Signals on the Trail

Trace how the nervous system protects the body and guides action.

HAP.5.b "Construct an explanation of the role of reflex arcs, the central nervous system, and special senses in the response to stimuli to maintain homeostasis and guide behavior."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline three stimuli, circle the named parts of the central nervous system, and number the steps of the foot-withdrawal reflex in the order they happen.

A Split-Second Step

1. On a hot afternoon, Maya runs along a park trail. A sharp pebble presses into her bare heel just as she approaches a fork. She pulls her foot away before she has time to decide what to do. Ahead, her eyes detect a shady route under trees, and she takes it. Meanwhile, heat from her body and the air raises her internal temperature. These events involve different kinds of signals, but they work together. A quick protective movement reduces injury, while choices and automatic responses help keep her body within a safe temperature range.

2. Pressure from the pebble activates pain receptors in Maya's heel. Sensory neurons carry impulses into her spinal cord, part of the central nervous system. There, an interneuron helps pass the signal to motor neurons, which cause leg muscles to contract and lift her foot. This path is a reflex arc. It produces a rapid response without waiting for a conscious decision, although signals also travel to her brain so she becomes aware of the pain. The reflex protects her foot, but it does not directly cool her body or choose the route at the fork.

3. The eyes are special sense organs: light from the trail reaches receptors in Maya's retinas, and sensory signals travel to her brain. Her brain uses that information to choose the shady route and adjust her steps. At the same time, the hypothalamus, a region of the brain, monitors body temperature using signals from the body and its own temperature-sensitive cells. When Maya is too warm, it triggers sweating and increased blood flow near the skin. Evaporation of sweat removes heat, and warm blood near the skin can release heat when the air is cooler. These responses help return body temperature toward its usual range.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why does Maya lift her foot before deciding to move it? Trace the signal from her heel to her leg muscles.

2. How does a special sense help Maya's brain guide her behavior at the fork?

3. Explain how Maya's brain helps bring her body temperature back toward its usual range.

4. How are Maya's response to the pebble and her choice of the shady route different? Explain what each response helps her do.

3 YOUR TURN

Your own words

Imagine you are walking to school on a cold morning. Your hand touches a sharp fence wire as you hear a bicycle bell. In four or five sentences, explain a withdrawal reflex, how hearing guides your next action, and how your central nervous system helps keep your body temperature stable.

ANSWER KEY

Signals on the Trail

HIGH SCHOOL · HAP.5.b

PART 1 · READ AND MARK

Underline three stimuli, circle the named parts of the central nervous system, and number the steps of the foot-withdrawal reflex in the order they happen. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why does Maya lift her foot before deciding to move it? Trace the signal from her heel to her leg muscles.	**Pain receptors detect the pebble's pressure. Sensory neurons carry impulses to the spinal cord, where an interneuron helps activate motor neurons that contract her leg muscles. This reflex arc does not wait for a conscious decision.**
2	How does a special sense help Maya's brain guide her behavior at the fork?	**Receptors in her retinas detect light from the trail and send signals to her brain. Her brain uses the visual information to choose the shady route and adjust her steps.**
3	Explain how Maya's brain helps bring her body temperature back toward its usual range.	**The hypothalamus monitors temperature and triggers sweating and increased blood flow near the skin when Maya is too warm. Evaporating sweat removes heat, while blood near the skin can release heat if the air is cooler.**
4	How are Maya's response to the pebble and her choice of the shady route different? Explain what each response helps her do.	**The spinal reflex quickly lifts her foot without a conscious decision, helping protect it from injury. Her brain uses visual information to choose shade, which helps her avoid further heating.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Pain receptors in my hand detect the sharp wire, and sensory neurons send an impulse to my spinal cord. An interneuron helps activate motor neurons, so my hand pulls away before I decide to move it. My ears detect the bell, and my brain uses that sound to make me turn and check for the bicycle before stepping aside. My hypothalamus responds to the cold by triggering shivering, which produces heat and helps stabilize my body temperature.

Accept equivalent explanations that correctly distinguish the spinal withdrawal reflex from a brain-guided response to sound. For the cold response, accept shivering or another accurate response controlled by the central nervous system.