

Neuromatrix Lesson

Motor Cortex Olympics

Introduction:

The primary motor cortex is a region of the cerebral cortex, the outer part of the brain. The motor cortex runs in a strip along the pre-central gyrus, parallel to the sensory strip. Each side of the brain has a motor strip, encoding signals to contralateral parts of the body. Other parts of your brain do the planning and guiding, and sensory feedback from the body is an important aspect of movement, but the encoding of signals to stimulate actual muscle contraction appears to come from the primary motor cortex.

When the encoding signal to move a part of your body has been made, it travels from the specific location (a group of neurons) of the motor cortex, through the nervous system, to the body part controlled, causing that part of the body to move. For instance, to lift your right index finger, the impulse passes from the spot on the motor strip in the left hemisphere dedicated to finger control down to the spinal cord, where it must synapse. The spinal cord sends a signal through your nerves to the muscles in your finger, prompting it to lift.

The motor cortex has been mapped. The more complex the body part, the more space allocated to it on the motor strip.

Web sites for Further Study:

Probe the Brain, Mapping the Motor Cortex: A History
A Science Odyssey produced by PBS
<http://www.pbs.org/wgbh/aso/tryit/brain/mapcortex.html>

Description of the basic motor pathway
Produced by Washington University School of Medicine
<http://thalamus.wustl.edu/course/basmot.html>

Description of the motor pathway
Brainconnection is produced by Scientific Learning, Oakland CA.
<http://www.brainconnection.com/topics/?main=anat/motor-anat>

Lesson Objectives:

Learn how the motor cortex controls the movements of your body's muscles.

Learn how some areas of your body such as your lips or your fingers occupy bigger areas on the cortex map than do parts of your body, such as your legs or back.

Game Objective:

Unscramble the signals to Monique's motor cortex.

Students will learn:

The motor cortex part of the brain controls the body's voluntary muscle movement.

Certain areas of the body such as the lips and fingers occupy larger areas on the motor cortex area of the brain than other parts of the body such as the legs and the back. How to connect the motor cortex, which controls the movement of various muscles in the body as they move while doing sports.

Major Concept:

The motor cortex sends instructions to muscles to cause voluntary movements.

Standards:

1. National Science Education Life Science Standards Levels 5-8: Structures and functions in living systems.
2. NSE Standards: Science as Inquiry: Abilities necessary to do scientific inquiry and understandings about scientific inquiry.

California State Language Arts Standards: Grade 6

Writing

Organization and Focus

1.1 Choose the form of writing (e.g., personal letter, letter to the editor, review, poem, report, narrative) that best suits the intended purpose.

Research and Technology

1.4 Use organizational features of electronic text (e.g., bulletin boards, databases, keyword searches, e-mail addresses) to locate information.

Set:

The many voluntary muscle movements involved in playing a sport are controlled by the motor cortex part of the brain. In the process of playing a sport, you use many parts of the motor cortex in your brain to activate a variety of muscle movements. Through participating in this lesson activity, students become aware of the major motor cortex

areas that activate the muscles used for the movements involved in playing a sport.

Activities:

1. Sports and the Motor Cortex

Students will choose a sport they like to play and identify three main body parts that are involved in those sports.

Give each student a copy of Handout #2: Typical Sports. Working together in small groups, students will use the handout #2 as a resource and take turns discussing each group member's favorite sport. Students will determine which parts of the body are used while executing each selected sport. The group will create a chart with a list of their sports and a list of the major body parts that correspond with each sport.

Using the handout with labels for different parts of the body and the motor cortex diagram, Handout #1: Motor Cortex and the Body, students will first write the name of their sport and circle the three main body parts used while participating in that sport. Then they will connect the voluntary movement of those three major body parts involved in the sport to the corresponding parts of the motor cortex diagram by drawing lines from the motor cortex diagram to the body parts diagrammed on the same handout.

Handout #1: Motor Cortex and the Body

This handout is a diagram of the motor cortex in the brain with all sections labeled on the left half of the page and a diagram of a human body on the right half of the page. Students are asked to circle three major body parts used in their sport of choice and then draw a line to connect the body part to its corresponding section in the motor cortex.

Handout #2: Typical Sports

Students are given this handout as a guide to help them identify a sport.

Summer Sports:

swimming
diving
track & field
volleyball
basketball
cycling
football

tennis
baseball

Winter Sports:
snowboarding
skiing
figure skating
ice hockey

2. Sign Language and the Motor Cortex

When people use sign language to communicate with a deaf person, they activate the muscles that move facial, arm and hand muscles. Use the diagrams of sign language in Handout #3: Sign Language, and draw a line from the correct spot on the motor strip to the part of the body it controls.

Handout #3: Sign Language

This handout will have the hand diagrams for the alphabet on the right half of the page and a diagram of the motor cortex in the brain with all sections labeled on the left half of the page. Students will use the handout to create the names of their favorite sport and connect the hand signs to the corresponding section of the motor cortex.

First students will circle the hand signs used to sign the name of their sport. Second, they will draw lines between the circled hand signs and the corresponding motor cortex sections used to activate the muscles used in signing the name of their sport.

Play the Game:

The Motor Cortex game will give you experience with how the motor cortex functions and how it sends signals to move the muscles in different body parts.

Game Objective:

Unscramble the signals to Monique's motor cortex.

Description:

The Nanobots are mixing up the mapping of a character's motor cortex. The player probes specific spots on her motor cortex to see her reaction when a particular spot is stimulated. The player maps places on the motor cortex that correspond to the following body parts:

shoulder
arm
hand

fingers
thumb
neck
brow
eye
face
lips
jaw
tongue

End Game: When you get all 12 in the correct places, they light up and Monique's motor cortex is functioning properly again. You will be able to see how the motor cortex relates to different parts off the body.

Assessment

This assessment has two parts:

1. Each student will draw a diagram of the motor cortex and label each area. The student will circle the parts of the motor cortex that are used to activate each muscle movement involved in a sport different from the sport they used in the activities.
2. Each student will write a descriptive paragraph that illustrates the diagram.