A Split-Second Signal

Trace a reflex and the body systems that respond

HAP.6 "Students will investigate the structures and functions of the nervous system, including the cause and effect of diseases and disorders. Describe and evaluate how the nervous system functions and interconnects with all other body systems..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the steps that carry the withdrawal signal from Maya's finger to her arm muscles, and number them in order. Circle the sentences that explain how her heart rate changes during and after the threat.

When Maya Touches a Hot Tray

1. When Maya brushes a hot baking tray, heat-sensitive nerve endings in her finger detect the danger. A sensory neuron in the peripheral nervous system carries an electrical signal toward her spinal cord, part of the central nervous system. There, an interneuron passes the signal to a motor neuron that runs back through the peripheral nervous system. The motor neuron triggers muscles in her arm to contract, pulling her hand away. This withdrawal reflex can begin before her brain identifies the heat as pain. Signals also travel up the spinal cord to her brain, where she becomes aware of the burn.

2. Signals travel along neurons, but other cells help those messages arrive. Schwann cells wrap many peripheral axons in myelin, an insulating layer that helps signals move quickly. In the brain and spinal cord, oligodendrocytes make myelin instead. If a peripheral nerve loses myelin, signals between a fingertip and spinal cord may become slower or less reliable, which can disrupt sensing and movement. Astrocytes help regulate the chemical conditions around neurons in the central nervous system, while microglia help clear damaged material and respond to injury. These supporting cells affect how well a reflex pathway works.

3. The alarm does not stop when Maya pulls away. Her brain interprets pain and helps coordinate responses across body systems. The sympathetic branch of the autonomic nervous system can raise her heart rate, sending more blood through the circulatory system during a threat. It can also increase sweating, which can help cool the body. Once the danger passes, the parasympathetic branch helps slow her heart rate toward its usual level. Her skin provides sensory information, her muscles move her arm, and her heart adjusts its pace. Together, these responses help her body react to danger and return toward a stable state.

2 ANSWER WITH EVIDENCE

Use the passage

1. Trace the signal that pulls Maya's hand away. Why can her hand move before she feels pain?

2. Compare the jobs of the peripheral and central nervous systems in Maya's withdrawal reflex.

3. Predict how loss of myelin in a peripheral nerve could affect Maya's response. Use the passage to explain why.

4. How do the sympathetic and parasympathetic branches affect Maya's heart rate at different times? Name the other body system involved.

3 YOUR TURN

Your own words

Imagine you step barefoot on a sharp pebble and have damaged myelin on a sensory nerve in that foot. In 4 to 5 sentences, trace a possible withdrawal response through the peripheral and central nervous systems, explain how the damage might affect it, and describe how your heart rate could change and recover.

A Split-Second Signal

PART 1 · READ AND MARK

Underline the steps that carry the withdrawal signal from Maya's finger to her arm muscles, and number them in order. Circle the sentences that explain how her heart rate changes during and after the threat. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Trace the signal that pulls Maya's hand away. Why can her hand move before she feels pain?	**A sensory neuron carries the signal to the spinal cord, where an interneuron passes it to a motor neuron that triggers her arm muscles. The spinal reflex can begin before signals reaching her brain make her aware of the pain.**
2	Compare the jobs of the peripheral and central nervous systems in Maya's withdrawal reflex.	**The peripheral nervous system carries signals toward and away from the spinal cord. The spinal cord, part of the central nervous system, connects the sensory and motor parts of the reflex pathway.**
3	Predict how loss of myelin in a peripheral nerve could affect Maya's response. Use the passage to explain why.	**Sensing the heat or moving her arm could become slower or less reliable because myelin helps signals travel quickly along peripheral axons.**
4	How do the sympathetic and parasympathetic branches affect Maya's heart rate at different times? Name the other body system involved.	**The sympathetic branch can raise her heart rate during the threat. Afterward, the parasympathetic branch helps slow it toward its usual level. These changes involve the circulatory system.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

A sensory neuron in my foot would carry a signal toward my spinal cord through the peripheral nervous system. In the central nervous system, a spinal interneuron could pass the signal to a motor neuron that moves my foot away. Damaged myelin on the sensory nerve might make the incoming signal slower or less reliable, so the withdrawal response could be delayed or weakened. If my brain detects the threat, sympathetic activity could raise my heart rate. After the danger passes, parasympathetic activity could help slow my heart rate toward its usual level.

Accept other accurate descriptions of the reflex route and the possible effects of sensory nerve damage. Students should describe a possible change in heart rate, not claim that it must occur.