

# Homunculus: “Little Man” Role Play Activity 1F

## Activity Objectives:

Using Role Cards and a Homunculus Man Diagram, students will be able to:

- ▼ investigate neural pathways in the body.
- ▼ identify and describe sensory and motor pathways.

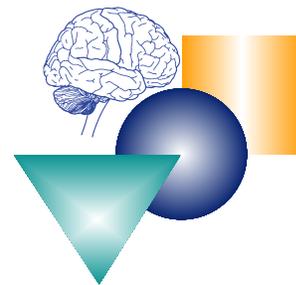
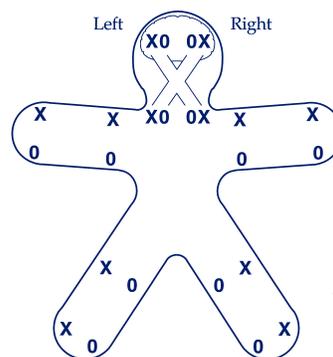
## Activity Description:

In this activity, students will role play how messages are passed from different parts of the body to and from the sensory and motor areas of the brain. Students will use the sheet titled “**The Little Man Role Play**” in conjunction with this activity. After the students participate in this activity, they will complete the *Student Data Page*. This will allow them to check their understanding of the paths that neurons take to and from the brain.

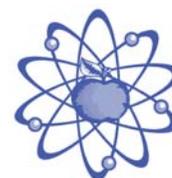
## Activity Background:

In the rearmost portion of each frontal lobe of the brain is a motor area, which helps control voluntary movement. Just behind this area, in the front part the parietal lobe, is the sensory area which also receives information about temperature, touch, pressure, and pain. The sensory and motor areas communicate with each other to control input of sensations from the body and to take appropriate motor action. Planned movements are controlled by the motor area. Our motor area sends signals down nerves to our muscles to tell them to move. Delicate movements need more brain power than big ones, so our lips and hands have larger areas of the homunculus controlling them than our legs. Because the left side of our brain controls the right side of our body, every time we want to move our right hand it is our left brain that is doing the work. Conversely, every time we want to move the left side of our body, it is the right side of the brain that controls it.

The body is “*mapped out*” on the surface of the brain in an image called a homunculus (or “*little man*”). The head and hands have the largest areas near the midline on the sensory and motor strips. The trunk of the body and legs are represented more laterally (away from the midline).



# Activity Overview



LESSON 1  
ACTIVITY 1F

The ability to detect cold, hot, pain, and pressure helps us survive. We have sensory nerves that run from our skin and muscles to our spinal cord. The messages are eventually carried to the part of our brain called the sensory area. It is here that our brain interprets these messages. If we burn our left hand, it is our right side of the brain that recognizes it as pain, and signals a response to the hand to move, by way of motor neurons.

The following activity “**Homunculus or the ‘Little Man’ Role Play**” is designed to illustrate how messages are transmitted from the body to the brain and then followed by appropriate actions. The activity involves the whole class and, after some practice, is characterized by its speed and interactions.

### Activity Materials: (per class)

- Index cards (at least 24)
- Clothespins
- 10 envelopes
- 1 copy of *Student Data Page* (per Student)

### Activity Instructions:

1. **Construct role cards for the students.** (This activity can involve up to 24 students. If you have fewer students, eliminate the roles for the neurons in the legs and arms.)

Have students write each of the roles on a separate index card. A clothespin may be used for the student to attach their role card to themselves where it is easily seen by the other students. It is recommended that the sensory neuron cards be written in red and the motor neurons in blue. As an alternative, use red cards for sensory neurons and blue for motor neurons.

### Role Assignments:

#### *Brain*

right motor neuron in brain  
left motor neuron in brain  
right sensory neuron in brain  
left sensory neuron in brain

#### *Spinal cord*

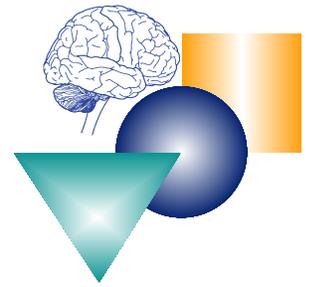
left motor neuron in spinal cord  
left sensory neuron in spinal cord  
right motor neuron in spinal cord  
right sensory neuron in spinal cord

#### *Hands*

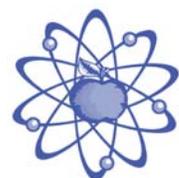
motor neuron in right hand  
sensory neuron in right hand  
motor neuron in left hand  
sensory neuron in left hand

#### *Legs*

motor neuron in left leg  
sensory neuron in left leg  
motor neuron in right leg  
sensory neuron in right leg



# Activity Overview Continued



LESSON 1  
ACTIVITY 1F

# The Brain: It's All In Your Mind

### *Arms*

motor neuron in right arm  
sensory neuron in right arm  
motor neuron in left arm  
sensory neuron in left arm

### *Feet*

motor neuron in left foot  
sensory neuron in left foot  
motor neuron in right foot  
sensory neuron in right foot

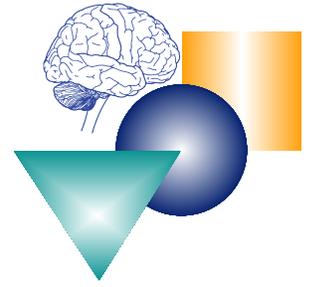
## 2. Prepare envelopes.

- A) Number each envelope 1 through 10. Photocopy and cut the envelope labels from the handout provided. Tape these on the outside of the envelope.
- B) Next, photocopy and cut the messages from the message page. Place the corresponding message into its envelope. For example, message #1 goes into envelope #1. Close each envelope.

## 3. Review the background information below with the students prior to performing the role play.

The homunculus or *“little man”* represents the sensory area of the cerebral cortex that interprets pain, touch, temperature, pressure and the motor area of the cerebral cortex which acts on the sensory inputs. Each hemisphere of the cerebrum controls the sensory and motor functions of the opposite side of the body. Sensory neurons carry messages toward the brain and/or spinal cord. Sensory neurons are found in the skin and other sense organs besides the brain and spinal cord. Motor neurons carry messages away from the brain. Motor neurons may be found in muscles as well as the brain and spinal cord.

Messages from one side of the body must cross over to the opposite side of the brain. When messages leave the sensory or motor areas of the brain, they also cross over to the opposite side of the body. Messages involving motor neurons cross over at the brain stem above the spinal cord. Messages involving sensory neurons cross over in the spinal cord. Messages from sensory neurons from the upper part of the body cross at the upper part of the spinal cord. Messages from sensory neurons from the lower part of the body (legs and feet) cross over at the lower part of the spinal cord. These cross over sites are designated on the diagram provided for the teacher. Even though there are several cross over sites in the spinal cord for sensory pathways, only one cross over site will be used for sensory pathways in the spinal cord to simplify this concept.



# Activity Overview Continued



LESSON 1  
ACTIVITY 1F

## The Brain: It's All In Your Mind

***Teacher note:***

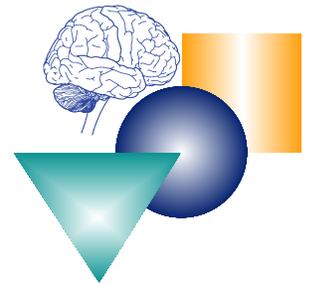
The students will simulate messages following a sensory pathway into the spinal cord and brain. The messages will be transferred to neurons that originate in the motor area of the brain and travel along a motor pathway to the muscles. The sensory neurons and motor neurons appear together in a spinal nerve and are called mixed nerves. There are 31 pairs of spinal nerves that branch off the spinal cord. The sensory pathway made up of sensory neurons leads into the spinal cord along the dorsal or backside of the spinal cord while the motor pathway made of motor neurons leads away from the spinal cord along the ventral, or front side, of the spinal cord. Messages involving the face will not be used in the role play since some of the twelve pairs of cranial nerves branching off the brain are sensory, some are motor, and some are mixed nerves like the spinal nerves.

**4. Arrangement of the students for role play**

Before beginning the activity, assign the roles to the students. Use the diagram provided to arrange the students to represent the neurons in different regions of the human body: brain, spinal cord, hands, arms, legs, and feet. It is recommended that the teacher draw a simple outline of the human body on butcher paper or use masking tape or chalk to outline the human body on the floor as shown in the diagram. The teacher may wish to do this activity outside. The students are to be positioned on an **X** or **O** according to their role card they are assigned. Each **X** represents a sensory neuron, and each **O** represents a motor neuron. If you have fewer than 24 students then it can be adapted by eliminating the neurons of the arms and legs, and the activities of the arms and legs (3, 8, 9, 10).

**5. Give the students the following guidelines:**

- A. We will role play neuron pathways to and from sensory and motor areas of the brain (specifically, the cerebral cortex). Each of you will be neurons who will take their positions on the diagram representing the human body.
- B. The teacher will give an envelope to one of the neurons. When a neuron receives an envelope, the neuron reads and performs the task written on the outside of the envelope.
- C. The whispering of any messages along sensory and motor neurons represents messages traveling across neuronal pathways.
- D. Only neurons in the brain can open and read messages in an envelope since the brain interprets messages for the body. When a brain neuron receives an envelope, the neuron will read and follow the directions on the message. After the brain interprets the message, the brain keeps the envelope.
- E. Students representing the brain or spinal cord neurons may be involved in the crossing over of messages from one side on the body to the other side of the body. The motor and sensory cross



# Activity Overview Continued



LESSON 1  
ACTIVITY 1F

The Brain: It's All In Your Mind

over sites in the spinal cord are indicated on the diagram. When a cross over occurs, the neurons starting the cross over must say out loud, “crossing over,” to alert the other neurons what is occurring in the pathway.

***Teacher note:***

It is recommended that the teacher practice with the students using envelope #1. The teacher starts with envelope #1 and hands it to the appropriate student. After each simulation, ask a student to volunteer to explain the complete pathway that was demonstrated. The student should name the neurons involved. Continue handing the next envelope to the appropriate student after each pathway is simulated. The teacher may have the students demonstrate several messages being interpreted by the brain at the same time by handing out envelopes #1, #2, #4, and #7 at the same time. Students should not start the messages traveling until the teacher gives the signal. Ask the students how they felt when they realized they were going to be involved in helping a message travel. The students’ responses should indicate feeling nervous or excited. Tell them the term “excited” is used when neurons are carrying messages in the body. The answers to the pathways students should simulate follow.

**Activity Management Suggestions:**

- 1. To save paper, students can practice tracing several pathways on their copy using a different color each time.
- 2. White boards can be used for tracing Homunculus Man onto the boards with permanent markers. Students can trace pathways with erasable markers.

**Modifications:**

*For students needing more assistance:*

Group these students with peers who can assist them during the activity. Check often for understanding.

*For highly able students:*

Allow these students to do research on the effects of drugs and neurological diseases on neural pathways.

**Extensions:**

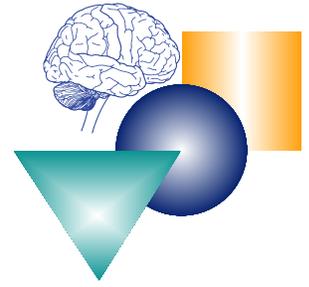
Students can research disorders involving the neural pathways.

**Suggested References:**

National Institutes of Health Medline Plus  
<http://medlineplus.gov/>

Neuroscience for Kids

<http://faculty.washington.edu/chudler/neurok.html>



**Activity Overview Continued**



## Envelope Labels

**#1 for sensory neuron in right foot**  
pass envelope along sensory pathway to brain

**#2 for sensory neuron in left hand**  
pass envelope along sensory pathway to brain

**#3 for sensory neuron in right arm**  
pass envelope along sensory pathway to brain

**#4 for right motor neuron brain**  
open envelope and read message

**#5 for right and left motor neurons of brain**  
open envelope and read message

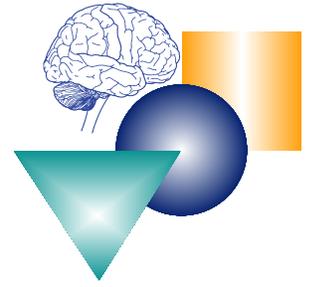
**#6 for left motor neuron of brain**  
open envelope and read message

**#7 for sensory neuron in left foot**  
pass envelope along sensory pathway to brain

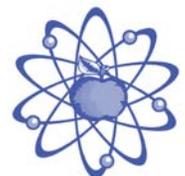
**#8 for sensory neuron in left arm**  
pass envelope along sensory pathway to brain

**#9 for sensory neuron in right leg**  
pass envelope along sensory pathway to brain

**#10 left and right motor neuron of brain**  
open envelope and read message



# Activity Overview Continued



LESSON 1  
ACTIVITY 1F

The Brain: It's All In Your Mind

## Messages (tasks) Inside Envelopes

**#1** Left sensory neuron in brain (say out loud):  
"My right foot feels so cold in ice water."

*Hand envelope and message to left motor neuron of brain.*

Left motor neuron in brain whispers to right motor neuron in spinal cord:

"Shake right foot to warm it up, pass it on."

**#2** Right sensory neuron in brain (say out loud):  
"Ouch! I touched a tack."

*Hand message to right motor neuron in brain.*

Right motor neuron of brain whispers to left spinal cord motor neuron:

"Shake left index finger, pass it on."

**#3** Left sensory neuron in brain (say out loud):  
"I feel someone pinching me on my right arm."

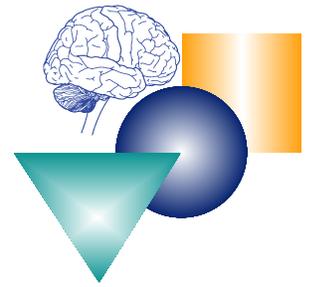
*Hand message to left motor neuron of the brain.*

Left motor neuron of brain whispers to right spinal cord motor neuron:

"Move your right arm, pass it on."

**#4** Whisper to left spinal cord motor neuron:  
"Tap your left foot 10 times, pass it on."

**#5** Whisper to right and left spinal cord motor neurons:  
"Shake your right and left hand, pass it on."

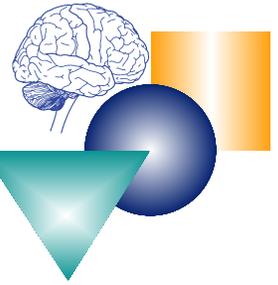


# Activity Overview Continued



LESSON 1  
ACTIVITY 1F

## The Brain: It's All In Your Mind



**#6** Whisper to right spinal cord motor neuron:  
"Pull on ear lobe with your right hand, pass it on."

**#7** Right sensory neuron in brain (say out loud):  
"I feel a spider crawling on my foot."

*Hand envelope and message to right motor neuron in brain.*

Right motor neuron in brain whispers to left motor neuron in spinal cord:

"Move right foot, pass it on."

**#8** Right sensory neuron in brain (say out loud):  
"My dog licked my left arm."

*Hand envelope and message to right motor neuron in brain.*

Right motor neuron in brain whisper to left motor neuron in spinal cord:

"Pat the dog with your left hand, pass it on."

**#9** Left sensory neuron in brain (say out loud):  
"A big yellow bumble bee stung my left leg."

*Hand envelope and message to left motor neuron in brain.*

Left motor neuron in brain whisper to right motor neuron in spinal cord:

"Shake right leg, pass it on."

**#10** Right and left motor neurons in brain (say out loud):  
"I am going to do three jumping jacks."

*Whisper to left and right spinal cord neuron:*

"Move your arms, legs, hands, and feet to do three jumping jacks, pass it on."



LESSON 1  
ACTIVITY 1F