**WebQuest: The Structure of the Nervous System**

The nervous system consists of three parts: the Brain, the Central Nervous System, and the Peripheral Nervous System. The Brain is the command center, the Central Nervous System is the brain and the spinal cord, and the Peripheral Nervous System consists of the nerves going from the spinal cord out to your body. Draw and label each of these parts on the diagram below:

**The Brain**

Go to the following web site and follow the instructions below:

http://serendip.brynmawr.edu/bb/kinser/Structure1.html

**The Cerebrum**

The cerebrum or cortex is the largest part of the human brain, associated with higher brain function such as thought and action. The cerebral cortex is divided into four sections called "lobes": the frontal lobe, parietal lobe, occipital lobe, and temporal lobe.

1. On the diagram below, label the four lobes of the cerebrum.

List the function of each of the lobes of the cerebrum.

Frontal Lobe:

Parietal Lobe:

Occipital Lobe:

Temporal Lobe:

1. Label the cerebellum on the diagram above.
2. What does the cerebellum do?
3. The limbic system is often referred to as the \_\_\_\_\_\_\_\_\_\_\_\_ brain.
4. Where is the limbic system found?

6. List the function of each of the parts of the limbic system:

Thalamus:

Hypothalamus:

Amygdala:

Hippocampus:

1. Label the Brain Stem on the diagram above.
2. What does the Brain Stem do?
3. List the function of each of the parts of the Brain Stem:

Midbrain:

Pons:

Medulla:

**Who was Phineas Gage?**

<http://www.smithsonianmag.com/history-archaeology/Phineas-Gage-Neurosciences->Most-Famous-Patient.html

1. Who was Phineas Gage and what happened to him?
2. Explain why Phineas’ personality changed due to his injury.

**Are you left or right brained?**

[www.web-us.com/BRAIN/braindominance.htm](http://www.web-us.com/BRAIN/braindominance.htm)

1. Take the Test.
2. Are you left or right brained?
3. What does this mean?
4. Read the attached information.

**The Synapse and Learning**

In this section we are going to focus on how nerve impulses travel from neuron to neuron and how we learn new things.

**NOTES:** 1. Use the PAUSE button as you go through the video if you want to slow things down.

2. Yes, I know that some of this information is a repeat of what you did in the last section.

http://outreach.mcb.harvard.edu/animations/synaptic.swf

1. Label the following parts of the neuron and describe what it is /what it does:

Dendrite, Cell Body, Axon and Axon Terminal

16. Signals are sent from one neuron to another by jumping across a tiny space or \_\_\_\_\_\_\_\_\_\_\_\_\_.

17. Label the following parts of the synapse and describe what it is /what it does:

Presynaptic Neuron, Vesicles, Calcium Channels, Synaptic Cleft,

Receptor Molecule and Postsynaptic Neuron



18. The list below is what happens when a neuron fires and sends a signal along to another neuron. Fill in the missing blanks in each statement. **(Remember to use the Pause button!)**

a. When an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ begins in a neuron, it travels down the \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

b. When the action potential reaches the \_\_\_\_\_\_\_\_\_\_\_ terminal, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

open and calcium ions rush into the neuron.

c. When calcium binds to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the vesicles carry \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ toward the presynaptic

membrane.

d. The neurotransmitter is released into the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

e. Neurotransmitter diffuses across the synaptic cleft and binds to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on the

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

f. The post synaptic neuron receptors are activated. In this case, these receptors allow \_\_\_\_\_\_\_\_\_\_\_\_\_ ions in,

causing an \_\_\_\_\_\_\_\_\_\_ potential to start in the postsynaptic membrane.

g. Neurotransmitters are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ back into the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ cleft.

**Exercises**

In this section you will learn how we learn new things. Do the exercises and answer the following questions.

19. By changing how nerves are connected, we \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_.

20. In the first exercise, the star is always \_\_\_\_\_\_\_\_\_\_\_.

21. How do we learn?

22. We have specific neurons for recognizing \_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_.

23. How did you learn to match the neurons, the star shape, and the color orange?

24. In the second exercise, what change did you make in your synapse?

**Neurons**

[www.g2conline.org](http://www.g2conline.org)

Then, search for “Virtual Neuron”. Using two neurotransmitters, balance the inputs of the neurons so that you get the primary neuron to fire. Summarize your findings from the animation.

25. List the ways that you might change a synapse.

**Nerve Impulse**

<http://www.mind.ilstu.edu/flash/synapse_1.swf>

26. Neurons communicate with other neurons at \_\_\_\_\_\_\_\_\_\_.

27. At the synapse the \_\_\_\_\_ of one neuron comes close to the \_\_\_\_ of another neuron.

28. They communicate by using what kind of messengers? \_\_\_\_\_\_\_

**Action Potential**

Access: http://outreach.mcb.harvard.edu/animations/actionpotential\_short.swf

29. Click on “Introduction” and press play. Answer the following questions:

a. What are Schwann cells and what do they do?

b. What is an “action potential”…how is electricity created during an action potential?

c. When can an action potential occur?

d. What is membrane polarity? What 2 ions create membrane polarity?

30. Click on “Resting Potential” and press play. Describe how resting potential is maintained for a cell.

Complete the resting potential exercise.

31. Click on “Depolarization” and press play. Summarize your findings below and complete the depolarization

exercise.

32. Click on “Repolarization” and press play. Summarize your findings below and complete the depolarization

exercise.

1. Click on “Return to Resting Potential” and press play. Summarize your findings below.
2. Click on “Zoom Out”. Summarize your findings below:

**Action Potential**

<http://www.blackwellpublishing.com/matthews/actionp.html>

1. View the animation. It shows the action potential moving in one direction along the axon. What is happening to the charge on the outside and inside of the cell as the action potential moves?

**Sodium/Potassium Pump**

Access: <http://sites.sinauer.com/neuroscience5e/animations04.02.html>

**Sodium/Potassium Pump**

<http://www.brookscole.com/chemistry_d/templates/student_resources/shared_resources/animations/ion_pumps/ionpump.html>

1. View the animation.
2. How many Na+ ions are being pumped out?
3. How many K+ ions are being pumped in?
4. Since the numbers are different, could this cause imbalance of charge on either side of the membrane?
5. What molecule is providing the energy for this ion transport?
6. What is the process called when particles are being transported against the concentration gradient across a membrane?

**For Fun:**

<http://www.pbs.org/wnet/brain/illusions/movement.html>

1. Click on “ACTIVATE ILLUSION” – Does the rotating spiral appear to be expanding or contracting?
2. STARE AT THIS BLACK AND WHITE SWIRL FOR AT LEAST ONE MINUTE (while its spinning), THEN LOOK AT AN OBJECT THAT IS STANDING STILL...WHAT HAPPENS?
3. Why does this happen?
4. Look at the other 2 movement illusions – describe what you see:
5. NOW CLICK ON “COLOR”
6. What do you see at the intersections of the white lines? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. Go to Illusion 2: What happens when you change from black lines to white lines?
8. NOW CLICK ON “ANGLES”
9. Do these 2 lines appear to be the same length? \_\_\_\_\_\_\_\_\_\_
10. Click on “ACTIVATE ILLUSION”: What do you see? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. Go to Illusion 2: Which line appears to be longer? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
12. Click on “ACTIVATE ILLUSION”: What do you see? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
13. Go to Illusion 3: Do the lines appear to be crooked or straight? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
14. 17. Click on “ACTIVATE ILLUSION” and turn background off: What do you see?
15. 18. Go to Illusion 5: Is this a perfect circle? \_\_\_\_\_\_\_\_\_\_
16. 19. Click on “ACTIVATE ILLUSION” and turn background off. What do you see?
17. NOW CLICK ON “FORM”
18. Is there anything wrong with Lincoln’s face?
19. Click on “FLIP THE PICTURE” and describes what happens:
20. Go to “ILLUSION 2”: Stare at the cube for at least one minute – what happens?

**http://faculty.washington.edu/chudler/nsdivide.html#cns**

1. What are the two parts of the CENTRAL NERVOUS SYSTEM?

a. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **CLICK ON “BRAIN FACTS AND FIGURES”**
2. Who has the heaviest brain? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ The lightest? \_\_\_\_\_\_\_\_\_\_\_\_\_
3. What % of a stegosaurus dinosaur’s total body weight was the brain? \_\_\_\_\_\_\_\_\_%
4. How does this compare to humans?

**http://faculty.washington.edu/chudler/vessel.html**

1. Although the brain is only about \_\_\_\_\_\_\_\_% of the total body weight in humans, it

receives \_\_\_\_\_\_\_\_- \_\_\_\_\_\_\_\_% of the body's blood supply. Because \_\_\_\_\_\_\_\_\_\_cells

will \_\_\_\_\_\_\_\_\_\_ if the supply of blood which carries \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is stopped, the

brain has\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for the blood. Even if other organs need blood, the body

attempts to supply the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ with a constant flow of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What materials does the blood bring TO the brain?
2. What materials does the blood take AWAY from the brain?
3. What is a stroke?
4. What conditions are linked to strokes?
5. How often do strokes occur in the United States? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. The brain uses \_\_\_\_\_\_\_ % of the body’s oxygen supply.