Signals Under Pressure

Trace how nervous system pathways protect the body.

HAP.6.4 "Compare and contrast the structures and functions of the central and peripheral nervous systems. Investigate how the systems interact to maintain homeostasis (e.g., reflex responses, sensory responses)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline central nervous system structures and circle peripheral nervous system structures. Then number the events from heat detection to hand withdrawal in order to trace how the systems work together.

A Split-Second Response

1. As Maya touches a hot baking tray, her nervous system is already monitoring her skin. The central nervous system (CNS) consists of the brain and spinal cord. It receives information and coordinates responses. The peripheral nervous system (PNS) includes nerves outside the brain and spinal cord. Sensory nerves carry signals from receptors toward the CNS, while motor nerves carry commands from the CNS to muscles and glands. Both systems communicate with electrical signals along nerve cells, but they have different locations and jobs. Without peripheral pathways, the CNS could not receive the tray's warning or send a response.

2. Heat and pain receptors in Maya's finger detect the tray's harmful heat. A sensory nerve carries a signal into her spinal cord. There, a connecting nerve cell passes the signal to a motor nerve, which directs arm muscles to pull her hand away. This rapid reflex can begin before her brain fully registers pain. Meanwhile, signals also travel up the spinal cord to the brain, where Maya becomes aware of the burn and decides to cool her finger under running water. The spinal cord and brain are both central structures, but their roles in this event differ.

3. Near the oven, Maya also begins to feel too warm. Temperature receptors in her skin and brain provide information about her body temperature. Sensory pathways from her skin carry information to the CNS; the hypothalamus, a region of the brain, helps coordinate cooling. Autonomic motor pathways in the PNS signal sweat glands to release sweat and skin blood vessels to widen. As sweat evaporates, it removes heat; increased blood flow near the skin also helps release heat. The reflex protects Maya from immediate injury, while cooling responses help keep her internal temperature within a workable range.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the locations and jobs of the CNS and PNS differ in Maya's response to the tray?

2. Trace the signal from Maya's finger to her arm muscles. Which parts of the route belong to the PNS, and which part belongs to the CNS?

3. How does the spinal cord's role in Maya's withdrawal differ from the brain's role after she touches the tray?

4. Compare how the CNS and PNS work together when Maya feels too warm with how they work together when she withdraws her hand.

3 YOUR TURN

Your own words

On a cold day, skin blood vessels narrow to limit heat loss, and muscles shiver to produce heat. Write 4 to 5 sentences explaining how the CNS and PNS could produce these responses, then compare them with Maya's hand-withdrawal reflex by naming one similarity and one difference.

Signals Under Pressure

PART 1 · READ AND MARK

Underline central nervous system structures and circle peripheral nervous system structures. Then number the events from heat detection to hand withdrawal in order to trace how the systems work together. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the locations and jobs of the CNS and PNS differ in Maya's response to the tray?	**The brain and spinal cord form the CNS, which receives information and coordinates responses. Nerves outside them form the PNS, which carries sensory signals toward the CNS and motor commands away from it.**
2	Trace the signal from Maya's finger to her arm muscles. Which parts of the route belong to the PNS, and which part belongs to the CNS?	**Receptors in the finger detect heat. A PNS sensory nerve carries the signal to the spinal cord, where a connecting nerve cell relays it. A PNS motor nerve then carries a signal to the arm muscles.**
3	How does the spinal cord's role in Maya's withdrawal differ from the brain's role after she touches the tray?	**The spinal cord helps start the rapid withdrawal reflex. The brain becomes aware of the burn and helps Maya decide to cool her finger.**
4	Compare how the CNS and PNS work together when Maya feels too warm with how they work together when she withdraws her hand.	**In both responses, peripheral sensory pathways carry information to the CNS, and peripheral motor pathways carry signals to effectors. The withdrawal reflex rapidly activates arm muscles through the spinal cord, while the brain helps coordinate sweating and wider skin blood vessels to release heat.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Cold receptors in the skin send signals through sensory nerves in the PNS to the CNS. The brain helps coordinate a response, sending signals through peripheral motor pathways that narrow skin blood vessels and activate muscles to shiver. Narrower vessels limit heat loss, while shivering produces heat. Like Maya's withdrawal reflex, this response depends on signals traveling between the PNS and CNS. Unlike her quick hand withdrawal, these responses help regulate body temperature.

Accept descriptions that correctly place the brain and spinal cord in the CNS and nerves outside them in the PNS. For the cold-day task, students should connect sensory input, central coordination, and motor output to heat conservation or production.