

Chapter 1—Introduction to Physiology and Homeostasis

MULTIPLE CHOICE

1. Select the incorrect association.
 - a. anatomy/function
 - b. human body/multicellular.
 - c. carbon dioxide/cell waste product.
 - d. physiology/body function.
 - e. unicellular/one-celled.

ANS: A PTS: 1

2. Which of the following emphasizes mechanism over purpose?
 - a. a person breathes to obtain oxygen.
 - b. a person sweats to cool off.
 - c. a person's stomach secretes digestive juices because it is stimulated by the nervous system.
 - d. a person's heart beats to pump blood.
 - e. a person's kidneys produce urine to eliminate wastes from the body.

ANS: C PTS: 1

3. When a blood capillary is cut, a clot forms under which influence?
 - a. negative feedback.
 - b. positive feedback.
 - c. extrinsic control.
 - d. both (a) and (b) above.
 - e. none of these answers.

ANS: B PTS: 1

4. The smallest functional unit in the human body from a physiologic perspective is the:
 - a. nucleus
 - b. atom
 - c. cell
 - d. tissue

ANS: C PTS: 1

5. Which of the following is associated with communication between body cells?
 - a. connective.
 - b. epithelial.
 - c. glandular.
 - d. muscle.
 - e. nervous

ANS: E PTS: 1

6. Which of the following factors of the internal environment is not homeostatically maintained?
- a. its concentration of nutrient molecules.
 - b. its concentration of nitrogen gas, of which 80% of the atmospheric air is composed.
 - c. its concentration of oxygen and carbon dioxide.
 - d. its pH.
 - e. its temperature.

ANS: B PTS: 1

7. This tissue type includes blood and bones.
- a. connective.
 - b. endocrine.
 - c. epithelial.
 - d. muscle.
 - e. nervous.

ANS: A PTS: 1

8. The respiratory system
- a. obtains oxygen from and eliminates carbon dioxide to the internal environment.
 - b. consists of the heart, blood vessels and lungs.
 - c. plays an important role in maintaining the proper pH of the internal environment by adjusting the rate of removal of acid-forming carbon dioxide.
 - d. both (a) and (c) above.
 - e. all of these answers.

ANS: C PTS: 1

9. Select the correct statement about muscle tissue
- a. bone is one example.
 - b. blood is one example.
 - c. hemoglobin can be found in the extracellular material.
 - d. there are 3 different types of muscle
 - e. it is not a primary tissue type.

ANS: D PTS: 1

10. Which of the following body systems is not directed entirely toward maintaining homeostasis?
- a. reproductive system.
 - b. endocrine system
 - c. nervous system.
 - d. both b and c
 - e. none of the above answers

ANS: A PTS: 1

11. Which sequence represents the correct hierarchy of biological organization?
- a. cell-organ-tissue-system-organism.
 - b. cell-tissue-organ-system-organism.
 - c. tissue-cell-system-organism-organ.
 - d. organ-tissue-cell-organism-system.
 - e. system-cell-organ-organism-tissue.

ANS: B PTS: 1

12. The internal environment
- is in direct contact with the body's cells.
 - consists of the intracellular fluid.
 - must be maintained at absolutely unchanging composition, temperature, and volume for survival of the body.
 - is in direct contact with the body's cells and consists of the intracellular fluid.
 - all of these answers.

ANS: A PTS: 1

13. Extracellular fluid
- is the internal environment of the body.
 - is outside the cells but inside the body.
 - consists of the plasma and interstitial fluid.
 - two of these answers.
 - all of these answers.

ANS: E PTS: 1

14. Nutrients and oxygen are distributed through the body mainly by the ____ system.
- circulatory.
 - digestive.
 - endocrine.
 - integumentary.
 - skeletal.

ANS: A PTS: 1

15. Which of the following statements concerning negative feedback is incorrect?
- negative feedback exists when a change in a regulated variable triggers a response that opposes the change.
 - negative feedback exists when the input to a system increases the output and the output limits its own production by inhibiting the input.
 - with negative feedback, a control system's input and output continue to enhance each other.
 - most of the body's homeostatic control mechanisms operate on the principle of negative feedback.
 - it is the only mode of extrinsic control.

ANS: C PTS: 1

16. Which statement(s) regarding endocrine glands is/are true?
- lack ducts.
 - secrete hormones internally into the blood.
 - are derived from epithelial tissue.
 - include the parathyroids.
 - all of these answers.

ANS: E PTS: 1

17. Which of the following is (not a type of muscle tissue)?

- a. smooth
- b. skeletal
- c. cardiac
- d. respiratory
- e. none of these answers.

ANS: D PTS: 1

18. The hormone insulin enhances the transport of glucose (sugar) from the blood into most of the body's cells. Its secretion is controlled by a negative-feedback system between the concentration of glucose in the blood and the insulin-secreting cells. Therefore, which of the following statements is correct?

- a. a decrease in blood glucose concentration stimulates insulin secretion, which in turn further lowers the blood glucose concentration.
- b. an increase in blood glucose concentration stimulates insulin secretion, which in turn lowers the blood glucose concentration.
- c. a decrease in blood glucose concentration stimulates insulin secretion, which in turn increases the blood glucose concentration.
- d. an increase in blood glucose concentration stimulates insulin secretion, which further increases the blood glucose concentration.
- e. none of these answers.

ANS: B PTS: 1

19. Sweating is initiated in response to a rise in body temperature that occurs on exposure to a hot environment. Evaporation of the sweat cools the body. This is an example of

- a. negative feedback.
- b. positive feedback.
- c. a feedforward mechanism.
- d. an intrinsic (local) control mechanism.
- e. autoregulation.

ANS: A PTS: 1

20. The activity of one organ is influenced by the activity of several other organs to maintain homeostasis. This is an example of:

- a. intrinsic control
- b. extrinsic control
- c. positive feedback
- d. lack of communication
- e. feed forward system

ANS: B PTS: 1

21. Calcium is stored mainly in the ____ system.

- a. digestive.
- b. endocrine.
- c. integumentary.
- d. muscular.
- e. skeletal.

ANS: B PTS: 1

22. Which cells are considered pluripotent?

- a. neurons
- b. tissue-specific stem cells
- c. embryonic stem cells
- d. both b and c
- e. none of these answers.

ANS: C PTS: 1

23. Which statement(s) regarding stem cells is/are correct?

- a. they are undifferentiated embryonic cells.
- b. they may reproduce many times.
- c. their daughter cells may differentiate into a number of different specialized cell types.
- d. all of these answers.
- e. none of these answers.

ANS: D PTS: 1

TRUE/FALSE

1. Cells eliminate carbon dioxide as a waste product.

ANS: T PTS: 1

2. All cells are capable of reproducing.

ANS: F PTS: 1

3. Highly differentiated tissues such as nervous and cardiac muscle are incapable of new cell production.

ANS: F PTS: 1

4. All enzymes are proteins but not all proteins are enzymes.

ANS: T PTS: 1

5. A mechanism explanation of why a person breathes is to obtain oxygen.

ANS: F PTS: 1

6. Every organ system of the human body is focused on homeostasis as its primary function.

ANS: F PTS: 1

7. Tissues are composed of two or more types of cells organized to perform a particular function or functions.

ANS: F PTS: 1

8. Muscle cells produce movement by expanding.

ANS: F PTS: 1

9. Blood is a type of connective tissue.

ANS: T PTS: 1

10. Glands are formed during embryonic development by pockets of epithelial tissue that dip inward from the surface.

ANS: T PTS: 1

11. Endocrine glands secrete hormones into the blood.

ANS: T PTS: 1

12. A lumen is a cavity within a hollow organ or tube.

ANS: T PTS: 1

13. Organs are composed of two or more kinds of primary tissues.

ANS: T PTS: 1

14. The external environment is found outside the body.

ANS: T PTS: 1

15. Factors that are homeostatically regulated are maintained at a constant, fixed level unless disease is present.

ANS: F PTS: 1

16. Most body cells are not in direct contact with the external environment.

ANS: T PTS: 1

17. The lungs remove carbon dioxide from the blood plasma.

ANS: T PTS: 1

18. To sustain life, the internal environment must be maintained in an absolutely unchanging state.

ANS: F PTS: 1

19. Not all activities performed by the muscular and nervous systems are directed toward maintaining homeostasis.

ANS: T PTS: 1

20. The plasma surrounds and bathes all of the body's cells.

ANS: F PTS: 1

21. In tissue exchange, materials move from plasma to the interstitial before moving into cells.

ANS: T PTS: 1

22. The concentration of salt (NaCl) in the extracellular fluid is the same as the concentration of salt in the intracellular fluid.
- ANS: F PTS: 1
23. Exocrine glands are the only structures in the body capable of secretion.
- ANS: F PTS: 1
24. Secretion refers to the release from a cell, in response to appropriate stimulation, of specific products that have in large part been synthesized by the cell.
- ANS: T PTS: 1
25. The endocrine system functions with the circulatory system for the transport of hormones.
- ANS: T PTS: 1
26. Some organs, such as the heart, skin, and intestine, belong to more than one body system.
- ANS: T PTS: 1
27. The digestive system eliminates carbon dioxide from the body.
- ANS: F PTS: 1
28. The skin is part of the integumentary system.
- ANS: T PTS: 1
29. Negative feedback operates to maintain a controlled factor in a relatively steady state, whereas positive feedback moves a controlled variable even further from a steady state.
- ANS: T PTS: 1
30. With positive feedback, a control system's input and output continue to enhance each other.
- ANS: T PTS: 1
31. Intrinsic control mechanisms involve the interactions of several different organs.
- ANS: F PTS: 1

COMPLETION

1. The smallest unit capable of carrying out the processes associated with life is the _____.
- ANS: cell
- PTS: 1

2. _____ cells are specialized to send electrical signals.

ANS: nerve

PTS: 1

3. _____ muscle tissue composes the heart.

ANS: cardiac

PTS: 1

4. _____ are composed of two or more types of primary tissue organized to perform a particular function or functions.

ANS: organs

PTS: 1

5. _____ glands secrete through ducts in the skin.

ANS: exocrine

PTS: 1

6. A(n) _____ is a collection of organs that perform related functions and interact to accomplish a common activity that is essential for survival of the whole body.

ANS: body system

PTS: 1

7. The internal environment consists of the _____, which is made up of _____, the fluid portion of the blood, and _____, which surrounds and bathes all cells.

ANS: extracellular fluid, plasma, interstitial fluid

PTS: 1

8. The _____ is the liquid part of the blood.

ANS: plasma

PTS: 1

9. The _____ is the liquid that bathes cells.

ANS: interstitial fluid

PTS: 1

10. The body cells are in direct contact with and make life-sustaining exchanges with the _____.

ANS: internal environment (extracellular fluid)

PTS: 1

11. _____ refers to maintenance of a relatively stable internal environment.

ANS: homeostasis

PTS: 1

12. _____ tissue is composed of cells specialized for contraction and force generation.

ANS: muscle

PTS: 1

13. The _____ system consists of hormone- secreting and gamete producing tissues

ANS: reproductive

PTS: 1

14. The two major control systems of the body are the _____ and the _____.

ANS:

nervous system, endocrine system

endocrine system, nervous system

PTS: 1

15. _____ are drugs that prevent rejection of transplanted tissues.

ANS: immunosuppressive drugs

PTS: 1

16. The _____ system is the transport system of the body.

ANS: circulatory

PTS: 1

17. The _____ system eliminates waste products other than carbon dioxide and plays a key role in regulating the volume, electrolyte composition, and acidity of the extracellular fluid.

ANS: urinary

PTS: 1

18. The _____ system controls and coordinates bodily activities that require swift responses, especially to changes in the external environment.

ANS: nervous

PTS: 1

19. _____ refers to the abnormal functioning of the body associated with disease.

ANS: pathophysiology

PTS: 1

20. Homeostasis is maintained by _____ mechanisms.

ANS: negative feedback

PTS: 1

MATCHING

Use the following answer code to indicate which tissue is being identified.

- a. nervous tissue
- b. epithelial tissue
- c. muscle tissue
- d. connective tissue

- 1. This tissue type is composed of cells specialized for contraction.
- 2. This tissue type is made up of cells specialized in the exchange of materials between the cell and its environment
- 3. This tissue type is connects, supports, and anchors various body parts
- 4. The heart is made of this type of tissue.
- 5. Blood is this tissue type.
- 6. Glands are a derivative of this tissue type.
- 7. The digestive tract is lined with this tissue.
- 8. The brain is primarily made of this tissue.
- 9. The skin is this tissue type.
- 10. This tissue is distinguished by relatively few cells within an extracellular material.
- 11. Skeletal, cardiac, and smooth are types of this tissue.

- | | |
|------------|--------|
| 1. ANS: C | PTS: 1 |
| 2. ANS: B | PTS: 1 |
| 3. ANS: D | PTS: 1 |
| 4. ANS: C | PTS: 1 |
| 5. ANS: D | PTS: 1 |
| 6. ANS: B | PTS: 1 |
| 7. ANS: B | PTS: 1 |
| 8. ANS: A | PTS: 1 |
| 9. ANS: B | PTS: 1 |
| 10. ANS: D | PTS: 1 |
| 11. ANS: C | PTS: 1 |

Temperature-sensitive nerve cells monitor the body temperature and provide information about its status to a temperature-control center in the hypothalamus, a part of the brain. The hypothalamus can bring about adjustments in body temperature by inducing shivering or sweating, among other things.

Indicate the roles served by each component of this control system using the following answer code:

- a. controlled variable
- b. integrator
- c. sensor
- d. effector
- e. effect to bring about change

- 12. body temperature
- 13. temperature-sensitive nerve cells
- 14. skeletal muscles and sweat glands
- 15. hypothalamus
- 16. sweating

- | | |
|------------|--------|
| 12. ANS: A | PTS: 1 |
| 13. ANS: C | PTS: 1 |
| 14. ANS: D | PTS: 1 |
| 15. ANS: B | PTS: 1 |
| 16. ANS: E | PTS: 1 |

Indicate whether the following physiological event represents

- a. intrinsic control
- b. negative feedback control
- c. positive feedback control

- 17. increased blood flow into muscle tissue in response to a localized increase in carbon dioxide
- 18. the release of a hormone to lower blood calcium levels when it gets too high
- 19. increased cardiac activity to elevate blood pressure when systemic pressure is low
- 20. rapid clotting of blood due to increasing levels of platelet activity at a site of vessel damage

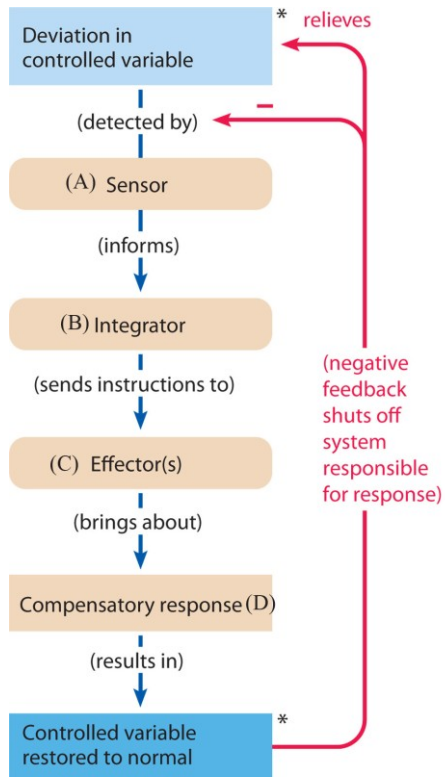
- | | |
|------------|--------|
| 17. ANS: A | PTS: 1 |
| 18. ANS: B | PTS: 1 |
| 19. ANS: B | PTS: 1 |
| 20. ANS: C | PTS: 1 |

Match the system to the function.

- a. Transports food, vitamins, minerals, and other nutrients
- b. The chemical breakdown of food
- c. Responsible for continuation of the human race
- d. Excretes nitrogenous waste material
- e. Exchange of oxygen and carbon dioxide

- 21. Blood
- 22. Respiratory System
- 23. Digestive System
- 24. Urinary System

21. ANS: A PTS: 1
22. ANS: E PTS: 1
23. ANS: B PTS: 1
24. ANS: D PTS: 1



On the image four major components of a homeostatic system are labeled A, B, C and D. Match the components with the statements below. Answers can be used more than once. All of the statements are in reference to temperature regulation.

25. Part of the nervous system that signals sweat glands to produce sweat.
26. Sweat glands
27. Detects skin temperature.
28. The act of sweating.
29. Part of the nervous that receives temperature signals from the skin.
30. The act of shivering.
31. Skeletal muscles.
32. Part of the nervous system that signals muscles to shiver.

25. ANS: B PTS: 1 OBJ: ART
26. ANS: C PTS: 1
27. ANS: A PTS: 1
28. ANS: D PTS: 1
29. ANS: B PTS: 1
30. ANS: D PTS: 1
31. ANS: C PTS: 1
32. ANS: B PTS: 1

ESSAY

1. Compare the external and internal body environments.

ANS:

Basic cell functions include: obtaining food and oxygen, extracting energy from nutrients, eliminating wastes, protein synthesis, controlling exchange between cells and the surrounding environment, internal cellular movement, being able to respond to changes in the surrounding environment, and reproducing.

PTS: 1

2. State the components of the internal environment and explain how materials are exchanged into and out of the cell.

ANS:

Internal environment consists of the extracellular fluid (ECF), which is composed of two distinct parts: the interstitial fluid that directly surrounds the cell, and the plasma, the fluid portion of the blood. Materials are exchanged between the plasma and interstitial fluid, and between the interstitial fluid and the intracellular fluid (ICF).

PTS: 1

3. Compare negative and positive feedback and explain why negative feedback is important in homeostasis.

ANS:

Negative feedback is a process that restores a factor to normal by moving the factor in the opposite direction of the initial change. Negative feedback is the basis for homeostasis because it returns factors to normal values. Positive feedback, on the other hand, enhances or amplifies the initial change and continues to drive the system in the direction of the initial change.

PTS: 1

4. What s one of the first effects of an exercise program on the heart?

ANS:

It allows the heart to become a more efficient muscle. In this way the heart can beat slower to pump the same amount of blood at rest.

PTS: 1

5. What are the component parts of a homeostatic control system? Describe a basic function of each.

ANS:

Components of a homeostatic system include the sensor, which monitors the magnitude of the variable being controlled, and the integrator or control center, which compares the sensor's input with what is considered a normal value (known as the set point) and then sends appropriate signals to the last component of the system (known as the effector). The effector in turn brings about an appropriate change to return the system back to the set point (normal).

PTS: 1