



### **13.2 Reproduction**

5. What is unusual about the process of meiosis that produces the egg?

6. How do sperm get past the zona pellucida that surrounds the egg?

### **13.3 Development**

7. What is the function of the placenta?

8. When during pregnancy do an embryo's major organs and body parts develop?

### **13.4 The Skeleton**

9. What are the functions of the skeleton?

10. Describe the structure of a typical bone.



11. What are the functions of red bone marrow and yellow bone marrow?

### 13.5 Muscles

12. How does a signal from a motor neuron result in the contraction of a muscle?

13. At what point in the process of muscle contraction is ATP required?

**(CLICK TO CHECK YOUR ANSWERS)**

### Challenging Review Questions

#### 13.1 Hormones

14. Suppose you know that the receptor for a hormone you are studying is found in the target cell's cytoplasm. Are you studying a protein hormone or a steroid hormone?



15. On a brilliant, sunny day, you take a long hike through open country. You sweat a lot, losing a lot of water. What hormone does your body release? Why?

16. Why does your body release insulin after you eat a large meal?

17. What is diabetes? What are the symptoms of diabetes?

### **13.2 Reproduction**

18. What is the role of meiosis in human reproduction?

19. Vasectomy is a form of male sterilization in which a section of each vas deferens is removed. How does this cause sterility, preventing a man from fathering children?

### **13.3 Development**

20. Does a fertilized human egg make anything other than the embryo?



21. Does a mother's blood mix with her baby's during pregnancy? Explain your answer.

### 13.4 The Skeleton

22. How do the skull, vertebrae, and ribs provide protection to the body?

23. Where in your body do you have a hinge joint? Where do you have a ball-and-socket joint?

### 13.5 Muscles

24. If muscles can only pull, not push, how is it possible for you to both bend your arm as well as straighten it?

25. Curare is an arrow or dart poison used by certain South American tribes in hunting. The darts in the photo shown below have been poisoned with curare. Curare binds to acetylcholine receptors in muscle cells. How does curare cause death?



26. What causes rigor mortis, the stiffening of the body after death?

**(CLICK TO CHECK YOUR ANSWERS)**



## Apply & Discuss Questions

27. Osteoporosis is a disease that primarily affects postmenopausal women, causing decreased bone density and brittle bones that are vulnerable to fracture. The hormone calcitonin is sometimes used to treat osteoporosis. Why?

28. Jet lag describes the fatigue and disorientation that result from flying across many time zones. What causes jet lag, and how does the body eventually adjust to a new time zone? Why is there no such thing as "train lag" or "bicycle lag"?

29. Only one sperm fertilizes an egg. If this is the case, why can low sperm count be a factor in infertility?

30. Each time myosin heads pull on actin, the sarcomere contracts only about 10 nm ( $10^{-9}$  meter). Given that, how are you able to produce large motions with your muscles?

31. Explain what happens when you wiggle your toe. Start with the decision to wiggle your toe, which occurs in your brain, and end with a description of the activity of your muscles and bones.

**(CLICK TO CHECK YOUR ANSWERS)**



## End of Chapter Solutions

### Simple Review Solutions

1. Protein hormones are, as their name suggests, proteins or modified amino acids. Steroid hormones are made from cholesterol. Protein hormones and steroid hormones work in different ways. Protein hormones bind to receptors on the cell membrane of their target cells. This binding starts a series of chemical reactions that result in the cell's response to the hormone. Steroid hormones cross the cell membrane and bind to receptors inside target cells—their receptors may be in the target cell's cytoplasm or nucleus. The hormone-receptor complex then binds to DNA in the nucleus and directly affects gene transcription.
3. Antidiuretic hormone helps regulate the amount of water in the body. Specifically, it helps the body conserve water by instructing the kidneys to produce urine that is more concentrated.
5. Eggs are large because they are the result of unequal meiosis—during cell division, the future egg receives almost all the cytoplasm, while the other cells (which quickly degenerate) receive very little cytoplasm.
7. The placenta provides oxygen and nutrients to the developing embryo and carries away wastes.
9. One function of the skeleton is to protect the body. For example, the skull protects the brain, the vertebrae protect the spinal cord, and the ribs protect the heart and lungs. The skeleton also supports the body and, working with the muscles, moves it.
11. Red bone marrow makes red and white blood cells for the circulatory system. Yellow bone marrow stores fat.
13. ATP is needed for the myosin heads to release actin, an essential step in the contraction cycle.

### Challenging Review Solutions

15. Antidiuretic hormone – this hormone helps you conserve water by producing a more concentrated urine.
17. The disease diabetes results when the pancreas doesn't make enough insulin or when the body's cells do not respond to insulin. In either case, blood glucose levels become abnormally high. Symptoms of diabetes include thirst, fatigue, weight loss, blurred vision, and nerve damage in the hands and feet. Diabetes is controlled through diet and medication.
19. If a section of each vas deferens is removed, sperm do not enter the semen.
21. The placenta consists of both embryonic and maternal tissues that are in close contact with one another. Maternal blood and embryonic blood do not come into direct contact in the placenta; however, they are close enough to allow for the exchange of nutrients and wastes between the mother's blood supply and the embryo's blood supply.
23. Hinge joints are found at your elbow, your knee, your ankle, and between the segments of your fingers. Ball-and-socket joints are found at your shoulder and hip.



25. When curare binds to acetylcholine receptors in muscle cells, acetylcholine itself is unable to bind to those receptors. This means that when motor neurons try to tell muscles to contract, they will not respond. Curare causes paralysis and then death as the respiratory muscles become paralyzed.

### Apply & Discuss Solutions

27. Two hormones, parathyroid hormone and calcitonin, work together to regulate blood calcium levels. Parathyroid hormone raises calcium levels in the blood, partly by causing calcium to be released from bones. Calcitonin has the opposite effect – it lowers blood calcium levels by causing bones to take up calcium. This is why it is useful for treating osteoporosis – calcitonin helps increase bone strength by increasing bone calcium.

29. Only one sperm fertilizes an egg, but many sperm are involved in the process of getting through the zona pellucida that surrounds the egg. Enzymes released from the heads of many sperm help to penetrate the zona pellucida.

31. You decide to wiggle your toe. Wiggling your toe is a voluntary movement, so the instruction to do so originates in the frontal lobe of your cerebrum (the left frontal lobe if you wiggle your right toe, the right frontal lobe if you wiggle your left toe). An action potential in a motor neuron that goes to your toe signals muscles there to contract. The action potential arrives at a chemical synapse connecting the neuron to the muscle cells. The action potential triggers the release of the neurotransmitter acetylcholine at the synapse. Acetylcholine then binds to receptors on the muscle cell's membrane, initiating an action potential in the muscle cell. This action potential causes calcium ions to be released from the muscle cell's endoplasmic reticulum. Calcium ions allow a series of "heads" on the myosin fibers to attach to actin. The myosin heads attach and pivot, pulling on the actin filaments. Each pull shortens the length of the sarcomere a tiny bit—about 10 nanometers—and, consequently, the length of the muscle as a whole. After pulling, the myosin heads release, extend, attach, and pull again. This cycle repeats, and the muscle becomes shorter and shorter. The shortened muscle pulls on the toe bone it is attached to, and your toe bends one way. A similar process causes opposing muscles to contract, bending your toe the other way. And there you are, wiggling your toe!

