Appendix A

Answers to Objective Questions with Explanations

Chapter 1

1. (a) The word *anatomy* is derived from the Greek prefix *ana,* meaning "up" and the suffix *tome,* "a cutting." In ancient times, the Greek word *anatomize* was more commonly used than the word *dissect.*
2. (a) In William Harvey's time, there were many misconceptions regarding the flow of blood. Using the scientific method, Harvey demonstrated the flow of blood and described the function of valves within veins.
3. (c) The concept of body humors was widely accepted by physicians in Greek and Roman times as an explanation for a person's disposition and general health. It was not until the Renaissance that this concept was gradually discarded in the light of scientific research.
4. (d) The Greeks held the body in great esteem and were eager to learn about its structure and function.
5. (a) Hippocrates is regarded as the father of medicine because of the sound principles of medical practice that he established. Although the Hippocratic oath cannot be directly credited to him, it undoubtedly represents his ideals and principles.
6. (c) Phlegm was thought to be the body humor associated with the lungs. It was believed that too much phlegm, or not enough, could result in respiratory disorders.
7. (c) Andreas Vesalius completed *De Humani Corporis Fabrica* in A.D. 1543 when he was 28 years old. This beautifully illustrated book corrected many anatomical errors that had been handed down as fact and provided a visual guide for studying anatomy.
8. (d) The development of movable type allowed for widespread access to printed material, and was therefore important in ushering in the Renaissance.
9. (b) Aristotle thought that the heart was the seat of intelligence and that the warm blood from the heart was cooled by the fluids surrounding the brain.
10. (a) Wilhelm Konrad Roentgen discovered X rays in 1895. His achievement was recognized in 1901, when he was awarded the Nobel Prize.

Chapter 2

1. (b) Although chordates have a distinct head, thorax, and abdomen, so do many invertebrate organisms.
2. (a) Because we have prehensile hands, digits modified for grasping, and large, well-developed brains, we are classified as primates along with monkeys and great apes.
3. (b) The tissue level of body organization is intermediate between the cell and organ levels.
4. (a) The urinary system maintains blood homeostasis. Basically, the kidneys are filtering organs of the blood.
5. (b) The cubital fossa is located on the anterior surface of the upper extremity, at the junction of the brachium and antebrachium. It is the anterior surface of the elbow.
6. (c) An organ is a body structure composed of two or more tissue types.
7. (c) By definition, both the coronal and sagittal planes extend vertically through the body, but there is no vertical plane designation.
8. (b) The external genitalia are located within the perineum, which is the area between the coccyx and the symphysis pubis.
9. (b) Within the mediastinum are the principal (primary) bronchi, esophagus, and heart, along with major vessels that transport blood toward and away from these organs.
10. (b) The epigastric region of the abdomen is centrally located, medial to the right and left hypochondriac regions.
11. (c) The mesenteries are modified serous membranes that support portions of the small and large intestines within the abdominal cavity.
12. (c) A coronal section divides the body into front (anterior) and back (posterior) portions.
13. (c) The anatomical position provides a consistent frame of reference when describing structures of the body.
14. (d) Some listening can be accomplished without the aid of an instrument, but the technique of choice is to use a stethoscope.

Chapter 3

1. (c) Electrolytes are formed from the breakdown of inorganic compounds in water. All three kinds of electrolytes—acids, bases, and salts—are important for normal cellular function.
2. (d) The elements carbon, oxygen, nitrogen, and hydrogen compose over 95% of the body and are often linked to form molecules and compounds.
3. (a) The strong hydrolytic enzymes in lysosomes digest foreign molecules and worn and damaged cells.
4. (e) Ciliated cells promote movement of substances through the tubes or ductules of sections of the respiratory and reproductive systems. For example, mucus containing trapped particles is moved in the bronchioles and trachea, sperm are moved in the ductus deferentia and ova are moved in the uterine tubes.
5. (b) Osmosis is movement of water and solvent molecules through a semipermeable membrane as a result of concentration differences.
6. (c) Metaphase is the stage of mitosis immediately preceding the separation of the chromatids.
7. (d) Anaphase is the stage of mitosis immediately following metaphase; it precedes the formation of two identical cells.
8. (a) The Golgi complex synthesizes carbohydrate molecules in the production of glycoproteins.
9. (b) Compensatory hypertrophy is an increase in cell mass in response to greater demands, such as the enlargement of a muscle fiber as a result of exercise.
10. (b) Hyperplasia is a protective mechanism that ensures the availability of an adequate number of cells to perform a particular task.
11. (d) cytosine always pairs with guanine.
12. (b) It contains the sugar ribose.

Chapter 4

1. (b) The four principal types of tissues are epithelial tissues, connective tissues, muscular tissues, and nervous tissues. The integument, or skin, is an organ.
2. (c) Blood is a fluid tissue that flows through blood vessels.
3. (a) Many body structures derive from mesoderm, including cartilage, bone, and other connective tissue; smooth, cardiac, and skeletal muscle; and the dermis of the skin.
4. (b) Elastic and collagenous fibers are characteristic of certain kinds of connective tissues.
5. (d) The entire abdominal portion of the gastrointestinal (GI) tract contains simple columnar epithelium lining the lumen.
6. (a) Based on structural classification, the mammary glands are classified as compound acinar. Based on secretory classification, the mammary glands are classified as apocrine.
7. (c) Dense regular connective tissue is the principal component of tendons, which accounts for their great strength.
8. (a) Reticular tissue, which contains white blood cells, is phagocytic in cleansing body fluids.
9. (b) Cartilage tissue is slow to heal because it is avascular (without blood vessels). Cartilage generally derives its nutrients from surrounding fluids rather than from permeating blood vessels and capillaries.

10. (d) Like skeletal muscle, cardiac muscle is striated. As compared to skeletal muscle or smooth muscle tissues, however, cardiac muscle tissue is unique in containing intercalated discs and experiencing rhythmic involuntary contractions.

Chapter 5

1. (a) Ectoderm is the outermost of the three embryonic germ layers, and it is from this germ layer that hair, nails, integumentary glands, and the epidermis of the skin is formed.
2. (b) The appearance and general health of nails is an indicator of general body health and of certain dietary deficiencies, such as iron deficiency.
3. (b) The stratum lucidum is an epidermal layer that occurs only in the skin of the palms of the hands and the soles of the feet.
4. (a) The dermal papillae may contribute to surface features of the skin, such as print patterns, but do not contribute to skin coloration.
5. (c) Mitosis occurs in the stratum basale, and to a limited extent, in the stratum spinosum.
6. (a) The sebum from sebaceous glands is emptied into a hair follicle, where it is dissipated along the shaft of the hair to the surface of the skin.
7. (c) Lanugo, or fetal hair, is thought to be important in the development of the hair follicles.
8. (b) Melanoma is an aggressive malignant skin cancer that is life threatening if untreated.
9. (b) A second-degree burn is serious, but it generally does not require skin grafts.
10. (d) A comedo is a blackhead or whitehead resulting from a small, localized skin infection.

Chapter 6

1. (c) A bone, such as the femur, is considered to be an organ because it is composed of more than two tissues integrated to perform a particular function.
2. (a) Skin, rather than bone, is involved in the synthesis of vitamin D.
3. Matching: 1(c), 2(d), 3(e), 4(a), 5(b)
4. (c) The mandible articulates with the mandibular fossae of the temporal bones.
5. (a) The sella turcica of the sphenoid bone is located immediately superior to the sphenoidal sinus, where it supports the pituitary gland.
6. (d) Osteoclasts are important in releasing stored minerals within bone tissue and in the continuous remodeling of bone.
7. (a) Located in the squamous part of the temporal bone, the mandibular fossa is the depression for articulation of the condyloid process of the mandible.
8. (b) The crista galli is the vertical extension of the ethmoid bone, which provides an attachment site for the dura mater.
9. (d) Cervical vertebrae contain transverse foramina that permit the passage of the vertebral vessels to and from the brain.
10. (c) A person may gain some protection against osteoporosis by maintaining a healthy diet and a regular exercise program.

Chapter 7

1. (a) When in anatomical position, a person is erect and facing anteriorly. The subscapular fossa is found on the anterior side of the scapula. The supraspinatus and infraspinatus fossae are located on the posterior side.
2. (c) The sternal extremity of the clavicle articulates with the manubrium of the sternum. The acromial extremity of the clavicle articulates with the acromion of the scapula.
3. (d) The clavicle has a conoid tubercle near its acromial extremity.
4. (b) The bony prominence of the elbow is the olecranon of the ulna.
5. (b) Sesamoid bones are formed in tendons, and none of the carpal bones are sesamoid bones. Sesamoid bones are fairly common, however, at specific joints of the digits.
6. (d) Pelvimetry measures the dimension of the lesser pelvis in a pregnant woman to determine whether a cesarean delivery might be necessary.
7. (e) The linea aspera is a vertical ridge on the posterior surface of the body of the femur, where the posterior gluteal muscles of the hip attach.
8. (b) The intertrochanteric line is located on the anterior side of the femur between the greater trochanter and the lesser trochanter.
9. (d) Sex-related structural differences in the pelvis reflect modifications for childbirth. For example, the female pelvis as compared to that of the male has a wider pelvic outlet, a shallower and shorter symphysis pubis, and a wider pubic arch.
10. (a) Talipes is a congenital malformation in which the sole of the foot is twisted medially.

Chapter 8

1. (b) Some joints are inmovable, some are slightly movable, and only synovial joints are freely movable.
2. (c) Synchondroses are cartilaginous joints that have hyaline cartilage between the bone segments.
3. (d) Syndesmoses are fibrous joints found in the antebrachium (forearm) and leg, where adjacent bones are held together by interosseous ligaments.
4. (d) Syndesmoses do not occur within the skull; rather, they are located only in the upper and lower extremities.
5. (c) The only saddle joint in the body is at the base of the thumb, where the trapezium articulates with the first metacarpal bone.
6. (d) Only the knee joints contain menisci.
7. (c) A pivotal joint is a synovial joint that permits rotational movement.
8. (b) The coxal (hip) joint has a wide range of movement, including hyperextension as the lower extremity is moved posteriorly beyond the vertical position of the body in anatomical position.
9. (b) The shoulder joint, with its relatively shallow socket and weak ligamentous support, is vulnerable to dislocation. In addition, we often place our arms in vulnerable positions as we engage in various activities.
10. (d) Rheumatoid arthritis is a chronic disease that frequently leaves the patient crippled. It occurs most commonly between the ages of 30 and 35.

Chapter 9

1. (b) The neuromuscular cleft is a slight gap within the neuromuscular junction where a motor nerve fiber and a skeletal muscle fiber meet.
2. (c) When there are many motor units present within a muscle, a person can be more selective at which ones are recruited, and thus have greater dexterity than when few motor units are present.
3. (e) Muscles are named on the basis of structural features, location, attachment, relative position, or function (action).
4. (d) When a nerve impulse reaches an axon terminal, a neurotransmitter chemical is released into the neuromuscular cleft at the neuromuscular junction.
5. (c) With respect to the muscles of the thigh, a single motor neuron serves a large number of muscle fibers and, therefore, has a low innervation ratio.
6. (a) The corrugator supercilli muscle is located beneath the medial portion of the eyebrow. When the muscle contracts, the eyebrow is drawn toward the midline.
7. (a) A description of a muscle's contraction is always made in reference to a person in anatomical position. In anatomical position, the shoulder joint is positioned vertically at 180°. When the pectoralis muscle is contracted while in this position, the angle of the shoulder joint is decreased; therefore, the joint is flexed.
8. (b) Although it is positioned on the anterior surface of the humerus, the biceps brachii muscle arises from the coracoid process of the scapula and from the tuberosity above the glenoid cavity of the scapula. Both heads insert on the radial tuberosity.
9. (c) Spanning both the hip and knee joints, the rectus femoris muscle can flex the hip joint and extend the knee joint.
10. (b) The tibialis posterior muscle is deep to the soleus muscle. Its tendinous insertion passes across the arches of the foot and inserts on the plantar surfaces of a number of foot bones. In this position, the tibialis posterior muscle supports the arches of the foot and plantar flexes and inverts the foot as it contracts.

Chapter 10

1. (e) The scalp is attached anteriorly to the supraorbital ridges. The eyebrows are attached to the scalp, just above the supraorbital ridges.
2. (b) The ala is a portion of the nose, lateral to the apex.
3. (d) The concha is a bony projection into the nasal cavity.
4. (d) The conjunctiva is a thin mucous membrane that covers the anterior surface of the eyeball and lines the undersurface of the eyelids.
5. (d) The cervix of the neck is the anterior portion. The cervical vertebrae can be palpated in the posterior portion, called the nucha.
6. (a) The carotid triangle is located on the lateral side of the neck and is bordered by the sternocleidomastoid, posterior digastric, and omohyoid muscles. Located within the carotid triangle are the common carotid artery, internal jugular vein, and vagus nerve.
7. (a) The ulnar nerve passes through the ulnar sulcus of the elbow. A fracture of the olecranon of the ulna often damages the ulnar nerve.
8. (b) The scapular muscles are usually obscure on an obese person.
9. (c) The axilla is the depression commonly known as the armpit. The anterior axillary fold is formed by the pectoralis major muscle and the posterior axillary fold consists of the latissimus dorsi muscle.
10. (a) The great saphenous vein and small saphenous vein are superficial veins of the leg that are frequently varicosed in elderly people.

Chapter 11

1. (d) The cerebellum is a structure within the metencephalon of the brain.
2. (a) The cerebral cortex is the outer portion of the cerebrum, and the cerebrum is a structure within the telencephalon of the brain.
3. (e) The medulla oblongata is a structure within the myelencephalon of the brain.
4. (c) As the nervous system matures in an infant, the neurolemmocytes wrap around the axons and some of the dendrites of neurons within the peripheral nervous system. Myelination is the process of forming myelin layers that protect neurons and aid conduction.
5. (d) Ganglia are collections of nerve cell bodies outside the CNS. Collections of nerve cell bodies within the CNS are called nuclei.
6. (a) A pseudounipolar neuron has a single process that divides into two, and its cell body is located in posterior root ganglia of the spinal and cranial nerves.
7. (a) Depolarization of an axon is produced by the movement of Na^+ into the axon and K^+ out of the axon. Once the action potential (nerve impulse) has completed its course to the axon terminal, repolarization of the axon is produced by the movement of K^+ into the axon and the movement of Na^+ out of the axon.
8. (a) The corpus collosum is composed of commissural fibers that connect the two cerebral hemispheres.
9. (d) The thalamus autonomically responds to pain by activating the sympathetic nervous system. It also relays pain sensations to the parietal lobes of the cerebrum for perception.
10. (b) The basal nuclei consist of cell bodies of motor neurons that regulate contraction of skeletal muscles. Basal metabolic rate is regulated, for the most part, in the hypothalamus and medulla oblongata.
11. (c) Located within the mesencephalon, the corpora quadrigemina is concerned with visual and hearing reflexes, the red nucleus is concerned with motor coordination and posture maintenance, and the substantia nigra is thought to inhibit forced involuntary movements.
12. (d) The fourth ventricle is located inferior to the cerebellum within the metencephalon and contains cerebrospinal fluid.

Chapter 12

1. (a) Anatomically speaking, the PNS consists of all of the structures of the nervous system outside of the CNS. That means, then, that all nerves, sensory receptors, neurons, ganglia, and plexuses are part of the PNS.
2. (b) The oculomotor nerve innervates the medial rectus eye muscles that, when simultaneously contracted, cause the eyes to be directed medially.
3. (b) The oculomotor nerve innervates the levator palpebrae superioris muscle with motor fibers. This muscle elevates the upper eyelid when contracted.
4. (c) The vestibulocochlear nerve serves the vestibular organs of the inner ear with sensory fibers. These organs are associated with equilibrium and balance.
5. (a) Passing through the stylomastoid foramen, the facial nerve innervates the muscles of facial expression with motor fibers and the taste buds on the anterior two-thirds of the tongue with sensory fibers.
6. (b) The accessory nerve innervates several muscles that move the head and neck with motor fibers.
7. (c) The four spinal nerve plexuses are the cervical, brachial, lumbar, and sacral.
8. (d) Only the brachial plexus consists of roots, trunks, divisions, and cords. The nerves of the upper extremity arise from the cords.
9. (a) The median nerve arises from the brachial plexus.
10. (c) The knee-jerk reflex is an ipsilateral reflex because the receptor and effector organs are on the same side of the spinal cord.

Chapter 13

1. (d) Postganglionic neurons from the superior mesenteric ganglion innervate the small intestine and colon.
2. (d) Parasympathetic neurons within the oculomotor, facial, and glossopharyngeal nerves synapse in ganglia located in the head.
3. (c) Parasympathetic ganglia, also called terminal ganglia, synapse with the effector cells near or within the organs being served.
4. (c) Secreted from synaptic vesicles, the neurotransmitter chemical acetylcholine facilitates transmission across a synapse.
5. (d) Because the preganglionic neurons of the sympathetic division of the autonomic nervous system exit the vertebral column from the first thoracic to the second lumbar levels, the sympathetic division is also called the thoracolumbar division.
6. (c) Nerve impulses through the postganglionic sympathetic neurons in the heart release norepinephrine, which stimulates the heart to contract.
7. (b) The cooperative effect of sympathetic and parasympathetic stimulation is evident in the erection of the penis (parasympathetic response) and the ejaculation of semen (sympathetic response).
8. (d) Most blood vessels dilate in response to sympathetic stimulation. A few blood vessels (e.g., those serving the external genitalia) constrict in response to parasympathetic stimulation. Visceral blood vessels do not constrict in response to parasympathetic stimulation.
9. (e) Parasympathetic stimulation increases digestive activity, constricts pupils, and decreases the heart rate. Because atropine blocks parasympathetic stimulation, it results in decreased mucus secretion and GI tract movement and causes dilation of the pupils. It also results in an increased heart rate.
10. (c) The medulla oblongata is the structure of the brain that most directly controls the activity of the ANS. The medulla oblongata contains control centers for the circulatory, respiratory, urinary, reproductive, and digestive systems.

Chapter 14

1. (e) The adenohypophysis derives from the hypophyseal pouch in the roof of the oral cavity.
2. (b) The neurohypophysis derives from the neurohypophyseal bud of neuroectoderm within the developing brain.
3. (d) The adrenal medulla derives from neural crest ectoderm within the primitive coelomic cavity.
4. (c) The pancreas derives from an outpouching of the endoderm along the developing foregut.
5. (a) The thyroid gland derives from the thyroid diverticulum of endoderm within the developing pharynx.
6. (c) The sella turcica is a depression within the sphenoid bone that supports the pituitary gland.
7. (d) Secreted from the thyroid gland, thyroxine determines the basic metabolic rate of most organs and promotes the maturation of the brain.
8. (c) Activation of the adrenal medulla causes the secretion of epinephrine and norepinephrine. Both of these hormones prepare the body for greater physical performance—the fight-or-flight response.
9. (e) Insulin is secreted from beta cells within the pancreatic islets in response to a rise in blood glucose. Insulin stimulates the production of glycogen and fat.

10. (d) The adrenal medulla releases epinephrine upon receiving sympathetic nerve impulse stimulation.
11. (a) The thyroid gland releases thyroxine upon receiving TSH stimulation from the adenohypophysis of the pituitary gland.
12. (b) The adrenal cortex releases corticosteroids upon receiving ACTH stimulation from the adenohypophysis of the pituitary gland in response to stress.
13. (e) The adenohypophysis of the pituitary gland releases ACTH in response to receiving CRF stimulation from the hypothalamus.
14. (d) Both the adrenal cortex and the gonads secrete steroid hormones.
15. (a) In the case of an endemic goiter, growth of the thyroid is due to excessive TSH secretion, which results from low levels of thyroxine secretion.

Chapter 15

1. (d) In order for perception to occur, there must be a stimulus at a receptor site that causes a nerve impulse to be conducted to the cerebrum of the brain.
2. (b) Located within the dermis of the skin, in certain visceral organs, and near synovial joints, lamellated corpuscles respond to heavy pressures.
3. (d) Located within connective tissue capsules in synovial joints, joint kinesthetic receptors are stimulated by changes in position caused by movements at the joints.
4. (c) Because sensations of referred pain are consistent from one person to another, an understanding of this phenomenon is of immense clinical importance in diagnosing organ dysfunction.
5. (d) When an object is viewed at a distance of at least 20 feet by someone with normal vision, the suspensory ligaments of the eyes are taut and the lenses are flat because the ciliary muscles are relaxed.
6. (a) Composed of tightly bound elastic and collagenous fibers, the toughened sclera is avascular but does contain sensory receptors for pain.
7. (b) In dim light, sympathetic motor impulses cause the radially arranged smooth muscle fibers within the iris to contract, permitting the pupil to become larger.
8. (a) The semicircular ducts contain endolymph and hair cells that respond to movements of the head and convey sensations to the brain that are important for maintaining equilibrium and balance.
9. (d) The vestibular window is at the footplate of the stapes and the cochlear window borders between the scala tympani and the tympanic cavity. Both windows separate the middle ear from the cochlea within the inner ear.
10. (b) A concave lens corrects myopia (nearsightedness) by causing the light waves to focus deeper within the posterior cavity upon the fovea centralis.

Chapter 16

1. (c) Fibrinogen is a protein in blood plasma that aids in clotting.
2. (a) An excessive leukocyte count, called leukocytosis, is generally diagnostic of infections or diseases within the body.
3. (b) The pulmonary arteries transport deoxygenated blood from the right ventricle of the heart to the lungs.
4. (c) The right atrium receives venous blood from the superior and inferior vena cavae and the coronary sinus. The coronary sinus collects venous blood from coronary circulation prior to delivery into an opening of the right atrium.
5. (f) Closure of the atrioventricular valves causes the "lub" sound of the heart.
6. (c) The QRS complex represents the depolarization of the ventricles. During this interval, the ventricles of the heart are in systole and blood is being ejected from the heart.
7. (b) Arising from ascending aorta, the coronary arteries feed directly into the myocardium of the heart to ensure a rich blood supply to the cardiac muscles.
8. (a) The external carotid arteries supply blood to the entire head, excluding the brain. The paired internal carotid arteries and vertebral arteries (that unite to form the basilar artery) supply blood to the brain.
9. (a) Branching from the external carotid artery at the level of the mandibular condyle, the maxillary artery supplies blood to the teeth and gums of the upper jaw and the superficial temporal artery supplies blood to the parotid gland and to the superficial temporal region.
10. (a) The hepatic portal vein drains nutrient-rich blood into the liver, where the blood is processed by a venous portal system. An arteriole portal system provides the pituitary gland with blood.
11. (b) Although the heart begins pumping blood at 25 days following conception, its development is not complete until the end of the fifth week (at about 35 days).
12. (c) The umbilical vein receives oxygenated blood from the placenta and transports it to the fetal heart.

Chapter 17

1. (b) Inhaled air is cleansed, moistened, and warmed prior to its arrival at the pulmonary alveoli.
2. (a) The paired palatine bones support the nasal septum but are not part of its structure.
3. (b) Adenoid is the common name of the pharyngeal tonsil. An adenoidectomy is the removal of both pharyngeal tonsils.
4. (a) There are four paranasal sinuses, each named according to the bone in which it is located. Hence, we have ethmoidal, sphenoidal, frontal, and maxillary sinuses.
5. (e) Unlike the right lung that has three lobes, the left lung has only a superior lobe and an inferior lobe.
6. (a) The parietal pleura lines the wall of the thoracic cavity and the visceral pleura covers the lung. The space between the parietal pleura and the visceral pleura is referred to as the pleural cavity.
7. (d) When contracted, the muscles of inspiration increase the dimensions of the thoracic cavity, causing a decrease in the air pressure surrounding the lungs. Air flows through the respiratory tract, inflating the lungs.
8. (d) The vocal folds (cords) are attached between the arytenoid and thyroid cartilages on either lateral side of the glottis.
9. (c) The vital capacity is the greatest amount of air that can be exhaled following a maximal inhalation—an approximate volume of 4,500 cc of air.
10. (a) The nuclei for normal breathing are located within the medulla oblongata of the brain.

Chapter 18

1. (d) Viscera are the organs located within the trunk of the body. In the thoracic cavity, the viscera include the heart, lungs, and esophagus. In the abdominopelvic cavity, the viscera include the stomach, small and large intestines, liver, gallbladder, spleen, pancreas, kidneys, and adrenal glands, along with major vessels.
2. (c) The deciduous dentition includes 8 incisors, 4 canines, and 8 molars. The permanent dentition includes 8 incisors, 4 canines, 8 premolars, and 12 molars. The third molars are called wisdom teeth.
3. (b) It is through the supporting mesentery that vessels and nerves supply the abdominal viscera.
4. (c) Lacteals are lymph ductules found within the lamina propria of the intestinal villi.
5. (b) Composed of lymphoid tissue, the spleen stores red blood cells and is an organ of the circulatory system.
6. (d) The papillae on the surface of the tongue provide a roughened surface for physically handling food. The papillae also support taste buds for responding to the chemical stimuli of various foods.
7. (c) Following the formation of chyme within the stomach, the food entering into the small intestine is ready for additional digestion and absorption. Bile and pancreatic juice enter the lumen of the duodenum to continue the chemical breakdown of food. Intestinal movements aid in its mechanical breakdown. The nutrients from digested food enter the bloodstream as absorption occurs within the small intestine.
8. (a) As the sphincter of ampulla opens, bile and pancreatic juice enter the duodenum. Stenosis of the sphincter of ampulla would prohibit the entry of these products.
9. (a) The hepatic portal vein transports absorbed nutrients within the bloodstream to the liver, where they are processed.
10. (d) Fats are absorbed into the lymphatic system. Proteins are broken down into amino acids before they are absorbed. Bile is secreted into the duodenum. The liver is served with blood from the hepatic portal vein and the hepatic artery; thus, it has a double blood supply, which becomes mixed at the capillary level.

Chapter 19

1. (b) The glomeruli are enclosed within the glomerular capsules in the renal cortex.

2. (d) The hilum of the kidney is the concave medial surface where the renal vessels enter and exit and where the ureter is located.
3. (c) Renal pyramids, containing the papillary ducts, are located within the renal medulla.
4. (a) The minor calyx receives urine directly from the papillary ducts. The urine then passes through the major calyx and into the renal pelvis.
5. (d) The kidneys are located high in the abdominal cavity between the levels of the twelfth thoracic and the third lumbar vertebrae.
6. (d) A renal calculus is most likely to cause a blockage of a ureter and backup of urine into the renal pelvis.
7. (e) The rugae of the empty urinary bladder permits distension as does the transitional epithelium that makes up the mucosa.
8. (c) Collectively, the three layers of smooth muscle within the wall of the urinary bladder are referred to as the detrusor muscle. The detrusor muscle plays an active role in forcing urine from the urinary bladder during micturition.
9. (b) The internal urethral sphincter is actually a modified portion of the detrusor muscle and is innervated by parasympathetic neurons.
10. (d) Metanephros are the last type of developmental kidneys. They are continuously functioning throughout the fetal period, with the urine produced being expelled into the amniotic fluid.

Chapter 20

1. (c) The perineum is of functional and clinical importance because the external genitalia are located there.
2. (a) The dartos muscle is embedded within the wall of the scrotum. Along with the cremasteric muscle, it regulates the position of the testes within the scrotum through involuntary contraction in response to cold temperatures.
3. (b) Produced by interstitial cells, testosterone maintains male sexuality, including production of spermatozoa, activity of accessory sex organs, expression of secondary sex characteristics, and determination of sex drives.
4. (e) As components of the root of the penis, the bulb attaches to the undersurface of the urogenital diaphragm and the crus is the expanded proximal portion of the corpora cavernosa penis.
5. (b) The spermatic cord contains the ductus deferens, which is a spermatic duct. The spermatic cord, however, also contains spermatic vessels, a nerve, and the cremasteric muscle.
6. (a) The epididymides are long, flattened organs that store sperm in their last stage of maturation. Sperm are also stored in the ductus deferentia.
7. (a) Mucus secreted by the urethral glands lubricates the urethra and retards the entry of pathogens into the urinary bladder.
8. (c) Emission is movement of stored sperm from the epididymides and ductus deferentia to the ejaculatory ducts. Ejaculation is the forceful discharge of semen from the erect penis. Emission and ejaculation occur only if stimulation is sufficient, as in masturbation or coitus.
9. (a) The ovum from a female may be fertilized by a sperm cell containing either an X or a Y chromosome. If the sperm cell contains an X chromosome, it will pair with the X chromosome of the ovum and a female child will develop. A sperm cell carrying a Y chromosome results in an XY combination, and a male child will develop. The Y chromosome, therefore, is responsible for the subsequent production of androgens, which cause masculinization.
10. (d) The epididymides, ductus deferentia, and seminal vesicles derive from the mesonephric duct. The prostate arises from an endodermal outgrowth of the urogenital sinus.

Chapter 21

1. (c) The cervix of the uterus is the inferior constricted portion that opens into the vagina.
2. (b) The usual site of fertilization is within a uterine tube. From there, the fertilized egg continues to develop and enters into the cavity of the uterus about 3 days after conception.
3. (c) The secretory phase of the endometrium is characterized by an increase in glandular secretion and blood flow into the endometrium in preparation for implantation. During this time the ovary is in its luteal phase, characterized by a regressive corpus luteum.
4. (d) A secondary oocyte is discharged from an ovary during ovulation. If a spermatozoon passes through the corona radiata and zona pellucida and enters the cytoplasm of the secondary oocyte, the second meiotic division is completed and a mature ovum is formed.
5. (d) In addition to the mesovarium, each ovary is supported by an ovarian ligament and a suspensory ligament.
6. (c) The endometrium consists of a superficial stratum functionale layer that is shed as menses during menstruation and a deeper stratum basale layer that replenishes the stratum functionale layer after each menstruation.
7. (b) Vaginal rugae permit distension of the vagina during coitus and also during parturition.
8. (d) The vulva is the collective term for the female external genitalia. The vagina is an internal reproductive organ.
9. (d) The paramesonephric ducts give rise to the genital tract of the female reproductive system, which includes the uterus and the uterine tubes.
10. (a) Both the labia majora of the female and the scrotum of the male derive from the embryonic labioscrotal swellings.

Chapter 22

1. (d) The preembryonic period of developments lasts 14 days and is completed when the three primary germ layers have been formed and are in place to begin migration and differentiation.
2. (c) The yolk sac only produces blood for about a 2-week period (the third to the fifth week) prior to the formation of the liver. The liver then produces blood until the red bone marrow is sufficiently developed to carry out the task.
3. (d) The placenta is an organ that serves many physiological functions, including the exchange of gases and other molecules between the maternal and fetal blood and the production of enzymes. In addition, it serves as a barrier against many harmful substances and as an endocrine gland in secreting steroid and glycoprotein hormones.
4. (c) The embryonic portion of the placenta is the chorion frondosum, and the maternal portion is the decidua basalis.
5. (d) Although the placenta is an effective barrier against diseases of bacterial origin, viruses and certain blood-borne diseases can diffuse through the vascular tissues. Furthermore, most drugs ingested by a pregnant woman can readily pass through the placenta, including nicotine, alcohol, and heroin.
6. (a) The embryonic heart begins pumping blood on about day 25, or during the fourth week of development.
7. (a) The neonatal period from birth to the end of the fourth week is characterized by major physiological changes, including the establishment of a stable heart rate and respiratory rate, and a consistent body temperature.
8. (b) A rapid heart rate of 120–160 beats/min ensures an adequate oxygen supply to all of the cells and helps to maintain a constant body temperature.
9. (c) Pubescence accompanies puberty and refers to the continuum of physical changes that occur during this period of maturation, especially with regard to body hair.
10. (b) As compared to males, females have a lower basal metabolic rate. This may account, in part, for the longer life span of females.
11. (c) The average age at which breast buds appear in healthy girls in the United States is about 11 years, but the range is from 9 to 13 years.
12. (c) Dizygotic, or fraternal, twins may be of the same sex or of different sexes and are not any more alike than brothers or sisters born at different times.
13. homozygous recessive (*bb*)
heterozygous (*Bb*)
homozygous dominant (*BB*)
14. (a) A recessive allele is not expressed in a heterozygous genotype. This means that the particular recessive trait is not physically apparent.
15. (c) In a monohybrid cross, the probability of an offspring having a particular genotype is one in four for homozygous dominant and homozygous recessive and one in two for heterozygous.