Introduction:
Why do you feel like an alien in your body? Why don’t your parents understand you? Why don’t your teachers understand you? Brothers and sisters don’t understand you. Often your peers can’t connect with what is going on in your head. Even you don’t have a clue why you said what you said, or did what you did. So what’s happening?

Objective: Using a webquest, students will develop their own portfolio on topics in neuroscience. It is an inquiry-based search that requires students to create their own drawings, tables. They will also answer questions as they explore topics related to neurobiology. At the completion of the quest project, students will have compiled a resource document that is a personal learning tool, and acquired a background on the topic that will help answer some of the questions posed in the introduction. It is a process of taking ownership in what you learn.

TOPIC SEQUENCE

A. The Big Picture: A look at your brain and its parts
B. Close Up Picture: The neuron and neurotransmitters
C. Getting the Picture: Technology used to “see” the brain
D. How is your brain changing?
E. Where in your brain are the changes happening?
F. What might these changes mean in terms of how you think, learn, and your behavior?
A. The Big Picture

A look at your brain and its parts:

Click on the URL below.

http://faculty.washington.edu/chudler/nsdivide.html

Read “The Central Nervous System”. Answer the following questions.

1a. How many parts make up the central nervous system?
2a. How much does an adult brain weigh?
3a. How many nerve cells are there in the brain?
4a. Are there any other special cells in the brain?
5a. What are they?

Click below to learn more about your brain and it’s parts.

http://uwf.edu/jgould/Cortex.jpg

*Make a drawing of the brain with it’s spinal cord: follow Making Your Drawing Guidelines. Label all the parts.
*Construct a table showing what each part does: follow Constructing a Table Guidelines.
B. A Close up Picture

The Neuron:

Click on the link below and scroll down to the paragraph that begins with Neurons. Read about neurons and glial cells.

http://www.mind.ilstu.edu/curriculum2/neuro/neuron_1.html

1b. What is a neuron?
2b. What does it do?
3b. About how many neurons are there in the human brain?
4b. Are neurons the only kind of cell in the brain?
5b. Give an example of another cell in the brain and what it does.

Structure of Neuron:

Examine the different types of neurons in the diagram of drawings done by Cajal.

6b. Do all neurons look the same?
7b. Generally, there are three types of neurons. What are they and what do they do?

Read about the parts of a typical neuron.
*Construct a table that lists and describes the “typical” parts of a neuron.
*Using the example in the article as a guide, draw a neuron and it’s connections to and from another neuron. Label all the parts.
Neurotransmitters:

Click on the link below.

http://www.thebrain.mcgill.ca/flash/i/i_01/i_01_m/i_01_m_ana/i_01_m_ana.html#2

Read about the synapse and its parts.

*Using the example on this page as a guide, draw and label a synapse between two neurons. Label only the following parts: (a) the axon, (b) vesicles, (c) neurotransmitters, (d) the synaptic cleft or gap, (e) membrane receptors (f) the dendrite

(Can’t find all the parts? Go back to your notes and drawing of a neuron.)

Click on the link neurotransmitters

*Construct a table for the listed neurotransmitters.

When constructing the table consider the following questions.

What column headings do you think would be needed for you and your classmates to clearly understand something about neurotransmitters?

Do you think they need to know the molecular structure or is it more important to know what they do and problems that might occur?

8b. According to this site, how many molecules meet the criteria for being a neurotransmitter?
C. Getting the Picture

A number of ways of “seeing” your brain


1c. List five technologies used to scan the brain. Include their acronyms. (Sentences are not required for this answer.)

1.
2.
3.
4.
5.

Click on the EEG arrow.
Read about EEGs and answer the following questions.

2c. Who was the first person to use this kind of technology?
3c. Where and when did he do this?
4c. Are images of the brain “seen” with this technology?
5c. What are researchers actually observing?
6c. What is the disadvantage of using this method for observing the brain
Select the Scan type CAT.

7c. When was this technology developed?
8c. This technology creates 3-dimensional images from what kind of 2-dimensional imaging technology?
9c. What can CAT scans detect?

Select the Scan type PET.

10c. When was this technology developed?
11c. What advantage does this technology have over earlier techniques for observing the brain?

Select the Scan type MRI
Take the tour of an MRI machine.

12c. What element in the body is affected by the magnets in the MRI machine?
13c. After the atoms return to their natural alignment having released their energy, what instrument is used to produce the image?
14c. What advantage does the MRI scan have over the PET scan for the subject?

Select the Scan type MEG

15c. What does MEG detect from the brain?
16c. What is the name of the sensitive instrument that detects the brain’s magnetic field?
17c. Although expensive and heavy, what can it do that makes it an important brain scanning method?
D. How is your brain changing?

Click on this link

http://www.nimh.nih.gov/publicat/teenbrain.cfm

Read the first three paragraphs of Teenage Brain: A Work In Progress. You may want to print a copy. After reading this part of the article, answer the following questions.

1d. What do scientists mean by the principle of “use-it-or-lose-it” when talking about how neurons connect?
2d. What is gray matter? (For more information select the link to the picture above.)
3d. What is a possible explanation for increased growth of gray matter in early puberty (age 11 to 12)?
4d. What technology is used by neuroscientists to observe the growth and pruning in the teenage brain?

Click on this link
http://www.loni.ucla.edu/~thompson/DEVEL/dynamic.html

Read the short abstract/press release Time-Lapse Imaging Tracks Brain Maturation Ages 5-20. Then examine Figure 1. You might want to click on the High Resolution Image link to get a closer look at the areas that are losing gray matter. As neurons are making their more permanent adult connections neurons go through a pruning process. Refer back to the principle of “use-it-or-lose-it”.

5d. Gray matter wanes (lessens) in which direction as the brain is pruned, back to front, or front to back?
E. Where in your brain are the changes happening?

Staying on this site and continue answering the following questions. (If you need them, refer back to your brain drawing and function table).

1e. Which parts (lobes) of the brain begin these changes first?
2e. Can you name a function in that area that would be affected?
3e. Which region of the brain changes last?

Click on this link
http://www.pbs.org/wgbh/pages/frontline/shows/teenbrain/work/adolescent.html

Scroll down to Changes in the Prefrontal Cortex
Read this section, which is part of an interview with Dr. Jay Giedd, whose research using MRi technology revealed an extensive amount of information on the developing teenage brain.

4e. Identify three functions of the prefrontal cortex.
5e. Identify three functions that improve as the teenage brain matures.
6e. Why is pruning synapses and losing gray matter important for brain development?

F. What might these changes mean in terms of how you think, learn, and your behavior?

View a video clip from “Inside the Teenage Brain”.
Click on the link
http://www.pbs.org/wgbh/pages/frontline/shows/teenbrain/view/

Select video clip 4. “You Just Don’t Understand.”
Select video clip 3. “Mood Swings”.

Having completed your webquest there is one final question.
Do you think you could answer any of the questions posed in the Introduction?

WEBQUEST FINISHED