Science Unit: *Human Anatomy – How Do We Move?*

Lesson 6: *The Nervous System*

School year:	2007/2008
Developed for:	Henderson Annex Elementary School, Vancouver School District
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Grade level:	Presented to grades 3-5; suitable for 3-7 with age-appropriate modifications but optimally matches Grade 5 curriculum.
Duration of lesson:	1 hour and 15 minutes

Objectives

1. Learn about the nervous system .
2. Conduct an experiment to measure reaction time.

Background Information

This is the sixth in a six-part series of "Human Anatomy" activities that all focus around the question: "How Do We Move?" The first session focused on the skeletal system, the second session focused on the muscular system, the third session focused on the circulatory system, the fourth focused on the respiratory system and the fifth focused on the digestive system.

Vocabulary

brain	the organ found inside your skull that is used to control the rest of your body
neuron	cell of the nervous system; they transmit messages
spinal cord	made up of a bunch of neurons, the spinal code transmits messages from your brain out to the rest of your body, and from the rest of your body back to your brain
neurotransmitter	special chemical that is released from one neuron to another (or to a muscle or other cell) to pass along a message
central nervous system	brain and spinal cord together

Materials

- pieces of paper with the word "neurotransmitter" written on them
- rulers

In the Classroom

Introductory Discussion

1. Ask students:
    - What do you know about your brain? What does your brain do?
    - What do you know about your spinal cord?

2. Short description of other items to discuss or review.

    - The **brain** is the "master control" centre of the body. Everything we do is controlled by messages sent from the brain. This includes both things we do voluntarily (e.g., moving your arms, running around) and things that our body does without us having to think about it (e.g., the beating of your heart, breathing, digesting food). Note that breathing is something that can be controlled both without us thinking about it sometimes and voluntarily (e.g., you can decide to take a deep breath, or hold your breath for a short time) at other times.

    - The brain contains 100 billion nerve cells (a.k.a., neurons) and trillions of support cells (a.k.a. glial cells).

    - The brain sends messages to the rest of the body by passing the messages from one nerve to another. The message gets passed along to the nerves in the **spinal cord** and then out to nerves in our body. For example, a message can be passed along from the brain, down the spinal cord and out to nerves in your leg that then pass the message to your muscle cell – the message would be "move your muscles!"

3. Briefly describe activity.

    - We are going to act out the steps of the nervous system passing along a message from the brain to the muscle cell.

    - Students will represent brain cells, neurons in the rest of the body and a muscle cell.

    - Then we will conduct an experiment to test our reaction time.

4. The students will practice conducting a scientific experiment (making a prediction, recording observations and drawing a conclusion).

Science Activity

Activity Title: Modeling the nervous system

Students will act out how the nerve cells in the nervous system pass along a message from the brain to the muscles. The students will line up in a row, each representing a nerve cell along the pathway from the brain to the muscle. Each student will be given a piece of paper with the word "neurotransmitter" on it. The brain will start the reaction by passing their piece of paper that says "neurotransmitter" on it to the first "neuron." The first neuron will then pass their piece of paper that says "neutrotransmitter" on it to the second "neuron" in the chain. Note that it is very important that the students can only pass the "neurotransmitter" that they started with – they cannot pass along the "neurotransmitter" that the other neuron gave to them. This process continues all the way along to the end of the chain. The last student in the chain is the muscle cell – when they receive the neurotransmitter, they receive the message that it's time to move!

Science Experiment

1. In this experiment, students will measure their reaction time. "Reaction time" refers to the amount of time it takes for a person to react to something – in this case, it refers to the amount of time it will take someone react to a ruler being dropped – one student will drop a ruler between the fingers of another student, who will them have to catch it.

2. Review the process that will be happening: when student #1 drops the ruler, student #2 will see it start to drop. A message will be sent from student #2's eyes, along neurons, into the part of the brain that controls the movement of muscles in the student's hand; a message will then be sent from student #2's brain, along neurons, down their spinal cord and out to the muscles in their hand; the "message" will be for the hand to close to catch the ruler. The "reaction time" is the time it takes for all of this to happen.

3. Divide the class into groups of two students each.
4. Have students make a prediction (i.e., hypothesis) about whether their reaction time will be faster with their right hand or their left hand and record this prediction on their worksheet.
5. Students will each have the opportunity for fourth tries with their right hand and four tries with their left hand.
6. Student #1 will hold the ruler vertically between the fingers of student #2. It is important that they hold the ruler with the very bottom of the ruler aligned with student #2's fingers (to ensure a consistent starting point each time) and that the 0 cm mark of the ruler be at the bottom.
7. Student #1 drops the ruler and student #2 catches the ruler as fast as they can.
8. Students record the point at which they caught the ruler ("catch distance") in cm on the worksheet.
9. Using the conversion chart on the worksheet, students can translate their catch distances into a measure of how much time it took them to react.
10. Since reaction time improves with practice, students will use their fourth time as their official reaction time.
11. Students compare their prediction with their results and discuss.

Closure Discussion

1. What did you learn about how neurons work from the activity where we pretended that we were neurons passing along a message?
2. What did you learn from conducting the reaction time experiment?
3. How does the nervous system work with all of the other systems that we have learned about in the past six weeks to help us move?

References

1. Nifty Neurons http://faculty.washington.edu/chudler/bex/4nt1.pdf. The worksheet for this lesson plan was adapted from this source. This source gives permission to use this material for noncommercial, educational use and requires attribution of it as the source.
2. Neuroscience for Kids. <http://faculty.washington.edu/chudler/bex/4rt2.pdf> Eric H. Chudler. Accessed 11 March 2008.

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Extension of Lesson Plan

1. Show the kids a magnetic resonance imaging (MRI) image of the brain
2. To work on mathematics skills, students can calculate the average of their fourth attempts with each hand.
3. The Neuroscience for Kids website has online reaction time tests that students can try: .(http://faculty.washington.edu/chudler/chreflex.html - at the bottom of the page)

Name: _____ Date: _____

Prediction:
I think my reaction time will be faster with my (right/left) _____hand

Observations:

You will measure your catch distance 4 times with your right hand and 4 times with your left hand.

Right Hand

	Catch Distance (in cm)	Reaction Time (in milliseconds)
1		
2		
3		
4		

Left Hand

	Catch Distance (in cm)	Reaction Time (in milliseconds)
1		
2		
3		
4		

Use the 4th catch as your official reaction time.

My right hand reaction time is _____ milliseconds.

My left hand reaction time is _____ milliseconds.

Conclusions:

Which hand has a faster reaction time – your right hand or your left hand? Was your prediction correct? Why was one hand faster at catching the ruler than the other hand?

_____

_____

_____

Distance & Time Chart

Catch Distance (in cm)	Reaction Time (in milliseconds)
5	100
6	107
7	114
8	121
9	128
10	135
11	142
12	149
13	156
14	163
15	170
16	177
17	184
18	191