Investigation of the Human Brain

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Grade level: 6-8 (7)  Time required: Two 60 minute sessions

Keywords: science, brain, anatomy, neuron, signals

Summary
Students will learn about the parts and functions of the human brain. They will also learn about neurons and the important role they play in signal communication.

Learning Objectives
After completing the lessons, students should be able to:
• Identify major structures and functions of the human brain
• Identify major structures of a neuron
• Understand the process of communication within the human brain

Wisconsin Educational Standards Covered
A.8.1 Develop their understanding of the science themes by using the themes to frame questions about science-related issues and problems
C.8.1 Identify* questions they can investigate* using resources and equipment they have available
F.8.1 Understand the structure and function of cells, organs, tissues, organ systems, and whole organisms
F.8.6 Understand that an organism is regulated both internally and externally
HSF1.a.4.m Determine the difference between tissues, organs, and systems of the human body.
HSF1.a.6.m Describe the functions of each organ system.
HSF1.c.m Create diagrams, charts, graphs and tables to communicate information.

Lesson Plan Details
Lesson 1: Brain Structure and Function
Begin by asking students to write down a list of things they are doing right now. Give the students 2-3 minutes to complete their list. When the time is up, ask the students to raise their hands and tell you what they came up with. If the students do not come up with enough ideas, give them a few examples to push them in the right direction. (Examples include: sitting, thinking, breathing, listening, regulating body temperature, maintaining heart rate, blinking, tapping their foot, keeping their balance, fighting germs, etc.) Ask the students how they think they are able to do all of these things at once. How can they control all of these different actions within the body? (Answer: Their brains!!)

Lecture:
Go through the different structures of the brain and their functions. Start with four main structures: the cerebrum, the cerebellum, the limbic system, and the brain stem. When
discussing the cerebrum, talk about the cerebral cortex and its main lobes: frontal, parietal, temporal, and occipital. Make sure to also mention the motor and somatosensory cortices. When discussing the limbic system, discuss the thalamus, hypothalamus, amygdala, and hippocampus. When discussing the brain stem, explain the midbrain, pons, and medulla. Use plenty of diagrams and charts to help make the explanation easier. Some examples are included below:

Left figure taken from: http://www.slideshare.net/REXTEC/lesson-12-main-parts-of-the-brain
Right figure taken from: https://sites.google.com/a/sudbury.k12.ma.us/ecms-school-counseling/the-middle-school-student/Yourchildsbrain/brain-parts-and-functions

Left figure taken from: http://thinktankcentre.blogspot.com/2015/08/the-limbic-system.html
Right figure taken from: https://cnx.org/contents/FPtK1zmh@8.25:fEI3C8Ot@10/Preface

**Activity:**
Set up a round of ‘Jeopardy’. This can be easily created using Power Point. You can create a slide with a grid of boxes. You can set up columns of different categories to give students a hint about what area of the brain the question will be from, or just give the columns numbers/ letters to make it harder. Within each column, have boxes of different point values. When clicked, the box will lead to another slide. Assign either a brain structure or function to each box that will show on the new slide, and when chosen, the students must give the
corresponding function or structure. Split the class into two groups. Keep track of points and give the winning team (or both teams) a treat!

Lesson 2: Neurons

Start an open discussion with the class by asking how they think their brain processes so much information at once and can control so many different things at once. Allow them time to discuss either with one another or as a class. Then ask how they think the brain communicates with itself and with the rest of the body.

Lecture

Begin the lecture by discussing a single neuron, or nerve cell. Describe the different parts including the dendrites, cell body, nucleus, axon, and axon terminals. Describe the synapse as the connection between two neurons. They are actually connected by a gap between the two neurons called the synaptic cleft. Explain a simple version of the process by which signals move through the brain. The dendrites of a neuron receive a chemical signal from the axon terminals of the previous neuron. If the signal is strong enough, an electrical signal is generated, which travels down the axon of the neuron until it reaches the axon terminals, where it sends a chemical signal to the next neuron. Explain that a coating around the axon called the myelin sheath helps the signal travel faster.

Explain that there are 100 billion neurons in the brain and they are each connected to many other neurons creating over 1,000 trillion synaptic connections. This is how our brain communicates and maintains all our body functions at once while keeping track of memories and analyzing the world around us from all of our senses. Explain that the brain receives a message from the body, analyzes that message, decides on a response, and sends a message of the correct response to the body. Use the example of a hand on a hot stove. Body sends message of pain, brain receives and analyzes the message, tells body to move the hand. Again, use images and videos to supplement the lecture. Some are included below.

Figure taken from: https://askabiologist.asu.edu/neuron-anatomy
Activity:

Print out some simple black and white diagrams of neurons. It would probably be best to laminate the sheets as well. Cut out the different parts of the neuron: dendrites, cell body, axon, and axon terminal. Put two of each of these parts into a plastic bag. Also include part labels in each bag, as well as small circles to mimic neurotransmitters (chemical signals) and an arrow to mimic electrical signals. Split the class up into groups and have them put together the neurons, label them correctly, and demonstrate the process by which a signal moves from one neuron to another. Have the groups brainstorm what kind of signals could be traveling through their brains (e.g., sight, smell, touch, sound, taste, pressure, pain, thoughts, etc.). Have the students share what they came up with to the class.