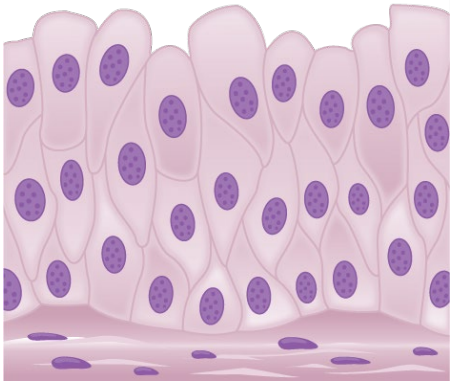
Biology 2e
Unit 7: Animal Structure and Function
Chapter 33: The Animal Body: Basic Form and Function

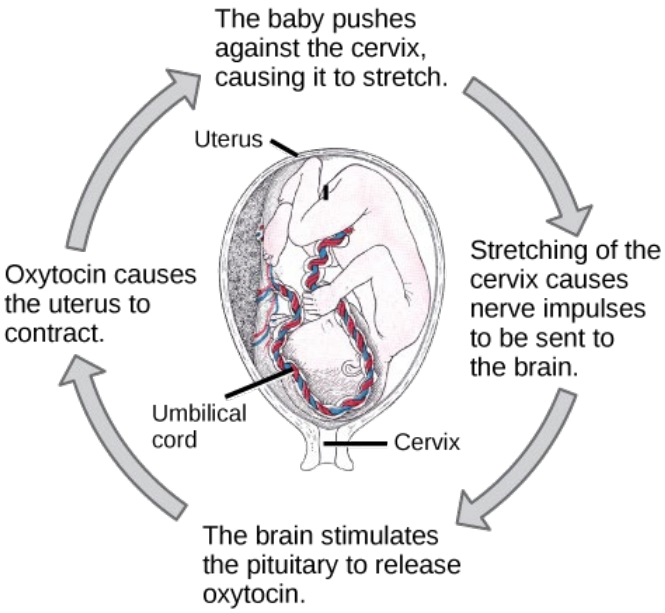
Visual Connection Questions

1. Which of the following statements about types of epithelial cells is false?



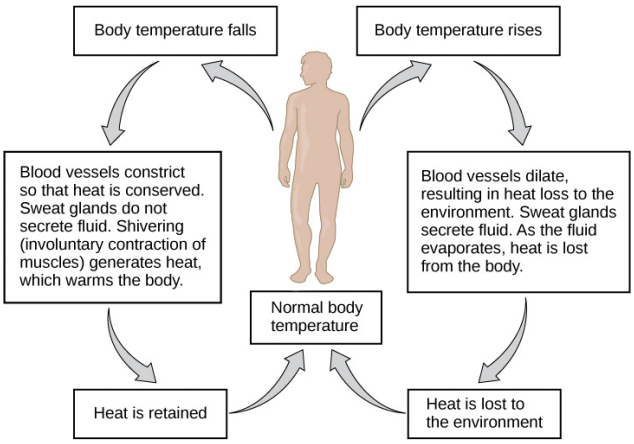
a. Simple columnar epithelial cells line the tissue of the lung.

2. State whether each of the following processes are regulated by a positive feedback loop or a negative feedback loop.



Both processes are the result of negative feedback loops. Negative feedback loops, which tend to keep a system at equilibrium, are more common than positive feedback loops.

3. When bacteria are destroyed by leuckocytes, pyrogens are released into the blood. Pyrogens reset the body's thermostat to a higher temperature, resulting in fever. How might pyrogens cause the body temperature to rise?



Pyrogens increase body temperature by causing the blood vessels to constrict, inducing shivering, and stopping sweat glands from secreting fluid.

Review Questions

4. Which type of animal maintains a constant internal body temperature?

a. endotherm

5. The symmetry found in animals that move swiftly is _____.

b. bilateral

6. What term describes the condition of a desert mouse that lowers its metabolic rate and "sleeps" during the hot day?

c. estivation

7. A plane that divides an animal into equal right and left portions is _____.

b. midsagittal

8. A plane that divides an animal into dorsal and ventral portions is _____.

d. transverse

9. The pleural cavity is a part of which cavity?

b. thoracic cavity

10. How could the increasing global temperature associated with climate change impact ectotherms?

d. Ectotherms will be able to expand into new habitats.

11. Although most animals are bilaterally asymmetrical, a few exhibit radial symmetry. What is an advantage of radial symmetry?
b. It allows the animal to gather food from all sides.

12. Which type of epithelial cell is best adapted to aid diffusion?
a. squamous

13. Which type of epithelial cell is found in glands?
b. cuboidal

14. Which type of epithelial cell is found in the urinary bladder?
d. transitional

15. Which type of connective tissue has the most fibers?
b. fibrous connective tissue

16. Which type of connective tissue has a mineralized different matrix?
d. bone

17. The cell found in bone that breaks it down is called an _____.
c. osteoclast

18. The cell found in bone that makes the bone is called an _____.
a. osteoblast

19. Plasma is the _____.
b. matrix of blood

20. The type of muscle cell under voluntary control is the _____.
b. skeletal muscle

21. The part of a neuron that contains the nucleus is the
b. dendrite

22. Why are intercalated discs essential to the function of cardiac muscle?
c. The discs ensure that all the cardiac muscle cells beat as a single unit.

23. When faced with a sudden drop in environmental temperature, an endothermic animal will:
c. increase muscle activity to generate heat

24. Which is an example of negative feedback?
a. lowering of blood glucose after a meal

25. Which method of heat exchange occurs during direct contact between the source and animal?
d. conduction

26. The body's thermostat is located in the _____.
b. hypothalamus

27. Which of the following is **not** true about acclimatization?
d. Acclimatization is passed on to offspring of acclimated individuals.

28. Which of the following is **not** a way that ectotherms can change their body temperatures?
a. Sweating for evaporative cooling.

Critical Thinking Questions

29. How does diffusion limit the size of an organism? How is this counteracted?
Diffusion is effective over a very short distance. If a cell exceeds this distance in its size, the center of the cell cannot get adequate nutrients nor can it expel enough waste to survive. To compensate for this, cells can loosely adhere to each other in a liquid medium, or develop into multi-celled organisms that use circulatory and respiratory systems to deliver nutrients and remove wastes.

30. What is the relationship between BMR and body size? Why?
Basal Metabolic Rate is an expression of the metabolic processes that occur to maintain an individual's functioning and body temperature. Smaller bodied animals have a relatively large surface area compared to a much larger animal. The small animal's large surface area leads to increased heat loss that the animal must compensate for, resulting in a higher BMR. A large animal, having less relative surface area, does not lose as much heat and has a correspondingly lower BMR.

31. Explain how using an open circulatory system constrains the size of animals.
In an open circulatory system, the heart(s) pump blood into an open cavity, bathing the tissues. As the blood diffuses through the tissue space, it delivers nutrients in exchange for receiving metabolic wastes. The blood then diffuses back to the heart to be pumped again. However, since this system relies on diffusion, the size of animals that use an open circulatory system is limited to fairly small volumes so that the blood can diffuse rapidly enough to efficiently exchange molecules with the tissues.

32. Describe one key environmental constraint for ectotherms and one for endotherms. Why are they limited by different factors?
Endotherms are constrained by the availability of food sources in the environment, while the temperature range in a geographic area limits ectotherms. The difference in how the two groups maintain their body temperature determines the key constraint for each group.

33. How can squamous epithelia both facilitate diffusion and prevent damage from abrasion?
Squamous epithelia can be either simple or stratified. As a single layer of cells, it presents a very thin epithelia that minimally inhibits diffusion. As a stratified epithelia, the surface cells can be sloughed off and the cells in deeper layers protect the underlying tissues from damage.

34. What are the similarities between cartilage and bone?
Both contain cells other than the traditional fibroblast. Both have cells that lodge in spaces within the tissue called lacunae. Both collagen and elastic fibers are found in bone and cartilage. Both tissues participate in vertebrate skeletal development and formation.

35. Multiple sclerosis is a debilitating autoimmune disease that results in the loss of the insulation around neuron axons. What cell type is the immune system attacking, and how does this disrupt the transfer of messages by the nervous system?
In multiple sclerosis, the immune system attacks the oligodendrocytes. The death of oligodendrocytes results in the loss of the insulating sheath around the axon of the neurons. When the sheath is gone, the electrical impulses travel much more slowly down the length of the axon.

36. When a person leads a sedentary life his skeletal muscles atrophy, but his smooth muscles do not. Why?
Skeletal muscles are involved in voluntary motion, so the person has to make the choice to work those muscles through exercise or movement. Smooth muscles are involved in involuntary activities of the body (ex. blood vessel expansion and contraction, intestinal peristalsis) so they are active even when a person is sedentary.

37. Why are negative feedback loops used to control body homeostasis?
An adjustment to a change in the internal or external environment requires a change in the direction of the stimulus. A negative feedback loop accomplishes this, while a positive feedback loop would continue the stimulus and result in harm to the animal.

38. Why is a fever a “good thing” during a bacterial infection?
Mammalian enzymes increase activity to the point of denaturation, increasing the chemical activity of the cells involved. Bacterial enzymes have a specific temperature for their most efficient activity and are inhibited at either higher or lower temperatures. Fever results in an increase in the destruction of the invading bacteria by increasing the effectiveness of body defenses and an inhibiting bacterial metabolism.

39. How is a condition such as diabetes a good example of the failure of a set point in humans?
Diabetes is often associated with a lack in production of insulin. Without insulin, blood glucose levels go up after a meal, but never go back down to normal levels.

40. On a molecular level, how can endotherms produce their own heat by adjusting processes associated with cellular respiration? If needed, review Ch. 7 for details on respiration.

Animals are capable of thermal uncoupling when they need to generate heat to maintain their body temperatures. In this process, an uncoupling protein provides a channel in the inner mitochondrial membrane that allows protons to leave the lumen without moving through the ATP synthase. This generates heat rather than chemical energy as the final product of cellular respiration.