix
    c) pylorus sphincter
    d) ileocecal valve

12. From which part of the intestines does the appendix arise?
    a) the cecum
    b) the jejunum
    c) the sigmoid flexure
    d) the ascending colon

13. The structures in the small intestine that are chiefly responsible for the absorption of digested food are called _______.
    a) villi
    b) rugae
    c) caries
    d) ampullae

14. The walls of the digestive system are composed of _______.
    a) cardiac muscle
    b) skeletal muscle
    c) smooth muscle
    d) sphincter muscle

15. Food is broken down into its chemical components by the action of _______.
    a) enzymes
    b) hormones
    c) peristalsis
    d) sphincter muscles

16. The organ in which protein digestion begins is the _______.
    a) mouth
    b) stomach
    c) duodenum
    d) jejunum
17. At each end of the stomach are muscles that relax to form an opening and contract to close the opening. These muscles are known as _______.
   a) smooth muscles  c) cardiac muscles  
   b) skeletal muscles  d) sphincter muscles

18. Enzymes are secreted by the _______.
   a) villi  c) liver and gallbladder  
   b) epiglottis  d) linings of the stomach and intestines

19. The epiglottis serves to prevent food from _______.
   a) being absorbed too rapidly  c) moving along the intestines too rapidly  
   b) being aspirated into the trachea  d) backing up from the stomach into the esophagus

20. The colon functions mainly to _______.
   a) digest fats  c) absorb water from the waste materials of digestion  
   b) secrete enzymes  d) absorb digested food materials into the circulating fluids

21. Simple sugar is normally stored in the liver in the form of _______.
   a) lactose  c) glucose  
   b) lactase  d) glycogen

22. Salivary glands are found in all the following locations except _______.
   a) in the nasopharynx  c) under the back part of tongue  
   b) in front of and below the ear  d) under the front part of the tongue

23. The sigmoid colon empties into the _______.
   a) rectum  c) anal canal  
   b) transverse colon  d) descending colon

24. The gallbladder functions to _______.
   a) store bile between meals  c) release bile when stimulated by a hormone from the small intestine  
   b) concentrate bile by reabsorbing water  d) all of the above
25. The parts of the colon in order, from proximal to distal, are ________.
   a) descending, transverse, ascending, sigmoid
   b) ascending, transverse, descending, sigmoid
   c) ascending, descending, transverse, sigmoid
   d) transverse, ascending, descending, sigmoid

**WORD REVIEW:** The student is encouraged to write down the meaning of each of the following words. The list can be used as a study guide for this unit.

- absorption
  
  *(Absorption is the process in which the digested nutrients are transferred from the intestines to the blood or lymph vessels.)*

- accessory digestive organs
  
  *(Accessory digestive organs consist of the teeth, tongue, salivary glands, pancreas, liver, and gallbladder.)*

- alimentary canal
  
  *(The alimentary canal consists of the mouth, pharynx, esophagus, stomach, and small and large intestines.)*

- anal canal
  
  *(The anal canal is the distal part of the large intestine, which ends with the anus.)*

- ascending colon
  
  *(The ascending colon is the first part of the large intestine that travels up the right side of the body from the cecum to the hepatic flexure.)*

- bile
  
  *(Bile is a bitter, alkaline, yellowish-brown fluid secreted by the liver that aids in fat digestion.)*
bolus

(A bolus is the soft ball of food created when food is chewed in the mouth, mixed with saliva, and then swallowed.)

cardiac sphincter

(The cardiac sphincter is the valve at the junction of the esophagus and stomach.)

cecum

(The cecum is the beginning of the large intestine, which receives food waste from the small intestine.)

chyme

(Chyme is a mixture of digestive juices, mucus, and food material.)

colon

(The colon is the large intestine.)

common bile duct

(The common bile duct is a tube from the gallbladder and pancreas into the duodenum.)

descending colon

(The descending colon is the part of the large intestine from the splenic flexure to the sigmoid flexure along the left side of the abdomen.)

digestion

(Digestion is the process of converting food into substances capable of being used by the cells for nourishment.)
duodenum

(The duodenum is the first section of the small intestine.)

feces

(Feces are the food waste that is excreted from the colon through the rectum and anus.)

hydrochloric acid

(Hydrochloric acid is gastric juice secreted by the stomach wall.)

ileum

(The ileum is the last part of the small intestine.)

ileocecal valve

(The ileocecal valve is the opening between the small intestine and the large intestine.)

jejunum

(The jejunum is the middle part of the small intestine.)

lacteals

(Lacteals are lymphatic capillaries located in the villi of the small intestine.)

oral cavity

(The oral cavity, or mouth, prepares food for entrance into the stomach.)
pancreatic duct

(The pancreatic duct is the tube from the pancreas that joins to form the common bile duct.)

pancreatic fluid

(Pancreatic fluid is digestive juice from the pancreas.)

peristalsis

(Peristalsis is the wavelike muscular action of the alimentary canal.)

pyloric sphincter

(The pyloric sphincter is the valve between the stomach and the small intestine.)

rectum

(The rectum is the distal end of the large intestine, where the waste is stored until it is excreted from the body.)

saliva

(Saliva is a fluid produced by the salivary glands in the mouth that contains enzymes that begin to digest carbohydrates.)

salivary glands

(Salivary glands are located in the mouth. They produce fluids and amylase to mix with food and begin the digestion of starches into simple sugars.)

sigmoid colon

(The sigmoid colon is the distal portion of the large intestine between the descending colon and the rectum.)
small intestine

(The small intestine, the longest part of the alimentary canal, consists of the duodenum, jejunum, and ileum.)

transverse colon

(The transverse colon is the middle portion of the large intestine as it travels across the upper abdomen from the hepatic flexure to the splenic flexure.)

villi

(Villi are small, finger-like projections in the walls of the small intestine that contain blood and lymph vessels that absorb nutrients from the small intestine.)
MATCHING: Match the term with the best description. Write the letter or letters of the appropriate excretory organ next to the term describing what that organ eliminates.

A. kidneys  C. liver  E. skin
B. large intestine  D. lungs

1. urine  
2. food wastes  
3. expiration  
4. bile  
5. uric acid  
6. feces  
7. urea  
8. heat  
9. carbon dioxide  
10. perspiration  
11. water

COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The functional unit of the kidney is the  \textit{(nephron)} .

2. The tubes that carry urine from the kidneys to the bladder are called  \textit{(ureters)} .

3. A hormone produced in the kidneys that acts to regulate blood pressure is  \textit{(renin)} .

TRUE OR FALSE: If the following statements are true, write true in the space provided. If they are false, replace the italicized word with one that makes the statement true.

\textit{(true)} 1. The kidneys normally filter 40 to 50 \textit{gallons} of blood plasma a day.

\textit{(involuntary)} 2. When a person urinates, voluntary muscles in the walls of the bladder contract, forcing the urine out of the body.
IDENTIFICATION: Identify the structures indicated in Figure 5.27 by writing the correct term in the numbered space that corresponds to the number on the figure.

1. (adrenal glands)
2. (inferior vena cava)
3. (kidney)
4. (renal artery)
5. (renal vein)
6. (aorta)
7. (ureter)
8. (bladder)
9. (urethra)

Fig. 5.27 The urinary system.
MULTIPLE CHOICE: Carefully read each statement. Choose the word or phrase that correctly completes the meaning and write the corresponding letter in the blank provided.

1. Urine is produced in and eliminated from the organs of the urinary system in the following order:
   a) cortex, urethra, bladder, ureter
   b) kidney, urethra, bladder, ureter
   c) kidney, pelvis, ureter, bladder
   d) kidney, ureter, bladder, urethra

2. The opening between the bladder and the urethra is controlled by a
   a) flaplike valve
   b) sphincter muscle
   c) band of cartilage
   d) fold of membranous tissue

3. The excretory function of the lungs is the elimination of
   a) oxygen
   b) heat
   c) carbon dioxide
   d) mucous

4. Materials for the production of urine come from the
   a) kidney
   b) bladder
   c) bloodstream
   d) lymph system

5. The wall of the bladder is composed of
   a) cartilage
   b) smooth muscle
   c) skeletal muscle
   d) adipose tissue

6. The excretory function of the colon is the elimination of
   a) water
   b) heat
   c) digestive wastes
   d) all of the above

7. The basic constituents of normal human urine are
   a) electrolytes, albumin, and water
   b) water, salts, sugar, and protein
   c) gases, water, coloring materials, and glucose
   d) salts, water, and organic substances such as urea

8. Which of the following is not considered an organ of the excretory system?
   a) the lungs
   b) the kidneys
   c) the colon
   d) the nose
9. Nephrons consist of _______.
   a) glomerulus and tubules  
   b) arterioles and lymph nodes 
   c) capillaries and islet cells  
   d) mucous membrane and synapses  

10. The glomerulus, encased in a capsule, contains a network of _______.
   a) fascia  
   b) capillaries  
   c) nervous tissue  
   d) smooth muscles

11. The outer portion of the kidney is the _______.
   a) medulla  
   b) Bowman’s capsule  
   c) loop of Henle  
   d) cortex

12. The _______ surrounds the glomerulus.
   a) renal artery  
   b) proximal tubule  
   c) Bowman's capsule  
   d) trigone in the bladder

13. The urge to void usually begins when the normal bladder contains approximately how much urine?
   a) four to eight drams (15 to 30 cc)  
   b) one to two quarts (1000 to 2000 cc)  
   c) two to four quarts (2000 to 4000 cc)  
   d) one-half to two-thirds pint (250-350 cc)

14. The inner portion of the kidney is the _______.
   a) medulla  
   b) ureter  
   c) renal pelvis  
   d) cortex

15. The blood supply to the kidney is carried by the _______.
   a) renal artery  
   b) loop of Henle  
   c) renal vein  
   d) proximal tubule

16. A cluster of capillary loops is the _______.
   a) renal artery  
   b) proximal tubule  
   c) renal vein  
   d) glomerulus

17. The functional unit of the kidney is the _______.
   a) cell  
   b) nephron  
   c) glomerulus  
   d) loop of Henle
18. The liver produces ________, which is excreted by the kidneys.
   a) bile          c) glucose  
   b) uric acid     d) urea

19. Fluid is carried from the kidneys to the bladder by the ________.
   a) renal vein    c) ureters  
   b) renal artery  d) urethra

20. Of the amount of plasma that is filtered through the kidneys, approximately how much is excreted as urine?
   a) 0.1%          c) 5%       
   b) 1%            d) 10%

**WORD REVIEW:** The student is encouraged to write down the meaning of each of the following words. The list can be used as a study guide for this unit.

**bile**
*(Bile is a bitter, alkaline, yellowish-brown fluid secreted by the liver that aids in fat digestion.)*

**bladder**
*(The bladder is an organ where the urine is stored.)*

**excretion**
*(Excretion is the process of excreting or eliminating waste from the body.)*

**metabolic wastes**
*(Metabolic wastes are products formed from cell metabolism.)*

**nephron**
*(The nephron is the functional unit of the kidney.)*
(Renin is a hormone produced by the kidneys that acts to regulate blood pressure.)

ureters

(Ureters are the tubes that carry urine from the kidneys to the bladder.)

urethra

(The urethra conveys urine from the bladder and carries reproductive cells and secretions out of the body.)

urinary system

(The urinary system includes two kidneys, two ureters, the bladder, and a urethra.)

SYSTEM TEN: THE HUMAN REPRODUCTIVE SYSTEM

COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. One-celled organisms that do not need a partner to reproduce do so by nonsexual means called (asexual) reproduction.

2. The term used to describe a reproductive cell that can unite with another reproductive cell to form the cell that develops into a new individual is called a (gamete).

3. In men, the reproductive cells are called (spermatozoa).

4. In women, the reproductive cells are called (ova).

5. The cell formed by the union of the male and female reproductive cells is called a (zygote).

6. The gland in the female that produces the reproductive cell is the (ovary).

7. The gland in the male that produces the reproductive cell is the (testes).
SHORT ANSWER: Number the following terms from 1 to 5 in the order that sperm would travel from the time it is produced until it leaves the body.

1. seminiferous tubules
2. epididymis
3. vas deferens
4. ejaculatory ducts
5. urethra

MATCHING: Match the term with the best description. Write the letter of the appropriate term in the space provided.

A. Cowper's glands  D. seminal vesicles  F. urethra
B. epididymis  E. testes  G. vas deferens
C. prostate gland

1. conveys both urine and sperm out of the body
2. two convoluted, glandular tubes located on each side of the prostate gland
3. stores the sperm until it becomes fully mature
4. forms the male hormone testosterone
5. mucus-producing glands that serve to lubricate the urethra
6. contains specialized cells that produce the spermatozoa
7. surrounds the first part of the urethra
8. two pea-sized glands located beneath the prostate gland
9. secretes an alkaline fluid that neutralizes the acidic vaginal secretions
10. secretions contain simple sugars, mucus, and prostaglandin
11. two small, egg-shaped glands made up of minute convoluted tubules
12. sperm collects here until it is expelled from the body
13. located in the scrotum; receives sperm from the testes
IDENTIFICATION: Identify the structures indicated in Figure 5.28 by writing the letter of the structure next to the appropriate term in the space provided.

1. bulbourethral gland
2. urethra
3. epididymis
4. erectile tissue
5. glans penis
6. prepuce
7. prostate gland
8. scrotum
9. seminal vesicle
10. testis
11. urinary bladder
12. vas deferens
13. spine
14. rectum
15. anal opening
16. ureter
17. symphysis pubis
18. spermatic cord
19. ejaculatory duct

Fig. 5.28 The male reproductive system.
COMPLETION: In the space(s) provided, write the word(s) that correctly complete(s) each statement.

1. The external part of the female reproductive system that includes the labia majora and the labia minora is termed the (vulva).

2. The muscular tube or canal that is the lower part of the birth canal is called the (vagina).

3. The chamber that houses the developing fetus is the (uterus).

4. The egg-carrying tubes of the female reproductive system are the (fallopian tubes).

5. The glands that produce estrogen and progesterone are the (ovaries).

6. The egg cell capable of being fertilized by a spermatozoon is the (ovum).

MATCHING: Match the term with the best description. Write the letter of the appropriate term in the space provided.

A. corpus luteum  C. gestation  E. menstruation
B. estrogen  D. menopause  F. ovulation

1. controls the development of secondary female sexual characteristics (B)

2. the release of the egg cell from the ovary (F)

3. ovarian site of estrogen and progesterone production (A)

4. occurs from the time an ovum is fertilized until childbirth (C)

5. the cyclic uterine bleeding that normally occurs at approximately 4-week intervals (E)

6. follicle transformed by luteinizing hormone (A)

7. the physiologic cessation of the menstrual cycle (D)
IDENTIFICATION: Identify the structures indicated in Figure 5.29 by writing the letter of the structure next to the appropriate term in the space provided.

1. anal opening  
2. cervix  
3. fallopian tube  
4. labia minora  
5. labia majora  
6. ovary  
7. spine  
8. rectum  
9. symphysis pubis  
10. urethra  
11. urinary bladder  
12. uterus  
13. vagina  
14. urinary opening  
15. fundus of uterus  
16. ureter  
17. sacral promontory  
18. clitoris

Fig. 5.29 The female reproductive system.
MULTIPLE CHOICE: Carefully read each statement. Choose the word or phrase that correctly completes the meaning and write the corresponding letter in the blank provided.

1. Sperm cells are stored primarily in the _______.
   a) epididymis          c) seminal vesicles
   b) vas deferens        d) ejaculatory ducts
   (a)

2. The hormone responsible for the development and maintenance of male secondary sexual characteristics is _______.
   a) ACTH                   c) testosterone
   b) FSH                    d) gonadotropin-releasing hormone
   (c)

3. The upper openings of the uterine cavity join with the _______.
   a) fimbriae               c) cervical canal
   b) ovaries                d) fallopian tubes
   (d)

4. Which of the following are canals or tubes through which the sperm pass as they are transported to the outside of the body?
   a) urethra                c) vas deferens
   b) epididymis             d) all of these
   (d)

5. The number of spermatozoa that penetrate, and thereby fertilize, the ovum is _______.
   a) only one               c) at least 3
   b) about 100              d) about 1 million
   (a)

6. Once the sperm enters the female reproductive tract, it is capable of fertilizing the ovum for _______.
   a) a month                c) less than an hour
   b) hours or days          d) more than a week
   (b)

7. The ejaculatory ducts empty into the _______.
   a) vas deferens           c) urethra
   b) scrotum                d) epididymis
   (c)

8. The penis is composed of what type of tissue?
   a) fatty                  c) erectile
   b) muscular               d) cartilaginous
   (c)

9. The hormone mainly responsible for the development and maintenance of female secondary sexual characteristics is _______.
   a) androgen                c) progesterone
   b) estrogen                d) luteinizing hormone
   (b)
10. The labia minora ________.
   a) compose the middle portion of the uterus  
   b) function chiefly as the female organs of sexual sensation 
   c) are two lip-like folds situated on either side of external opening of the vagina 
   d) form a membranous fold that encircles the vaginal orifice

11. The tubular portion of the uterus that extends downward into the upper part of the vagina is the ________.
   a) cervix  
   b) perimetrium  
   c) endometrium  
   d) ostium uteri

12. The inner lining of the uterus is known as the ________.
   a) hymen  
   b) epididymis  
   c) myometrium  
   d) endometrium

13. The free ends of the fallopian tubes ________.
   a) encircle the uterus  
   b) are closed, finger-like processes  
   c) form a solid mass over each ovary  
   d) are open-ended, with finger-like fimbriae

14. The physiologic cessation of the menstrual cycle is ________.
   a) menarche  
   b) menopause  
   c) a period  
   d) virginity

15. Fertilization of an ovum usually takes place in the ________.
   a) uterus  
   b) cervix  
   c) fallopian tubes  
   d) vagina

16. The secretions of the various glandular tissues of the male reproductive system combine to form ________.
   a) semen  
   b) testosterone  
   c) mucous  
   d) sperm

17. The pathway that the sperm travel from the testes out of the body is ________.
   a) urethra, seminaliferous tubule, epididymis, vas deferens  
   b) seminaliferous tubule, epididymis, vas deferens, urethra  
   c) epididymis, seminaliferous tubule, vas deferens, urethra  
   d) vas deferens, epididymis, seminaliferous tubule, urethra

18. A cell formed by the unification of a male and female reproductive cell is a ________.
   a) gamete  
   b) fetus  
   c) zygote  
   d) embryo
19. The _______ produces an alkaline fluid that is part of the semen.  
   a) Cowper's gland 
   b) testes 
   c) seminal vesicle 
   d) prostate gland 

20. Which of the following organs do not contribute to the formation of semen?  
   a) seminal vesicles 
   b) testes 
   c) vas deferens 
   d) prostate gland 

WORD REVIEW: The student is encouraged to write down the meaning of each of the following words. The list can be used as a study guide for this unit.

- asexual reproduction
  
  (Asexual reproduction is a method of reproduction of lower forms of life using nonsexual means.)

- bulbourethral glands
  
  (Bulbourethral glands, or Cowper's glands, are two pea-sized glands located beneath the prostate that produce a mucous substance that serves to lubricate the urethra.)

- cervix
  
  (The cervix is the opening of the uterus from the vagina.)

- corpus luteum
  
  (The corpus luteum is a yellowish endocrine body formed in the ruptured ovarian follicle that produces estrogen and progesterone.)

- ejaculatory ducts
  
  (Ejaculatory ducts enter the prostate gland and empty into the urethra.)

- epididymis
  
  (The epididymis is located in the scrotum and receives sperm from the testes, which it stores until they become mature.)
(Estrogen is a female hormone responsible for development of secondary sexual characteristics.)

Fallopian tubes

(Fallopian tubes, or oviducts, are the egg-carrying tubes of the female reproductive system.)

Fertilization

(Fertilization is the union of the female ovum and the male spermatozoon.)

Fetus

(A fetus is the developing child from the third month of pregnancy until birth.)

Gamete

(A gamete is a reproductive cell that can unite with another gamete to form the cell that develops into a new individual.)

Gestation

(Gestation, or pregnancy, is the physiologic condition that occurs between fertilization and childbirth.)

Gonad

(A gonad is a sex gland that produces the reproductive cell.)

Labia majora

(The labia majora are the outer lips of the vulva.)
labia minora

(The labia minora are the small, inner lips of the vulva.)

luteinizing hormone

(Luteinizing hormone from the pituitary gland transforms the ovarian follicle into the corpus luteum.)

menopause

(Menopause is the physiologic cessation of the menstrual cycle.)

menstrual cycle

(The menstrual cycle is the periodically recurring series of changes that take place in the ovaries, uterus, and related structures in women.)

menstruation

(Menstruation is the cyclic, physiologic uterine bleeding that occurs at about four-week intervals during the reproductive period of women.)

penis

(The penis is the male organ of copulation.)

pregnancy

(Pregnancy, or gestation, is the physiologic condition that occurs from the time that an ovum is fertilized until childbirth.)

ovary

(The ovaries are glandular organs in the pelvis that produce the ovum and female sex hormones.)

oviducts

(The oviducts, or fallopian tubes, carry the egg from the ovary to the uterus.)
ovulation

*(Ovulation is the discharge of a mature ovum from the follicle of the ovary.)*

ovum

*(An ovum is the egg cell capable of being fertilized by a spermatozoon and developing into a new life.)*

progesterone

*(Progesterone is a hormone produced in the ovaries that promotes the lining of the uterus to thicken in preparation for receiving the fertilized egg.)*

prostate gland

*(The prostate gland secretes an alkaline fluid that enhances the sperm’s motility.)*

scrotum

*(The scrotum is the sack that holds the testes.)*

semen

*(Semen is excreted from the body during ejaculation.)*

seminal fluid

*(Seminal fluid forms most of the semen when ejaculated.)*

seminal vesicles

*(The seminal vesicles are two glandular tubes located on each side of the prostate that produce a nutritious fluid that is excreted into the ejaculatory ducts at the time of emission.)*

spermatozoa

*(Spermatozoa are tiny detached male reproductive cells, egg-shaped, and equipped with a tail that enables them to swim.)*
testes

(The testes are two small, egg-shaped glands that produce the spermatozoa.)

testosterone

(Testosterone is a male hormone responsible for development of secondary sexual characteristics.)

urethra

(The urethra conveys urine from the bladder and carries reproductive cells and secretions out of the body.)

uterus

(The uterus is a pear-shaped, muscular female organ that expands during pregnancy to accommodate the fetus.)

vagina

(The vagina is a muscular tube leading from the vulva to the cervix and is the lower part of the birth canal.)

vas deferens

(The vas deferens is the tube from the testes that carries the sperm to the ejaculatory duct.)

vulva

(The vulva forms the external part of the female reproductive system.)

zygote

(A zygote is a fertilized ovum.)