Signals and Scans

Choosing tools to study the nervous system

SS24.P.5d "Describe technologies used to study the brain and nervous system.*"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each technology, circle what it measures or produces, and number the limits described in the passage. Use your marks to compare the questions each tool can answer.

Which Tool Fits the Question?

1 Imagine a goalie who keeps missing shots after a hard fall. A clinician may begin with magnetic resonance imaging, or MRI. Strong magnets and radio waves help a computer create detailed pictures of brain tissue without using X-rays. A structural MRI can reveal a change in the brain's shape, such as swelling, but it does not show the exact moment a person makes a decision. Functional MRI, or fMRI, uses the same kind of scanner to track changes in blood oxygen. Active brain areas tend to need more oxygen, so fMRI helps researchers estimate which areas are engaged during a task.

2 Timing matters when the goalie sees a puck and moves a hand. Electroencephalography, or EEG, uses electrodes placed on the scalp to record patterns of electrical activity produced by groups of brain cells. Its readings can show changes that happen within milliseconds. A researcher could compare the electrical patterns just before and after a flash of light. EEG is useful for studying when a response occurs, but the skull and scalp blur signals. As a result, EEG usually cannot locate the precise source of activity deep inside the brain. It records signals; it does not read thoughts.

3 Not every nervous system question begins in the brain. If the goalie has numb fingers after a wrist injury, a clinician might order a nerve conduction study. Small electrodes deliver a brief electrical pulse to a nerve and record the response farther along its path or in a muscle. The time and strength of that response help show whether the signal travels normally through a peripheral nerve. This test can identify a problem along the tested nerve, but it cannot map activity across the whole brain. Choosing a tool depends on whether the question concerns structure, location of activity, timing, or nerve signaling.

2 ANSWER WITH EVIDENCE

Use the passage

1. A clinician suspects swelling after the goalie's fall. Describe how structural MRI could help and what it cannot show about a decision.

2. What change does fMRI track, and how does that help researchers study brain activity?

3. How does EEG measure brain activity, and why is it better for studying response timing than locating a deep source?

4. How would a nerve conduction study test the goalie's numb fingers, and what part of the nervous system would it assess?

3 YOUR TURN

Your own words

Invent a question about the brain or nervous system during an everyday activity not described in the passage. In 4 to 5 sentences, describe two technologies you would use, what each would measure, and one limitation of your plan.

ANSWER KEY

Signals and Scans

HIGH SCHOOL · SS24.P.5d

PART 1 · READ AND MARK

Underline each technology, circle what it measures or produces, and number the limits described in the passage. Use your marks to compare the questions each tool can answer. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	A clinician suspects swelling after the goalie's fall. Describe how structural MRI could help and what it cannot show about a decision.	**Structural MRI produces detailed pictures of brain tissue that may reveal swelling. It cannot show the exact moment the goalie makes a decision.**
2	What change does fMRI track, and how does that help researchers study brain activity?	**fMRI tracks changes in blood oxygen. Because active areas tend to need more oxygen, those changes help researchers estimate which areas are engaged.**
3	How does EEG measure brain activity, and why is it better for studying response timing than locating a deep source?	**Scalp electrodes record patterns of electrical activity from groups of brain cells. EEG detects changes within milliseconds, but the skull and scalp blur signals from deep sources.**
4	How would a nerve conduction study test the goalie's numb fingers, and what part of the nervous system would it assess?	**Electrodes would send a brief pulse through a nerve and record the time and strength of a response farther along its path or in a muscle. The test assesses a peripheral nerve.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

When a player watches a tennis serve, which brain areas respond, and how soon does the response begin? I would use fMRI while the player watches serves on a screen to estimate which areas are active from changes in blood oxygen. I would use EEG during the same viewing task to measure the timing of electrical responses. EEG could show when a response occurs, but it could not pinpoint a deep source precisely.

Accept other accurate descriptions of what each technology measures or produces and what it cannot determine. For Part 3, the proposed activity must be new, and both tools must address the student's question.