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Instructor's Resource Material for
Homeostasis

ANSWER KEYS

Answers to Quick Check Questions

1. The body's internal environment is a watery fluid that surrounds the cells of the body.
2. *Homeostasis* is the relatively constant state maintained by the body.
3. In physiology, a set point value for a physiological variable is the value at which the body's control systems have "set" as the normal value.
4. Because the human body is essentially a group of many living cells living in a bag (of skin) filled with body fluid, one can use the analogy of a fishbowl, where the cells living in body fluid are like fish living in water. Like the fishbowl accessories that maintain a stable environment for the health of fish, our organs maintain a stable fluid environment in our body.
5. The basic components of every feedback control system are the sensor mechanism, the integrator or control center, the effector mechanism, and the feedback. The variable is the physiology characteristic being controlled by the feedback loop and the set point value is the "normal" value for the variable.
6. Room temperature (variable) is kept stable by a thermostat (sensor-integrator) that feeds back information about room temperature to a controller that turns on the furnace (effector) if the room temperature dips below the value set on the thermostat (set point value).
7. A feedback loop is "negative" when its response reverses the direction of change (in the variable) detected by sensors.
8. Negative feedback control systems are inhibitory. They produce an action that is opposite to the change that activated the system. Negative feedback control systems stabilize physiological variables. Positive feedback control systems are stimulatory. Positive feedback tends to amplify or reinforce the change that is occurring. Typically, such responses result in instability and disrupt homeostasis.
9. Examples of such circumstances include bacterial infection, when a higher temperature benefits the fight against infection, and when variables need to be higher or lower than average during particular times of the day in order to maintain normal function of the body.
10. A *circadian rhythm* is a daily pattern in body function, such as a daily drop in body temperature while sleeping.
11. Any time the body responds to a change that has not happened, but is likely to happen, is a *feed-forward* response—like when the stomach becomes active and begins producing digestive juices just before a meal.
12. *Intracellular* control mechanisms operate at the cell level. These mechanisms regulate functions within the cells. *Intrinsic* control mechanisms operate at the tissue and organ levels. They often make use of chemical signals. *Extrinsic* control mechanisms operate at the system and organism levels. These usually involve nervous and endocrine regulation.

Answers to Case Study Questions (p. 35)

1. **b:** An adrenaline boost causes a number of physical symptoms, including rapid pulse and breathing, which are all designed to urge the body into action. The term *flight-or-flight response* is used to describe an adrenaline release, because it addresses the body's reaction to the increase in hormone production.
2. **d:** When Anniston ran her race, skeletal muscles (particularly her legs) worked extensively thus using energy at a very high rate. This increase in muscle contraction produced a substantial amount of heat, which raised her core body temperature. In attempt to cool the body down from this increase in temperature, her sweat glands were activated to produce/secrete sweat (water). This secretion of sweat reduced her body water levels.



- b:** This is an example of negative feedback. As the level of water in the blood falls, negative feedback ensures that the amount of ADH rises. As the level of water in the blood rises, negative feedback ensures that the amount of ADH falls.

Answers to Review Questions (pp. 36-37)

- Homeostasis* is the relatively constant state maintained by the body (relative uniformity of the normal body's internal environment). Examples include the following: the body maintains a constant internal temperature, the blood and body fluid must maintain a constant chemical composition, or any other occurrence that demonstrates the body's homeostatic regulation.
- Homeostatic control mechanisms* are devices for maintaining or restoring homeostasis. *Feedback control loops* are systems that respond to changing internal environments and restore and maintain a healthy internal environment.
- The four basic components of a control loop are (1) a sensor mechanism, (2) an integrator or control center, (3) an effector mechanism, and (4) feedback.
- A negative feedback loop causes a reversal of a change that is occurring in the body, thus stabilizing a controlled variable near a set point value. A positive feedback loop, on the other hand, works in the opposite manner—amplifying a change in the controlled variable and thus promoting further movement away from the set point.
- A drop in body temperature below the set point temperature acts as a stimulus, which promotes the response of muscle shivering. Shivering produces heat that moves the body temperature back toward the set point temperature.
- Examples mentioned in this chapter include: regulation of body temperature, blood oxygen concentration, blood carbon dioxide concentration, blood acid levels (pH), and water content of body tissues.
- Examples mentioned in this chapter include: regulation of labor contractions during childbirth, immune system response to infection, and formation of a blood clot.
- A *circadian rhythm* is regular daily pattern in the body, such as highs and lows of temperature, blood pressure, or hormone concentrations in the blood.
- Feed-forward* is the concept that information may flow ahead to another process to trigger a change in anticipation of an event that will follow. It allows the body to react to anticipated changes in the body, rather than reacting only to changes after they have happened.
- The three levels of homeostatic control in the body are intracellular, intrinsic, and extrinsic control mechanisms. Intracellular control mechanisms operate at the cell level. Intrinsic control mechanisms operate at the tissue and organ levels. Extrinsic control means “outside” control and operates at the system and organism levels.
- Health usually involves an overall stability of the body maintained by homeostatic feedback loops. Disease is often the result of some disruption of homeostasis when abnormal changes to the body cannot be easily returned to normal ranges.
- Risk factors mentioned in this chapter include: genetic factors, age, lifestyle, stress, environmental factors, microorganisms, and preexisting conditions.
- A *pathogen* is an agent that causes disease. Examples mentioned in this chapter include: prions, viruses, bacteria, fungi, protozoa, and animals.

Answers to Critical Thinking Questions (p. 37)

- Just as an aquarium filter removes toxic fish wastes, keeping the toxin levels relatively constant at a low, safe level, the kidneys remove toxic cellular wastes from the blood—thus keeping toxin levels in the blood at a relatively constant safe (low) level.

2. Your eyes (seeing you are drifting out of your lane) are the sensory mechanism. Your brain is the integrator or control center. Your arms and hands are the effector mechanism. This is a negative feedback loop because the response opposes the change that stimulated it and returns it to set point (your own lane).
3. As blood glucose levels drop below the set point value, sensors detect this and provide the information to integrator mechanisms. Integrators respond by using regulatory mechanisms (such as, hormones) to push the glucose back up to normal concentrations.
4. This is negative feedback, because it reverses the drop in tissue oxygen levels by increasing the flow of blood to the local tissues (by dilating the nearby vessels). It is an example of intrinsic control, because it is happening at the tissue level, using cell-to-cell communication.