

AP Biology: Animal Physiology Review

Chapter 40

1. Which of the following statements about nervous tissue is true?
 - A) Neurons outnumber glial cells in our nervous system.
 - B) Glial cells generate and conduct electrochemical signals.
 - C) Cell bodies are long extensions of neurons over which impulses travel to reach other neurons.
 - D) Glial cells support and protect neurons.
2. Which of the following contributes to the proper maintenance of homeostasis in the bodies of animals?
 - A) pH buffering of the blood
 - B) Control of blood flow to the skin
 - C) Production of hormones
 - D) All of the above
3. In an environment with an ambient temperature lower than an animal's core body temperature, which of the following would be an inappropriate physiological or behavioral response if the animal needed to eliminate excess body heat?
 - A) Wallowing in a pool of water
 - B) Preventing blood flow to peripheral vessels
 - C) Sweating
 - D) All of the above
4. A lizard lives in a desert environment where the temperature at night is low and during the day is high. What might this animal do to maintain the highest stable body temperature?
 - A) Stay in a burrow during the night and shuttle between the sun and shade on the surface during the day
 - B) Stay on the surface during the night and move to a burrow during the day
 - C) Increase metabolism and heat production during the night and decrease it during the day
 - D) None of the above
5. On a warm day your dog has been running around fetching his Frisbee and returning it to you. You notice that he is panting heavily. Which of the following does not describe the condition of your dog?
 - A) Your dog is using evaporative cooling to lower core body temperature.
 - B) Your dog is operating at a basal metabolic rate.
 - C) Your dog is at the upper end of its thermoneutral zone.
 - D) All of the above
6. Evaporative cooling is an effective way to increase heat loss, but carries with it the physiological drawback of
 - A) increased use of ATP and substantial water loss.
 - B) lowering the hypothalamic thermal set point.
 - C) decreased use of ATP and substantial water gain.
 - D) exhaustion of the supply of brown fat.

7. Fever
- A) is a higher than normal body temperature that is always dangerous.
 - B) decreases the metabolic rate of the body to conserve energy.
 - C) is regulated by chemicals that reset the thermostat of the body to a higher set point.
 - D) causes the liver to release large amounts of calcium, which seems to inhibit bacterial growth.
8. Which of the following is a characteristic unique to connective tissue?
- A) Highly modified cells that show the special property of contractility
 - B) Diverse anatomy with distinct specializations for information transfer
 - C) Lining of the inner surfaces of the intestines and lungs in mammals
 - D) Loose array of cells embedded in an extracellular matrix
9. Elephants use their ears to release heat to the environment. What mechanisms might they employ to increase heat loss from the ears?
- A) Increased convection due to flapping of the ears
 - B) Moving into the sun
 - C) Increased blood flow to the ears
 - D) Both a and c
10. Which organ system is involved in the maintenance of homeostasis in humans?
- A) Endocrine
 - B) Digestive
 - C) Muscle
 - D) All of the above
11. What is the difference between a negative feedback mechanism and a positive feedback mechanism?
- A) Negative feedback mechanisms only exist in the circulatory system.
 - B) Negative feedback mechanisms return a system to a set point, and positive feedback mechanisms amplify a response.
 - C) Negative feedback mechanisms move away from a set point, and positive feedback mechanisms stabilize toward a set point.
 - D) Negative feedback mechanisms stabilize toward a set point, and positive feedback mechanisms reset the set point.
12. A number of physiological processes can undergo acclimatization. Which of the following statements about acclimatization is true?
- A) It occurs in response to seasonal temperature changes.
 - B) Acclimatization of metabolic rate occurs because enzyme expression changes.
 - C) It involves the changing of a set point.
 - D) All of the above
13. In fast-swimming cool-water fishes such as sharks and tunas, which of the following contribute(s) to the generation and maintenance of core body temperatures in excess of ambient water temperatures?
- A) Specializations in the size and arrangement of blood vessels
 - B) Low rates of activity in the swimming muscles
 - C) An ability to acclimatize rapidly to the surrounding water
 - D) Metabolic rates that are insensitive to temperature change

14. Which of the following statements about hypothalamic function is false?
- A) Circulating blood temperature is monitored by the hypothalamus.
 - B) Hypothalamic thermal set points never change.
 - C) The hypothalamus is a part of the central nervous system.
 - D) Different thermoregulatory responses have different hypothalamic set points.
15. Some animals use brown fat as a source of heat generation. Which of the following statements about brown fat is true?
- A) Brown fat is involved in nonshivering thermogenesis.
 - B) The protein thermogenin is involved in uncoupling proton movement from ATP production.
 - C) Brown fat is found in endotherms.
 - D) All of the above
16. During childbirth, the pressure exerted on the mother's cervix by the emerging infant leads to increased contraction of the uterus. This interaction can be explained by
- A) negative feedback.
 - B) feedforward feedback.
 - C) positive feedback.
 - D) acclimatization.
17. Having measured the metabolism of two animals of similar size at 15°C and 25°C, you find that the metabolic rate of the first animal is 115 and 55 ml of oxygen per hour at 15°C and 25°C, respectively. The metabolic rate of the second animal is 5.5 and 11.5 ml of oxygen per hour at 15°C and 25°C, respectively. Calculate the Q_{10} for the metabolic rate in both animals and determine if they are endotherms or ectotherms.
18. Why is it important for an organism to maintain homeostasis? Give three specific examples of how this works.

Chapter 41

19. A paracrine hormone
 - A) circulates in the bloodstream and affects distant cells.
 - B) always acts on a wide variety of target tissues.
 - C) acts on nearby cells.
 - D) None of the above

20. A target cell's response to a hormone depends on
 - A) the amount of hormone released.
 - B) the number of receptors on that target cell.
 - C) how well the hormone binds with the receptor.
 - D) All of the above

21. "Upregulation" of hormone receptors refers to
 - A) increase in abundance of hormone receptors in response to low hormone levels.
 - B) increase in abundance of hormone receptors with high neurotransmitter levels.
 - C) increase in hormone levels produced by increase in abundance of hormone receptors.
 - D) decrease in hormone levels produced by decrease in abundance of hormone receptors.

22. Hormones have various regulatory functions. Which of the following statements does not describe how hormones function?
 - A) They act in very low concentration.
 - B) Many act at sites distant from where they are produced.
 - C) They are transported in blood.
 - D) All of the above

23. In insects, juvenile hormone
 - A) is produced by the corpora cardiaca.
 - B) is also known as brain hormone.
 - C) prevents maturation.
 - D) All of the above

24. Vitamin D
 - A) is a hormone secreted by skin cells.
 - B) is activated on passing through the liver and kidneys.
 - C) decreases loss of calcium in the urine.
 - D) All of the above

25. Which of the following glands has one part that develops from the embryonic mouth cavity and a second part that develops from the floor of the developing brain?
 - A) Adrenal gland
 - B) Thyroid gland
 - C) Hypothalamus
 - D) Pituitary gland

26. Which of the following glands is involved in biological rhythms, such as photoperiodicity?
- A) Pineal gland
 - B) Thyroid gland
 - C) Adrenal glands
 - D) Ovaries
27. The half-life of hormones in the plasma ranges from
- A) minutes to hours.
 - B) minutes to days or weeks.
 - C) days to weeks.
 - D) hours to months.
28. The target tissues of hormones are those tissues that
- A) the particular hormone can actually penetrate.
 - B) have specific enzymes with which hormones directly interact.
 - C) have high concentrations of the "second messenger."
 - D) have receptors for the particular hormone.
29. Which of the following sets of vertebrate hormones are produced in the anterior pituitary gland?
- A) Somatostatin, antidiuretic hormone, insulin
 - B) Prolactin, growth hormone, enkephalins
 - C) Oxytocin, prolactin, adrenocorticotropin
 - D) Estrogen, progesterone, testosterone
30. Hormones that are secreted by one endocrine gland and control the activities of another endocrine gland are called _____ hormones.
- A) growth
 - B) obstructive
 - C) tropic
 - D) selective
31. Which of the following has both endocrine and exocrine functions?
- A) Pancreas
 - B) Heart
 - C) Testes
 - D) Adrenal glands
32. Which of the following hormones have antagonistic effects?
- A) Insulin; glucagon
 - B) Growth hormone; oxytocin
 - C) Oxytocin; prolactin
 - D) Cortisol; testosterone
33. Steroid hormones are
- A) water-soluble.
 - B) produced by the thyroid gland.
 - C) lipid-soluble.
 - D) derived from the amino acid tyrosine.

34. Describe the modes of action of lipid-soluble and water-soluble hormones.

35. The pituitary gland is made up of the anterior and posterior pituitary. What are the relationships between these two parts of the pituitary gland and the hypothalamus?

Chapter 44

36. The extensions of postsynaptic neurons that provide the main receptive surface for presynaptic neurons are

- A) nuclei.
- B) somas.
- C) axons.
- D) dendrites.

37. The substance that wraps the axon of many neurons and provides for increased conduction speed is

- A) dendrase.
- B) histamine.
- C) acetylcholine.
- D) myelin.

38. The long extensions from the neurons that provide the pathway for action potentials to synapse are

- A) dendrites.
- B) cell bodies.
- C) axons.
- D) presynaptic membranes.

39. The threshold of a neuron is the

- A) amount of inhibitory neurotransmitter required to inhibit an action potential.
- B) membrane voltage at which an axon potential will be suppressed.
- C) amount of excitatory neurotransmitter required to elicit an action potential.
- D) membrane voltage at which the membrane potential develops into an action potential.

40. When a membrane is at the resting potential, the concentration of
- A) sodium and potassium ions is higher on the inside of its membrane.
 - B) sodium and potassium ions is higher on the outside of its membrane.
 - C) sodium ions is higher on the inside of its membrane and of potassium ions is higher on the outside.
 - D) sodium ions is higher on the outside of its membrane and of potassium ions is higher on the inside.
41. Glial cells are specialized to do all of the following *except*
- A) receive neural impulses.
 - B) insulate axons.
 - C) supply neurons with nutrients.
 - D) help maintain a proper ionic environment for the neuron.
42. The cells that create the blood–brain barrier, keeping toxic substances from entering the brain are _____ and belong to a type of neural tissue called _____.
- A) endothelial cells; Schwann cells
 - B) astrocytes; glial cells
 - C) glial fibers; axons
 - D) dendrites; synapses
43. A particular disease of the nervous system specifically involves the Ca^{2+} ion channels at the chemical synapses of motor neurons where neurotransmitter is stored and released. In other words, this disease affects the
- A) axon terminals of the presynaptic cell and the release of acetylcholine.
 - B) axon terminals of the postsynaptic cell and the release of K^+ ions.
 - C) electrical synapses.
 - D) axon terminals of the presynaptic cell and the release of K^+ ions.
44. Which of the following statements about electrical synapses is *false*?
- A) Connexons form molecular tunnels between two cells.
 - B) Electrical synapses cannot be inhibitory.
 - C) Electrical synapses do not allow for temporal summation.
 - D) Electrical transmission is very slow.
45. One group of neurotransmitter receptors is the metabotropic receptors. Which of the following statements about metabotropic receptors is *false*?
- A) Metabotropic receptors are transmembrane proteins.
 - B) Metabotropic receptors are coupled with A proteins.
 - C) Metabotropic receptors are not ion channels.
 - D) Responses in the postsynaptic cell mediated by metabotropic receptors are usually slower than those mediated by ionotropic receptors.
46. The rapid depolarization of a neuron during the first half of an action potential is due to the
- A) exit of K^+ ions from the cell through gated potassium channels.
 - B) rapid reversal of ion concentration caused by the action of the sodium–potassium pump.
 - C) entry of Na^+ ions into the cell through gated sodium channels.
 - D) movement of both Na^+ and K^+ ions through appropriate open channels.

47. The refractory period of a neuron results from
- A) the period when the sodium–potassium pump is nonfunctional.
 - B) activation of voltage-gated chloride channels.
 - C) closing of inactivated voltage-gated sodium channels.
 - D) the action potential reaching the synapse.
48. Which of the following statements about neurotransmitters is *false*?
- A) Gases, such as carbon monoxide and nitric oxide, may act as neurotransmitters.
 - B) Each neurotransmitter has a single type of receptor.
 - C) Amino acids and their derivatives, monoamines, function as neurotransmitters.
 - D) Neurotransmitters have different effects in different tissues.
49. You are trying to determine the role of the potassium channels in a neuron. To do this you have knocked out all the functional potassium channels, and you depolarize the membrane potential. What will happen to the membrane potential after depolarization?
50. The active ingredients in many nerve gases belong to a class of chemicals called anticholinesterases. Suggest a possible synaptic mechanism to explain how these chemicals can damage an animal's nervous system.

Chapter 46

51. A man has damage to his brain that affects his ability to recognize the faces of people he knows. Where did the damage occur?
- A) Hypothalamus
 - B) Temporal lobe
 - C) Parietal lobe
 - D) Frontal lobe
52. The secretion of hormones from an endocrine gland is most likely under the control of which of the following components of the nervous system?
- A) Autonomic
 - B) Voluntary
 - C) Dendritic
 - D) Limbic

53. The motor cortex of the cerebrum is
- A) mapped from the head region on the lower side of the cortex to the lower part of the body on the upper side of the cortex.
 - B) areas of the brain where the most sensitive body areas are represented by the largest areas of the cortex.
 - C) located in the parietal lobe.
 - D) None of the above
54. Which of the following statements about the sympathetic division of the autonomic nervous system is *false*?
- A) It increases heart rate.
 - B) It relaxes the urinary bladder.
 - C) It stimulates digestion.
 - D) It increases blood pressure.
55. Which of the following is not part of the central nervous system?
- A) Brain stem
 - B) Spinal gray matter
 - C) Cerebellum
 - D) Neuronal cell body of a sensory afferent
56. Observations of patients with aphasia indicate that
- A) only Broca's area is essential for normal language skills.
 - B) language skills depend on proper neural flow between the temporal lobes and motor cortex.
 - C) the right hemisphere dominates the production and use of language in humans.
 - D) most people can control language functions from either cerebral hemisphere.
57. If you want to find a complex cell in a cat's visual system, you would look in
- A) Broca's area.
 - B) the spinal cord.
 - C) the occipital cortex.
 - D) the reticular system.
58. Which of the following statements about the peripheral nervous system is *false*?
- A) Afferent portions of the peripheral nervous system carry information to the CNS.
 - B) Efferent portions of the peripheral nervous system carry information from the CNS.
 - C) The peripheral nervous system communicates only with the circulatory and digestive systems.
 - D) The efferent portion is broken down into voluntary and involuntary divisions.
59. Which of the following statements about the knee-jerk reflex is *false*?
- A) It is a monosynaptic reflex.
 - B) The leg extends in response to a hammer tap.
 - C) Chemoreceptors sense the hammer tap.
 - D) The afferent nerve travels from the receptor to the spinal cord.

Chapter 47

60. Which of the following statements is *false*?
- A) Strength training induces the formation of new actin and myosin filaments in existing muscle fibers.
 - B) Satellite cells are muscle stem cells.
 - C) Aerobic exercise increases the number of mitochondria in muscle cells and the density of capillaries in muscle.
 - D) A common effect of strength training is the production of more muscle fibers.
61. A motor unit is best described as
- A) all the nerve fibers and muscle fibers in a single muscle bundle.
 - B) one muscle fiber and its single nerve fiber.
 - C) a single motor neuron and all the muscle fibers that it innervates.
 - D) the neuron that provides the central nervous system with information on the state of contraction of the muscle.
62. The oxygen-binding molecule in skeletal muscle is
- A) myoglobin.
 - B) hemoglobin.
 - C) ATP.
 - D) myokinase.
63. The action potential that triggers a muscle contraction travels deep within the muscle cell by means of
- A) sarcoplasmic reticulum.
 - B) transverse (or T) tubules.
 - C) synapses.
 - D) motor end plates.
64. A sarcomere is best described as a
- A) moveable structural unit within a myofibril bounded by H zones.
 - B) fixed structural unit within a myofibril bounded by Z lines.
 - C) fixed structural unit within a myofibril bounded by A bands.
 - D) moveable structural unit within a myofibril bounded by Z lines.
65. ATP provides the energy for muscle contraction by allowing for
- A) an action potential formation in the muscle cell.
 - B) the breaking of actin-myosin bonds.
 - C) the formation of actin-myosin bonds.
 - D) release of calcium by sarcoplasmic reticulum.
66. Ca^{2+} binds to _____ in skeletal muscle and leads to exposure of the binding site for _____ on the _____ filament.
- A) troponin; myosin; actin
 - B) troponin; actin; myosin
 - C) actin; myosin; troponin
 - D) tropomyosin; myosin; actin

67. Tropomyosin is moved by which of the following proteins?
- A) Calmodulin
 - B) Acetylcholine
 - C) Actin
 - D) Troponin
68. Summation of frequent muscle twitches to give maximum contraction is called
- A) motor unit summation.
 - B) twitch.
 - C) facilitation.
 - D) tetanus.
69. The primary difference between an endoskeleton and an exoskeleton is
- A) the presence of both circular and longitudinal muscles.
 - B) whether or not the skeleton is on the inside of the body.
 - C) the presence or absence of joints.
 - D) the amount of fluid in the body.
70. A soccer player suffers a knee injury that damages the tissue holding his upper and lower leg bones together. The damaged tissue is probably a
- A) muscle.
 - B) tendon.
 - C) ligament.
 - D) cartilage.

Chapter 48

71. Which of the following statements is *false*?
- A) A given volume of air is easier to move across the respiratory organs than the same volume of water.
 - B) Air holds more oxygen per unit volume than does water.
 - C) Water breathers have a difficult time ridding themselves of CO₂ because CO₂ does not dissolve well in water.
 - D) Temperature increases affect the O₂ content of water more than they do that of air.
72. External gills, tracheae, and lungs share which of the following sets of characteristics?
- A) Part of gas-exchange system; exchange both CO₂ and O₂; increase surface area for diffusion
 - B) Used by water breathers; based on countercurrent exchange; use negative pressure breathing
 - C) Exchange only O₂; are associated with a circulatory system; found in vertebrates
 - D) Found in insects; employ positive-pressure pumping; based on crosscurrent flow
73. Which of the following is shared by bird and mammal lungs?
- A) Both need two cycles of inhalation and exhalation for air to move through the lungs.
 - B) Both contain alveoli as the terminal end of the lung.
 - C) Both have an anatomical dead space.
 - D) Both exchange O₂ and CO₂ with blood in capillaries.

74. According to Fick's law of diffusion, which of the following does not play a role in the diffusion of oxygen across a membrane?
- A) Surface area
 - B) Volume
 - C) Difference in concentration or partial pressure
 - D) Diffusion distance
75. Because of the relatively high altitude of Antonito, Colorado, the town has a normal barometric pressure of about 600 mm Hg rather than 760 mm Hg as at sea level. The partial pressure of oxygen in Antonito's air is approximately _____ mm Hg.
- A) 75
 - B) 126
 - C) 160
 - D) 76
76. Air flows into the lungs of mammals during inhalation because the
- A) pressure in the lungs falls below atmospheric pressure.
 - B) volume of the lungs decreases.
 - C) pressure in the lungs rises above atmospheric pressure.
 - D) diaphragm moves upward toward the lungs.
77. The movement of O₂ and CO₂ between the blood in the tissue capillaries and the cells in tissues depends most directly upon
- A) active transport of O₂ and CO₂.
 - B) total atmospheric (barometric) pressure differences across the cell membranes.
 - C) diffusion of O₂ and CO₂ down a concentration gradient.
 - D) diffusion of O₂ and CO₂ down a partial pressure gradient.
78. The alveoli of the lungs do not contain "air" because
- A) we normally do not ventilate our lungs at a high enough rate.
 - B) the lungs have too many alveoli to ventilate.
 - C) there is dead space in the trachea and bronchi.
 - D) the trachea and bronchi are too small in volume.
79. Which of the statements about hemoglobin is *false*?
- A) Hemoglobin allows the blood to carry a large amount of O₂.
 - B) Hemoglobin contains a single polypeptide chain with very high affinity for O₂.
 - C) Hemoglobin is packaged inside red blood cells.
 - D) Fetal hemoglobin is structurally different from adult hemoglobin.
80. As blood becomes fully O₂ saturated, hemoglobin is combining with _____ molecule(s) of oxygen.
- A) 1
 - B) 2
 - C) 4
 - D) 8

81. The Bohr shift describes the
- outward movement of Cl^- from the blood cell in exchange for HCO_3^- moving into the cell.
 - leftward shift of the entire oxygen equilibrium curve when temperature rises.
 - rightward shift of the entire oxygen equilibrium curve when pH rises.
 - rightward shift of the entire oxygen equilibrium curve when pH falls.
82. The presence of CO_2 in blood will lower pH because CO_2 combines with _____, with the rate of reaction increased by _____.
- H_2O to form H^+ and HCO_3^- ; carbonic anhydrase
 - H_2O to form only HCO_3^- ; carbonic anhydrase
 - H_2O to form only H^+ ; carbonic ions
 - H^+ to form HCO_3^- ; oxyhemoglobin
83. The largest proportion of CO_2 carried by the blood is in the form of
- bicarbonate ions (HCO_3^-) carried in the plasma.
 - molecular CO_2 dissolved in the plasma.
 - bicarbonate ions (HCO_3^-) carried within the red blood cells.
 - molecular CO_2 chemically bound to hemoglobin.
84. Which of the following is involved in the control of breathing?
- Neurons in the medulla
 - Chemoreceptors on the surface of the medulla
 - Chemoreceptors in large blood vessels leaving the heart
 - All of the above
85. Which of the following statement is *false*?
- Air-breathing animals are remarkably insensitive to falling levels of O_2 .
 - In water-breathing animals, O_2 is the primary feedback stimulus for breathing.
 - In humans, chemoreceptors for CO_2 are located on the medulla.
 - Areas of the brain above the medulla have no impact on breathing rate.
86. The gills of fish employ a countercurrent exchange mechanism to ensure that a large amount of oxygen is extracted from the water. Describe how the countercurrent exchange works.
87. What is the difference between the myoglobin oxygen-binding curve and the hemoglobin oxygen-binding curve?

Chapter 49

88. Which of the following is *not* one of the reasons that closed circulatory systems are more efficient than open circulatory systems?
- A) Closed systems rely exclusively on simple diffusion for transport, whereas open systems rely on pumping mechanisms.
 - B) Transport within closed systems is more rapid than in open systems.
 - C) Blood can easily be directed to specific areas in closed systems, but not in open systems.
 - D) Closed systems operate better under higher pressure than do open systems.
89. In which of the following would you record the highest blood pressure?
- A) The ventricle supplying blood to the gills of a fish
 - B) The anterior dorsal artery of an ant
 - C) The pulmonary vein of a frog
 - D) The ventricle supplying blood to the systemic circuit of a bird
90. Blood consists of a fluid fraction consisting of _____ and a solid fraction consisting of _____.
- A) plasma; water, erythrocytes, and platelets
 - B) erythrocytes; leukocytes, macrophages, and platelets
 - C) plasma; erythrocytes, platelets, and leukocytes
 - D) leukocytes; erythrocytes and platelets
91. Red blood cells are
- A) biconcave cells containing hemoglobin.
 - B) spherical cells containing hemoglobin.
 - C) spherical cells capable of ameboid motion and containing hemoglobin.
 - D) biconcave cells that contain platelets.
92. Blood clotting pathways cause the conversion of _____ to _____.
- A) vitamin K; prothrombin
 - B) fibrin; fibrinogen
 - C) thrombin; prothrombin
 - D) None of the above
93. Which of the following regions of the vascular bed is the actual site of gas exchange with surrounding tissue?
- A) Arteries
 - B) Capillaries
 - C) Lymphatic vessels
 - D) Veins
94. The purpose of the AV node is to _____, and the purpose of the Purkinje fibers is to _____.
- A) create simultaneous atrial and ventricular depolarization; speed up transmission of the cardiac impulse into the ventricle
 - B) delay ventricular depolarization relative to atrial depolarization; insulate the cardiac impulse from the general ventricular fibers
 - C) delay ventricular depolarization relative to atrial depolarization; ensure the cardiac impulse spreads rapidly and evenly throughout the ventricles
 - D) delay atrial depolarization relative to ventricular depolarization; transmit the cardiac impulse to very small localized groups of ventricular fibers

95. The atrial walls are _____ than the ventricular wall, and pressure generated in the atrial chambers is _____ than in the ventricles.
- A) thinner; higher
 - B) thinner; lower
 - C) thicker; higher
 - D) thicker; lower
96. Which of the following structures of the lymphatic system acts primarily as a filter for detecting and destroying microorganisms in lymph traveling through major lymph vessels?
- A) Lymph nodes
 - B) Thymus
 - C) Lymph capillaries
 - D) Tonsils, but not the appendix
97. The net loss of fluid from blood capillaries will increase if
- A) plasma filtration decreases.
 - B) the osmotic pressure of plasma increases.
 - C) blood pressure increases in the capillaries.
 - D) the colloid osmotic pressure of interstitial fluid decreases.
98. Which of the following statements about the control of circulation in humans is *false*?
- A) Sympathetic nerve input to skeletal muscle causes the blood vessels in the muscle to dilate.
 - B) Blood flow can be regulated by autonomic nerve signals emanating from cardiovascular control centers in the medulla of the brain.
 - C) Carotid artery chemoreceptors detect low O₂ levels in the blood and promote increased blood pressure.
 - D) Hormones such as angiotensin and vasopressin cause venules to constrict.
99. What are the important differences between the circulatory system of a fish and that of a reptile?
100. The human heart pumps blood to the pulmonary and the systemic circuit. Describe the path that blood takes as it moves through the circulatory system, starting at the right ventricle.
101. You are about to take a final exam in your freshman biology course and are very nervous. What responses will your circulatory system have to your nervousness?

Chapter 18

102. Phagocytes
- A) are T and B cells.
 - B) present antigen on MHC II complexes.
 - C) digest nonself materials.
 - D) Both b and c
103. B cells
- A) secrete antibodies.
 - B) present antigen on MHC II.
 - C) ingest antigens.
 - D) All of the above
104. Nonspecific responses in the immune system include
- A) macrophages.
 - B) natural killer cells.
 - C) complement proteins.
 - D) All of the above
105. When the receptor of a T_H cell binds to a pathogen being presented on a macrophage, it
- A) inactivates itself.
 - B) secretes cytokines.
 - C) inactivates B cells.
 - D) All of the above
106. Part of the normal immune response includes
- A) the production of B memory cells.
 - B) the production of memory macrophages.
 - C) antibody secretion by eosinophils.
 - D) the production of B cells that attack the individual's own cells.
107. Antibody molecules are
- A) produced by B cells and have only a constant region.
 - B) secreted by B cells, once a signal (a cytokine) is received from a T cell.
 - C) produced by T cells and have a variable and a constant region.
 - D) Both a and b
108. Cytotoxic T cells
- A) release cytokines that activate B cells.
 - B) attack pathogens by binding to cell surface antigens on those pathogens.
 - C) destroy pathogens by lysing them.
 - D) destroy host cells that are infected with virus.
109. The humoral response
- A) is due to the secretion of antibodies.
 - B) occurs when T cells bind antigen-presenting cells.
 - C) is due to T cells secreting their receptors.
 - D) occurs when natural killer cells engulf cancer cells.

110. Autoimmunity is
- A) active when organ transplantation is successful.
 - B) caused by clonal anergy.
 - C) the response of the immune cells attacking the body's own tissues.
 - D) Both b and c
111. Patients with HIV are susceptible to a variety of infections because
- A) the virus produces cell surface receptors that bind to pathogens, making it easier for those pathogens to be infective.
 - B) synthesizing a DNA copy of the viral genome makes a person feel sick.
 - C) HIV attacks and destroys the T helper cells, which are central to mounting an effective immune response, making those individuals more susceptible to other infections.
 - D) HIV destroys B cells so that antibodies cannot be made in response to invading pathogens.
112. DNA rearrangements in the B cell
- A) are responsible for generating single B cells that can express many different antibodies.
 - B) lead to mutations in T cells resulting in the elimination of essential T cell genes.
 - C) occur only in B memory cells.
 - D) are responsible for generating many different antibodies, with each B cell expressing only one set of identical antibodies.
113. Major histocompatibility proteins function in the immune system by
- A) presenting antigen to T cells.
 - B) presenting self antigens to T helper cells so those T cells will continue to tolerate self throughout the lifetime of the individual.
 - C) generating antibodies to different pathogens.
 - D) Both a and b
114. Which of the following is *not* a granular cell?
- A) Basophil
 - B) Neutrophil
 - C) B cell
 - D) Mast cell
115. Inflammation occurs when _____ release _____.
- A) mast cells; histamine
 - B) neutrophils; toxins
 - C) B cells; histamine
 - D) mast cells; toxins
116. Imagine that a particular bacterium has surface molecules that resemble membrane proteins found on the heart valves. What will happen to the individual infected with this bacterium if the infection is not treated?

117. Vaccinations are effective against an array of different pathogens. How do they work? Vaccinations against HIV virus have not been effective in preventing the disease. Why not?

Chapter 50

118. Certain amino acids are essential to the diet of animals because
- A) they prevent overnourishment.
 - B) they are cofactors and coenzymes that are required for normal physiological function.
 - C) an animal cannot directly synthesize them through the transfer of an amino group to an appropriate carbon skeleton.
 - D) animals need these substances in order to make stored fats that are used during hibernation and migration.
119. Which of the following descriptions describes the digestive characteristics of a sheep?
- A) It is a saprobe; it engulfs food and performs intracellular digestion.
 - B) It is an autotroph; it synthesizes organic nutrients and performs extracellular digestion.
 - C) It is an herbivore; it ingests food and performs extracellular digestion.
 - D) It is a detritivore; it ingests food and performs intracellular digestion.
120. Protection of the walls of the stomach against the action of its own digestive juices
- A) results from the presence of an antienzyme chemical formed by the gastric glands.
 - B) results from the nervous reactions of the lining of the stomach.
 - C) is controlled by a center in the medulla of the brain.
 - D) results from the mucous coating that covers its inner surface.
121. The gallbladder
- A) produces bile.
 - B) is part of the liver.
 - C) stores bile produced by the liver.
 - D) produces cholecystokinin.
122. The pancreas
- A) produces exocrine products involved in chyme digestion.
 - B) is exclusively an endocrine gland that produces salivary amylase.
 - C) contains villi to increase surface area.
 - D) produces urobilinogen (a bile pigment).
123. Hydrochloric acid
- A) is secreted by the gastric glands of the liver.
 - B) is secreted by the gastric glands of the stomach.
 - C) produces a low pH in the small intestine.
 - D) Both a and c

124. Bile produced in the liver is associated with which of the following?
- A) Emulsification of fats into tiny globules in the small intestine
 - B) Digestive action of pancreatic amylase
 - C) Emulsification of fats into tiny globules in the stomach
 - D) Digestion of proteins into amino acids
125. Most of the chemical digestion of food in humans is completed in the
- A) small intestine.
 - B) appendix.
 - C) ascending colon.
 - D) stomach.
126. Which of the following does not contribute to the large surface area available for nutrient absorption in the small intestines?
- A) Villi
 - B) Intestinal length
 - C) Microvilli
 - D) Bile duct
127. Waves of muscle contractions that move the intestinal contents are
- A) caused by contraction of skeletal muscle.
 - B) regulated by liver secretions.
 - C) called peristalsis.
 - D) voluntary.
128. Digestive enzymes responsible for breaking down disaccharides include
- A) pepsin, trypsin, and trypsinogen.
 - B) amylase, pepsin, and lipase.
 - C) sucrase, lactase, and maltase.
 - D) pepsin, trypsin, and chymotrypsin.
129. Which of the following is characteristic of the large intestine?
- A) It has almost no bacterial populations.
 - B) It contains chyme.
 - C) It absorbs much of the water remaining in waste materials.
 - D) It is the site of most of digestion.
130. Which of the following hormones stimulates gluconeogenesis?
- A) Glucagon
 - B) Insulin
 - C) Estrogen
 - D) All of the above
131. Which of the following statements about mammalian teeth is true?
- A) Enamel covers the crown and the root of a tooth.
 - B) Teeth lack nerves and blood vessels.
 - C) The teeth of omnivores are more specialized than the teeth of carnivores and herbivores.
 - D) Carnivores have large canines, whereas herbivores have large premolars and molars.

132. Toxins ingested by animals
- A) come exclusively from human activities.
 - B) always bioaccumulate.
 - C) are broken down by enzymes of the stomach.
 - D) may cause cancer or infertility if they bioaccumulate.
133. Ingested food typically contains many useful proteins. However, these proteins are not used in the form in which they are ingested, but are broken down into smaller peptides and amino acids. Why does the digestive system break down these ingested proteins?
134. In ruminants, such as cows and bison, microorganisms that break down cellulose are found in two chambers of the greatly enlarged stomach. In other herbivores, including rabbits, the microorganisms that break down cellulose are found in the cecum, a chamber off the large intestine. In which type of herbivore would the absorption of nutrients from cellulose be more efficient?

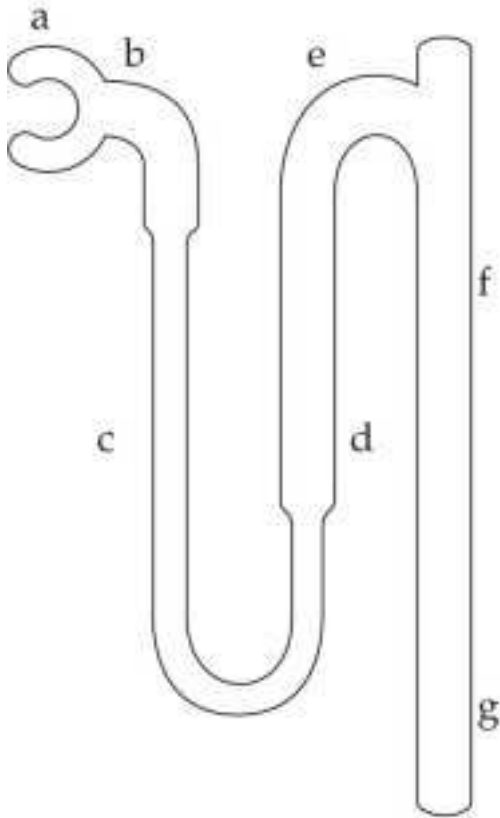
Chapter 51

135. What mechanisms does a marine bony fish use to maintain homeostasis?
- A) It excretes only small amounts of water and pumps sodium out of its body at the gills.
 - B) It excretes large amounts of water and pumps sodium into its body.
 - C) It converts nitrogenous wastes to urea.
 - D) None of the above
136. Which of the following statements about the excretory system of insects is false?
- A) Active transport moves materials from the coelomic fluid into the Malpighian tubules.
 - B) The Malpighian tubules can produce a highly concentrated urea solution, allowing insects to inhabit some of Earth's driest habitats.
 - C) Reabsorption of salts takes place mostly in the gut.
 - D) Water reabsorption is by osmotic movement only.
137. What pathway is taken by water and solutes as they travel through a nephron?
- A) Glomerulus, to Bowman's capsule, to proximal tubule, to loop of Henle, to distal tubule, to collecting ducts
 - B) Bowman's capsule, to glomerulus, to distal tubule, to loop of Henle, to proximal tubule, to collecting ducts
 - C) Glomerulus, to Bowman's capsule, to distal tubule, to loop of Henle, to proximal tubule, to collecting ducts
 - D) Glomerulus, to Bowman's capsule, to proximal tubule, to collecting ducts, to distal tubule, to loop of Henle

138. Na^+ and Cl^- are actively transported out of the tubules to help set up the countercurrent multiplier. Which of the following are sites of active Na^+ and Cl^- transport in the nephron?
- A) Proximal tubule, ascending limb of the loop of Henle
 - B) Descending limb of the loop of Henle, ascending limb of the loop of Henle
 - C) Ascending limb of the loop of Henle, proximal tubule
 - D) Collecting duct, descending limb of the loop of Henle
139. The sole mechanism for water reabsorption by the renal tubules is
- A) active transport.
 - B) osmosis.
 - C) cotransport with sodium ions.
 - D) cotransport with bicarbonate ions.
140. Several hormones help to regulate water and solute uptake and release in the nephron. Antidiuretic hormone (ADH) promotes _____ in response to _____.
- A) active transport of Cl^- ; increased solute concentration
 - B) active transport of Na^+ ; increased blood pressure
 - C) increased permeability of the collecting duct to water; decreased blood pressure
 - D) decreased permeability of the collecting duct to water; increased solute concentration
141. Which of the following is not a normal constituent of the glomerular filtrate?
- A) Red blood cells
 - B) Urea
 - C) Sodium ion
 - D) Glucose
142. If the afferent arteriole that supplies blood to the glomerulus becomes dilated,
- A) the protein concentration of the filtrate decreases.
 - B) hydrostatic pressure in the glomerulus decreases.
 - C) the glomerular filtration rate increases.
 - D) All of the above
143. Osmoreceptors in the brain detect changes in blood ion concentration that can reflexively result in _____ by the kidneys.
- A) water retention
 - B) water loss
 - C) ion retention
 - D) All of the above
144. If the human kidneys filter 150 liters of plasma in a 24-hour period, what is the typical amount of urine produced and eliminated in that time period?
- A) 0.15 liters
 - B) 1.5 liters
 - C) 15 liters
 - D) 30 liters

Use the following to answer questions 145-149:

Use the following diagram to complete the statements about the mammalian nephron.



145. The composition of the filtrate would be most like plasma in the tubule next to letter _____.
146. The NaCl concentration in the extracellular fluid would be greatest in the area of letter _____.
147. The osmolarity of the filtrate next to letters _____ is similar to the osmolarity of blood plasma.
148. The urine would be most concentrated in the collecting duct next to letter _____.
149. Most of the glomerular filtrate is reabsorbed into the blood in peritubular capillaries next to letter _____.
150. Based on your knowledge of how the nephron works, explain why mammals produce concentrated urine whereas reptiles cannot.
151. The drug urizadole inhibits antidiuretic hormone secretion from the pituitary. How will this change glomerular filtration rate, urine flow, and urine concentration in patients taking this medication?

Answer Key

1. D
2. D
3. B
4. A
5. B
6. A
7. C
8. D
9. D
10. D
11. B
12. D
13. A
14. B
15. D
16. C
17. The metabolic rate of the first animal increases with a decrease in environmental temperature, making this animal an endotherm. The metabolic rate of the second animal decreases with a decrease in environmental temperature, making this animal an ectotherm. Using the equation $Q_{10} = (R_T/R_{T-10})$, the Q_{10} for metabolic rate can be calculated. The Q_{10} of the endotherm's metabolic rate is 0.48, whereas the Q_{10} of the ectotherm metabolic rate is 2.1 using the equation provided.
18. Homeostasis is the maintenance of a constant internal environment. The body functions with the help of proteins and enzymes. Changes in characteristics of the internal environment such as pH, temperature, glucose level, and oxygen and carbon dioxide levels can affect cellular function. Loss of homeostasis can lead to improper function of proteins and cell membranes and ultimately lead to cell death.
19. C
20. D
21. A
22. D
23. C
24. D
25. D
26. A
27. B
28. D
29. B
30. C
31. A
32. A
33. C
34. The plasma membrane of cells is hydrophobic. Lipid-soluble hormones, which as their name suggests dissolve in lipids (fats), cross the plasma membrane and act on receptors inside the target cells. Water-soluble hormones cannot cross the lipid-based plasma membrane and act on receptors on the outside of target cells. Such binding by water-soluble hormones initiates changes in the cell by activating enzymes. Because lipid-soluble hormones cross the plasma membrane and enter the cell, they tend to take longer to act, but they also remain active for a longer time period than water-soluble hormones.

35. The hormones secreted by the posterior pituitary gland are produced by neurons in the hypothalamus. The neurohormones move down neurons into the posterior pituitary gland, where they are stored and secreted. The anterior pituitary produces the hormones it secretes. However, hormones from the hypothalamus control the release of the anterior pituitary's hormones.
36. D
37. D
38. C
39. D
40. D
41. A
42. B
43. A
44. D
45. B
46. C
47. C
48. B
49. The potassium voltage-gated channels are responsible for setting up the resting potential of a membrane. Potassium ions have a tendency to diffuse out of the cell, leaving a negative charge inside. Knocking out the function of the potassium voltage-gated channels would result in the cell's being unable to maintain resting potential. If the cell was depolarized by the opening of sodium voltage-gated channels, it might not repolarize because the potassium channels that help to repolarize the membrane would not be functioning.
50. The neurotransmitter at many synapses is acetylcholine. Acetylcholine transmits the action potential from a presynaptic cell to a postsynaptic cell. Acetylcholinesterase is found in the synaptic cleft, and it cleaves acetylcholine to help remove it from the synaptic cleft after an action potential. A nerve gas composed of anticholinesterases would block the action of acetylcholinesterase, causing acetylcholine to build up in the synaptic cleft. This buildup would mean that the receptors on the postsynaptic cell would remain bound with acetylcholine.
51. B
52. A
53. A
54. C
55. D
56. B
57. C
58. C
59. C
60. D
61. C
62. A
63. B
64. D
65. B
66. A
67. D
68. D
69. B
70. C
71. C
72. A

73. D
74. B
75. B
76. A
77. D
78. C
79. B
80. C
81. D
82. A
83. A
84. D
85. D
86. In the countercurrent exchange in the gills of fish, water and blood move in opposite directions. This results in blood with low oxygen content entering the gills and flowing past water that has a higher oxygen content. Oxygen diffuses down the partial pressure gradient into the blood. As blood moves along the lamella, it picks up oxygen, but it always has a lower oxygen content than the water moving in the opposite direction. In this way the blood is able to optimize oxygen uptake during the entire trip through the lamella.
87. The oxygen-binding curve of myoglobin is shifted to the left in relationship to the oxygen-binding curve of hemoglobin. This allows myoglobin to pick up O_2 and hold it at lower partial pressures of O_2 .
88. A
89. D
90. C
91. A
92. D
93. B
94. C
95. B
96. A
97. C
98. D
99. Fish have a two-chambered heart, with blood flowing from the heart of the fish to the gills and then directly to the body. Reptiles have a more complex three-chambered heart, with a subdivided ventricle that directs outflow to the pulmonary circuit and to the systemic circuit. Thus the circulatory system of fish delivers blood to the respiratory organ and the body tissues in succession, whereas the circulatory system of reptiles delivers blood to the respiratory organ and the body tissues in parallel.
100. Blood from the right ventricle exits through the pulmonary valve into the pulmonary artery and then goes to the lungs. From the lungs, the blood returns to the left atrium and passes through the atrioventricular valve into the left ventricle. Blood from the left ventricle is pumped to the systemic circuit through the aortic valve and into the aorta. From the aorta, blood moves to the tissues in arteries and arterioles, passes through tissues in the capillaries, and returns via the venules, veins, and ultimately the superior vena cava and inferior vena cava to the right atrium of the heart. From the right atrium, blood is pumped back where we started—into the right ventricle through the atrioventricular valve.

101. Stress and nervousness elicit the fight-or-flight response. Signals from the medullary cardiovascular control center stimulate sympathetic inputs from the autonomic nervous system. In response to sympathetic inputs, the adrenal gland releases epinephrine into the bloodstream. Epinephrine stimulates an increased heart rate and arterial pressure. The blood flow to the smooth muscles decreases due to constriction of blood vessels. By constriction of smooth muscles, blood is diverted away from areas such as the digestive tract to the skeletal muscle needed for fight or flight.
102. D
103. D
104. D
105. B
106. A
107. B
108. D
109. A
110. C
111. C
112. D
113. D
114. C
115. A
116. If the bacterial infection is not treated, the individual's immune response to this pathogen will include secreting antibodies that may be able to cross-react with the individual's own membrane proteins on the cells of the heart valve. Such antibodies could create an autoimmune response and heart disease.
117. Vaccinations work against foreign pathogens because of B and T memory cells that are made during every immune response. If these memory cells are reexposed at a later time to the same antigen, they will mount a faster and more efficient immune response to that pathogen. One challenge in creating vaccines against HIV is that the virus mutates frequently (HIV uses reverse transcriptase, an enzyme prone to introducing genetic mutations, in its reproductive cycle). A vaccine that creates memory cells specific to a certain protein in one strain of HIV will not be effective against mutant HIV forms in which that protein has been modified if the memory cells do not recognize the modified protein.
118. C
119. C
120. D
121. C
122. A
123. B
124. A
125. A
126. D
127. C
128. C
129. C
130. A
131. D
132. D

133. Proteins in digested food are not absorbed and used in their original form for a number of reasons. First, the proteins are too large to be easily absorbed by the cells of the digestive tract, whereas amino acids are readily absorbed. Second, proteins are species-specific, and thus a protein that is optimal for a prey species may not be optimal for the predator species. Lastly, the proteins of another species would be considered foreign and attacked by the immune system.
134. In vertebrates, most nutrients are absorbed in the small intestine. Because ruminants break down cellulose in chambers of their stomach (which comes before the small intestine in position along the gut), the nutrients from cellulose are available for absorption in the small intestine, and absorption is relatively efficient. In non-ruminant herbivores, however, cellulose is broken down in the cecum, after it has passed through the small intestine, so nutrient absorption is less efficient. Some non-ruminant species produce two types of feces and eat the one containing cecal material to gain greater access to nutrients.
135. A
136. B
137. A
138. A
139. B
140. C
141. A
142. C
143. D
144. B
145. a
146. g
147. a, b, and e
148. g
149. b
150. The loop of Henle acts as a countercurrent ion multiplier in the medulla of mammals. This allows mammalian kidneys to produce concentrated urine. Reptiles lack the countercurrent multiplier of the loop of Henle.
151. Inhibition of antidiuretic hormone by urizadole will affect the permeability of the collecting ducts to water. This will result in increased urine flow because water will not be able to be reabsorbed across the collecting ducts. Blockage of ADH will have no effect on the glomerular filtration rate.