Cells on Call

How cell structure supports a rapid response

HS-AP5-2 "Observe and identify the structure and function of the various neurons and neuroglia. Explain how the varying structures determine the specified function."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each type of neuron or neuroglial cell. Circle one structural feature of each cell, then give that feature and the function it supports the same number.

Pulling Away from a Hot Skillet

1. A cook brushes a hot skillet and pulls a hand away before deciding what happened. Heat and tissue stress activate receptors in the skin. A sensory neuron carries the signal toward the spinal cord. Its cell body sits beside the spinal cord, while one long process splits into branches reaching the skin and spinal cord. This layout gives the signal a relatively direct route past the cell body. In the spinal cord, an interneuron receives the message. Its many short, branching dendrites can collect signals from several neurons, helping the circuit combine information before passing a signal onward.

2. A motor neuron sends the spinal cord's response toward a forearm muscle. Many dendrites gather incoming signals near its cell body, but a single axon carries its output over a much longer distance to muscle fibers. At the axon's endings, the neuron releases a chemical messenger that triggers muscle contraction. Neurons are not the only cells on this route. Schwann cells wrap sections of peripheral axons in myelin, a fatty insulating layer. Gaps between wrapped sections allow electrical signals to be regenerated as they travel, making conduction faster than along an otherwise similar unmyelinated axon.

3. Inside the spinal cord, oligodendrocytes make myelin around axons, but one oligodendrocyte can extend branches to wrap sections of several axons. A Schwann cell usually wraps one section of one peripheral axon instead. Other glia do different work. Astrocytes have branching extensions that touch neurons and small blood vessels. This position helps them supply nutrients and regulate the chemical environment around synapses, where neurons exchange messages. Microglia have flexible branches that survey spinal cord tissue. When cells are injured, microglia can move toward damage and engulf debris. These support cells do not replace neurons as the circuit's signal carriers.

2 ANSWER WITH EVIDENCE

Use the passage

1. How does the sensory neuron's shape give a signal from the skin a relatively direct route to the spinal cord?

2. Compare the structures of the interneuron and motor neuron. How does each structure fit its job in the skillet response?

3. How do Schwann cells and oligodendrocytes differ in where and how they wrap axons?

4. How does the position or shape of astrocytes and microglia help each cell perform its function?

3 YOUR TURN

Your own words

A designer proposes replacing a motor neuron's long axon with a cluster of short dendrites to control a foot muscle, and removing its nearby Schwann cells. In four sentences, explain why this design would fail, how the neuron and glial cells should be arranged, and what might happen to movement.

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PART 1 · READ AND MARK

Underline each type of neuron or neuroglial cell. Circle one structural feature of each cell, then give that feature and the function it supports the same number. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How does the sensory neuron's shape give a signal from the skin a relatively direct route to the spinal cord?	**One long process splits into branches reaching the skin and spinal cord, so the signal can travel past the cell body beside the spinal cord.**
2	Compare the structures of the interneuron and motor neuron. How does each structure fit its job in the skillet response?	**The interneuron's many short, branching dendrites collect signals from several neurons. The motor neuron's long axon carries output from the spinal cord to a forearm muscle.**
3	How do Schwann cells and oligodendrocytes differ in where and how they wrap axons?	**A Schwann cell usually wraps one section of one peripheral axon. In the spinal cord, one oligodendrocyte can extend branches to wrap sections of several axons.**
4	How does the position or shape of astrocytes and microglia help each cell perform its function?	**Astrocyte extensions touch neurons and small blood vessels, helping supply nutrients and regulate the environment around synapses. Microglia's flexible branches survey tissue, and the cells can move toward damage to engulf debris.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

This design would fail because short dendrites collect incoming signals near the cell body instead of carrying output to a distant foot muscle. A working motor neuron needs a long axon extending from the spinal cord to the muscle. Schwann cells should wrap sections of that peripheral axon in myelin, with gaps that help the signal travel quickly. Without those wraps, signaling would be slower, so the muscle might respond late.

Accept explanations that accurately connect each cell's structure or location to its function. For Part 3, look for the distinct roles of dendrites, the long motor axon, and Schwann cell myelin.