

5. Give some examples of variables for which the body maintains homeostasis.

12.3 The Brain

6. What are some of the functions of the brainstem?

7. Which part of the brain is responsible for balance and posture?

8. Why can damage to one side of the cerebrum affect the functioning of the opposite side of the body?

9. Describe the functions of each of the four lobes of the cerebrum.

12.4 Organization of the Nervous System

10. Which structures make up the central nervous system?



11. A typical neuron has dendrites, a cell body, and an axon. What is the function of each of these parts?

12. What are the functions of sensory neurons, interneurons, and motor neurons?

13. What kinds of functions are controlled by the somatic nervous system and the autonomic nervous system?

12.5 How Neurons Fire

14. What is a membrane potential?

15. What happens to the membrane potential of a neuron during an action potential?

16. Why is an action potential described as an all-or-nothing event?



17. What causes an action potential to travel down a neuron's axon?

12.6 How Neurons Communicate With Other Cells

18. How does an electrical synapse work?

19. How does a chemical synapse work?

12.7 The Senses

20. What are the two types of light-sensitive cells in the eyes? How do they differ from each other?

21. Describe how sound waves enter the ear and ultimately cause you to hear.



22. How are action potentials generated in chemosensory cells?

23. What are proprioceptors?

(CLICK TO CHECK YOUR ANSWERS)

Challenging Review Questions

12.1 Organization of the Human Body

24. Is the brain a tissue, an organ, or an organ system? Defend your answer.

25. The stomach is an organ. Describe some of the different tissues that make up the stomach.

12.2 Homeostasis

26. Why do you shiver when you are cold?

27. One aspect of homeostasis is maintaining the appropriate amount of water in the body. How does the body regulate this? Is feeling thirsty an important aspect of maintaining homeostasis?



28. When you exercise, your cells use more oxygen and you breathe harder. Is this an example of negative feedback? Defend your answer.

29. This man is cooling off after an intense run. He is probably going to drink some of the water in his water bottle too. Explain how sweating, pouring water on yourself, and drinking water relate to homeostasis.



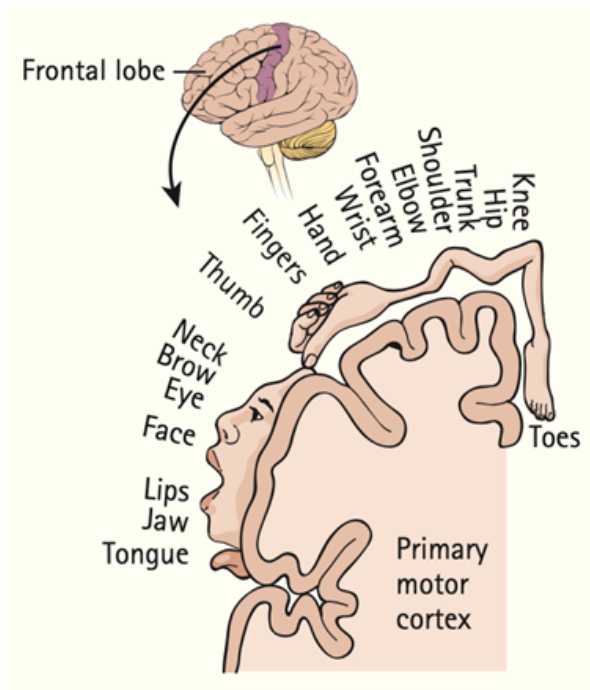
12.3 The Brain

30. When you move your body, is your cerebrum in complete control of your motions? What other parts of your brain are involved? Explain.

31. Why is the surface of your brain wrinkled?



32. The figure shows a map of the motor control area of the brain, found in the frontal lobe of the cerebrum. Why is such a large part of the brain responsible for controlling the actions of the hands and lips? Why is only a small part of the brain responsible for controlling the trunk?



12.4 Organization of the Nervous System

33. Describe the structure of a typical neuron.

34. Of the three types of neurons—sensory neurons, motor neurons, and interneurons—which type goes to your biceps muscle and tells you to bend your elbow? Which type tells you whether your feet feel cold?

35. What happens during the “fight or flight” response?



36. Is a neuron that slows your heartbeat part of the somatic or autonomic nervous system? Is this neuron part of the sympathetic or parasympathetic division?

12.5 How Neurons Fire

37. What is an action potential? Describe how the membrane potential changes during an action potential.

38. What role do sodium channels and potassium channels play in an action potential?

39. What would be the effect of removing the myelin sheath from the axon of a neuron?

12.6 How Neurons Communicate With Other Cells

40. Do neurotransmitters enter the target cell? If not, how do they have an effect on the target cell?

41. What determines whether a target cell responds to a specific type of neurotransmitter?



12.7 The Senses

42. Many nocturnal animals have only rods in their retinas. In addition, many have a reflective layer of tissue behind the retina that bounces light back toward the retina. You can see this in the “eyeshine” of the cat in the photo below. How do these two features help animals see at night?



43. Are your rods or cones more important for reading a book? Defend your answer.

44. If you accidentally hit your eye, you may “see” a flash of light. Why?

45. In some people, the bones of the middle ear stiffen with age. This can result in deafness. Why?



46. You eat an apple. What senses are involved? Explain.



(CLICK TO CHECK YOUR ANSWERS)

Apply & Discuss Questions

47. Does maintaining homeostasis of body temperature involve feedback regulation? Explain.

48. Animals vary in how “wrinkled” their brains are. Some animals have very wrinkled brains, while others have smooth brains. What would you predict about an animal that has a wrinkled brain rather than a smooth one?



49. You talk with a friend on the telephone. Which parts of your brain do you use?

50. If a signaling neuron has an excitatory effect on a target cell, does it increase or decrease the membrane potential of the target cell? Defend your answer.

51. Stars come in different colors depending on their surface temperatures. But when you look up at a starry night sky, all the stars look like they are the same color. Why?

(CLICK TO CHECK YOUR ANSWERS)



End of Chapter Solutions

Simple Review Solutions

1. Epithelial tissue consists of sheets of tightly packed cells that cover the internal and external surfaces of the body. Skin is an example of epithelial tissue. Connective tissue consists of cells scattered within an external matrix. Bone, cartilage, and blood are all connective tissues. Muscle tissue consists of cells that are able to contract, or shorten. Three types of muscle tissue are found in the body. Skeletal muscle is responsible for all voluntary movements. Smooth muscle functions in the internal organs of the digestive system as well as in certain blood vessels. Cardiac muscle produces the heartbeat. Nervous tissue transmits information from one place in the body to the other. Nervous tissue is found in the brain, spinal cord, and nerves.
3. An organ system is a set of organs that work together to perform a particular bodily function.
5. Oxygen supply and body temperature are two of the many variables the body carefully regulates. The amount of water in the body, the concentration of nutrients and waste products in the blood, the concentrations of important ions inside and outside cells, and blood pH—all these variables are carefully regulated as part of maintaining homeostasis.
7. The cerebellum controls balance, posture, coordination, and fine movements.
9. The frontal lobes deal with reasoning, voluntary movements, and speech. The parietal lobes take in sensory information about temperature, touch, taste, and pain. The occipital lobes process what you see—that is, visual information. The temporal lobes deal with sound and help you comprehend language.
11. A typical neuron has three parts: (1) dendrites receive information from other neurons or cells, (2) the cell body contains the neuron's nucleus and organelles, and (3) the axon transmits information to other neurons or cells.
13. Motor neurons in the somatic nervous system control voluntary actions, such as running to class. These neurons provide instructions to your voluntary muscles, such as the muscles of your arms, legs, and fingers. Motor neurons in the autonomic nervous system control involuntary actions. These neurons control organs and involuntary muscles (such as heart or stomach muscle).
15. An influx of positively charged ions causes the membrane potential to spike and become positive. This spike is called an action potential.
17. When an action potential begins, sodium ions enter the end of the axon that is closest to the cell body. These ions diffuse into adjacent areas along the axon. Because the sodium ions are positively charged, they cause the local membrane potential to increase. When the local membrane potential reaches threshold, a new action potential, further along the axon, begins. The process is similar to the way a row of dominoes falls—the first domino knocks down the next one, which knocks down the next one, and so forth. In this way, the action potential travels down the entire axon.
19. In a chemical synapse, a neuron communicates with a target cell using molecules of neurotransmitter. When an action potential arrives at the end of an axon, vesicles containing neurotransmitter fuse to the neuron's cell membrane. Neurotransmitter molecules are released into the narrow space between the



axon and the target cell, and they diffuse to the target cell. There, the neurotransmitter molecules bind to receptors on the target cell's membrane. The binding causes ion channels to open, and ions enter the target cell. The membrane potential of the target cell may increase or decrease, depending on the type of ion that enters. An excitatory signal increases the target cell's membrane potential and makes the target cell more likely to fire. An inhibitory signal decreases the target cell's membrane potential and makes it less likely to fire.

21. Sound waves move through the air to the outer ear, or pinna, the cartilaginous flap on the side of your head. The pinna funnels the waves in, and they move towards a thin membrane of skin—the eardrum. Sound waves make the eardrum vibrate, just the way blowing on a piece of paper makes it shake. The eardrum's vibrations move three middle ear bones—the hammer, the anvil, and the stirrup—in sequence. These bones amplify the vibrations, making them more powerful. The stirrup then transfers the vibrations to the fluid-filled inner ear. In the inner ear, sound vibrations enter the cochlea, a coiled tube containing the organ of Corti. The organ of Corti contains the sensory cells responsible for hearing. Fluid vibrations in the inner ear move the organ of Corti's basilar membrane, causing sensory "hairs" embedded in it to brush against an overlying membrane and bend. This bending causes ion channels to open, initiating action potentials that are transmitted to the brain.

23. Proprioceptors in your muscles, tendons, and joints tell you where different parts of your body are.

Challenging Review Solutions

25. The stomach is lined on both the inside and outside with epithelial tissue. The stomach has a lot of smooth muscle tissue that functions in churning and digesting food. The neurons that go to the stomach to regulate its activities are made of nervous tissue. The blood vessels that supply it are filled with blood, a type of connective tissue.

27. The body regulates water levels largely by controlling whether the urine that is produced is concentrated or dilute. Antidiuretic hormone causes urine to become more concentrated. However, behavior is important too. When water levels in the body are low, you become thirsty, and you seek out and drink water.

29. Sweating and pouring water on the body both help with heat regulation, or maintaining homeostasis of body temperature. Since the man has become overheated due to running (all the work the body does while running releases a lot of heat), sweating and covering himself with water helps cool his body. Drinking water, on the other hand, helps with regulating water levels in the body. The man has lost water through sweating, and his feeling of thirst causes him to drink water. This helps maintain homeostasis of water levels in the body.

31. The cerebral cortex is the thin layer that covers the surface of the cerebrum. It performs most of the information processing that occurs in the cerebrum. "Wrinkles" in the cerebral cortex increase the surface area available for information processing without increasing the overall size of the brain and head.

33. A typical neuron has dendrites that receive information from other neurons or cells, a cell body that performs the cellular processes required by all cells, and an axon that transmits information to other neurons or cells.



35. The “fight or flight” response occurs when you are in danger and need to either run away (“flight”) or stay and “fight.” The sympathetic nervous system promotes this response, speeding up your heartbeat to speed the transport of oxygen to your muscles. The sympathetic nervous system also slows down digestion and other activities that are unimportant during emergencies.

37. An action potential is a neuron’s way of “firing” or signaling. During an action potential, the neuron’s membrane potential increases slowly until it reaches a certain threshold value—at that point, it suddenly spikes. The spike is brief—the membrane potential quickly decreases again and returns to threshold value.

39. The action potential would travel much more slowly along the axon, and not “jump” from one gap in the myelin sheath to the next.

41. A target cell responds to a neurotransmitter if it has receptors for that neurotransmitter.

43. Your cones – cones are responsible for making out fine details, such as the letters in a book.

44. Hitting your eye accidentally stimulates the rods and cones in the retina and causes them to send signals to the brain. However, the brain interprets any signal that comes from the retina as something visual, so you “see” a flash of light.

45. If the middle ear bones stiffen, they are less effective at transferring and amplifying sound vibrations from the outer ear to the inner ear. Reduced vibrations in the fluid of the inner ear results in fewer signals being sent from the organ of Corti to the brain. As a result, you hear less.

Apply & Discuss Solutions

47. Yes. You learned that feedback regulation occurs when the level of a body variable initiates a process that comes back to affect that variable. In the case of body temperature, when body temperature is low, the body initiates activities such as shivering or putting on more clothes that help to increase body temperature. When body temperature is high, sweating and other activities help to lower it. These are both examples of feedback regulation.

49. You use the temporal lobes of your cerebrum to understand spoken language (what your friend says to you on the phone). You use the frontal lobes of your cerebrum to talk to your friend—to speak.

51. When you are looking at the night sky, there is very little light, so you are using your rods to see. Rods see only in black and white, so you cannot see the colors of the stars. This is why stars look much more colorful in photographs than to the naked eye.

