Teacher Notes and Answers

SECTION 2

Instant Replay
1. body temperature and levels of fluids, nutrients, salts, and gases must remain within narrow ranges to keep the body functioning
2. positive feedback-it increases change away from set conditions

Vocabulary Check
1. homeostasis
2. positive feedback
3. feedback
4. negative feedback

The Big Picture
5. sensors, control center, communication systems, targets
6. negative feedback loop; it is counteracting a change away from the body’s normal internal temperature
7. the targets
The tissues, organs, and organ systems in your body all work together to accomplish one goal: keeping you alive. To do this, they must respond to conditions* in the world around you.

**Conditions within the body must remain within a narrow range.**

A car will not operate properly unless it is in good condition. It needs its oil changed, its engine tuned up, and its tires rotated from time to time. Cars also respond to conditions on the road. It is harder to control a car when the road is wet, slippery, or covered with ice. Your body is much more complicated than a car, but it also responds to conditions inside the body and in the environment. The organs in your body will work well only in certain conditions.

**Temperature** One of the conditions your body requires is that its temperature remain between 36.7°C and 37.1°C (98.2°F and 98.8°F). If it rises past 41°C (106°F), you could die from overheating. If your temperature drops below 27°C (80°F), your heart could stop.

**Minerals** The trace minerals in your body must also stay within certain limits. If your levels of a mineral are too high or too low, you could get sick or die.

**Chemical reactions** The work that your cells, tissues, and organs do depends on chemical reactions. Trillions of chemical reactions take place in your body every second. Chemical reactions depend on the actions of enzymes. However, enzymes stop working if the temperature inside the body rises too high. This is why keeping a stable temperature is so important.
Homeostasis and the Internal Environment

Your temperature and your levels of fluids, nutrients, salts, and gases are part of your internal environment. Your body has control* systems that keep your internal environment stable*. Your body’s ability to maintain a stable internal environment is called **homeostasis**.

Control Systems in the Body

Control systems in the body are composed of four parts.

**Sensors**  Sensors collect information about conditions inside and outside your body.

**Control center**  Sensors send this information to a control center, such as your brain. The control center compares this information to the conditions that are necessary for the body to be at its best. When conditions change too much, the control center sends messages through a communication system to respond to the change.

**Communication systems**  There are two main communication systems in your body. One is the nervous system, which uses nerve impulses to send information. The other is the endocrine system, which sends messages by releasing hormones.

**Targets**  Nerve impulse or hormone messages are sent to targets in the body. The target is any organ, tissue, or cell that changes its activity in response to a message. For example, when it is cold outside, a message might cause your muscles to contract and shake, or shiver, to generate heat.

Why is it so important that control systems maintain your body’s homeostasis?

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* ACADEMIC VOCABULARY

**control**  command, regulate

**stable**  steady, constant

The nervous system, which includes your brain, uses nerve impulses to send information throughout your body.
Negative feedback loops are necessary for homeostasis.

The flow of information from sensors to control centers, to communication systems, and to targets forms a feedback loop. This means that information constantly moves back and forth between different parts of the body. Feedback is information from sensors that allows a control center to compare current conditions to a set of ideal values.*

**Negative Feedback**

Most functions in the body are ruled by negative feedback loops. In **negative feedback**, a control system sends instructions to a target to counteract* changes. The target responds to bring conditions back to normal.

**Positive Feedback**

Negative feedback loops help your body to maintain homeostasis. They work to bring the body back to its normal conditions. Sometimes, though, the body needs to make adjustments. It must, at least for a short time, take an action that moves it further away from ideal conditions. Instructions from a control center to make this kind of a change is called **positive feedback**. For example, if you cut your finger, a control system increases the clotting factors in your blood until the wound has been sealed.

* ACADEMIC VOCABULARY

- **ideal values** the best conditions
- **counteract** to take action against something

If you inhale and hold your breath, sensors in your body send feedback to your brain stem: oxygen levels are falling too low and carbon dioxide levels are rising too high.

Your brain sends messages to the muscles of your diaphragm and rib cage to counteract these changes. You are forced to exhale and then inhale deeply until conditions return to normal.
Suppose you have an ear infection. A feedback loop in your body increases your temperature until you have a fever. Is this an example of positive feedback or negative feedback? Explain.

Choose the correct term from the list for each description.

1. Your body’s control over its internal environment __________________
2. Feedback from a control center that increases the amount of change away from ideal values __________________
3. Information from sensors that allows a control center to compare current conditions to a set of ideal values __________________
4. Feedback from a control center that counteracts change away from ideal values __________________

5. What four parts of a control system must work together in a feedback loop?

6. Suppose you are caught out in the rain and get drenched and cold. Which type of feedback loop would cause your body to start shivering to keep warm? Explain your answer.

7. In question 7 above, the muscles that start shivering represent which part of the control system?