

**Activity 2.2.2: Student Response Sheet**

Complete the activity “Action Potential” found at Life Sciences/HHMI Outreach Program <http://outreach.mcb.harvard.edu/animations/actionpotential_short.swf>. Follow the directions to generate an electrical impulse down the axon of a neuron. Use information from this activity to answer the questions and complete the tasks listed below. Use the buttons at the bottom of the page to help you navigate the activity.

1. What do we call electrical messages that are sent down the axon of a neuron?

We call electrical messages sent down the axon, **action potentials**.

1. In one sentence, describe how the electricity in an action potential is generated.

The electricity in an action potential is generated when the sides of a cell membrane have opposite changes and there is a sudden change, resulting in electricity being released.

1. Draw a diagram of the cell membrane of the axon. Label the following on your drawing: **cell interior, cell exterior, Na+ channels, K+ channels, Na+/K+ pump**.

Done in lab journal.

1. The main component of cell membranes are fats called phospholipids. Use the Internet to research the structure of a phospholipid. Label a phospholipid on your diagram.

Done in lab journal.

1. What do these terms *hydrophilic* and *hydrophobic* mean and how do they relate to the structure of a cell membrane?

Hydrophilic means the substance is attracted to water. Hydrophobic is not attracted to water, it repels water. The phospholipid bilayer has hydrophilic heads that can interact with water in the cell and hydrophobic tails that repel water and deny entry in and out of the cell.

1. Return to your cell membrane diagram. Use a blue marker or colored pencil to color the parts of a phospholipid that are hydrophilic. Use a red marker or colored pencil to color in the parts of the molecules that are hydrophobic.

Done.

1. Add Na+ and K+ ions to your cell membrane drawing to show the placement of ions when the cell is at *rest*. Think about which side will have more K+ and which side will have more Na+.

Done. The interior will have more K+, the exterior will have more Na+.

1. How does the location of these ions relate to the overall membrane potential (charge) at this point? Place (-) signs on the side that is now negative and (+) signs on the side that is now positive.

In the resting position, the cell exterior which holds NA+ ions is positive and the cell interior which holds K+ ions is negative.

1. The Na+/K+ pump pumps 3 Na+ ions out of the cell for every 2 K+ ions it brings into the cell. Is this specialized protein working via active or passive transport? Explain your reasoning.

This process is driven by ATP, therefore, it is active transport.

1. What causes the inside of the membrane to reverse charge and begin the action potential?

Depolarization is the first step in changing the charge of the inside of the membrane to positive. The potassium channel is first closed to ensure that more of the negatively charge K+ does not enter the interior. Then, the sodium channel is closed to allow sodium to stay in the interior.

1. Draw a graph of the action potential broken down into four steps as in the Internet activity. Make sure to label the axes and add units. Highlight or shade each step in a different color.

Done in lab journal.

1. Beneath the graph, use the color marker or pen that corresponds to the step to describe in words what happens in the membrane during this step. Make sure to relate what is happening in the membrane to the value for membrane potential shown on the graph. Add a title to each step.

Done in lab journal.

1. Which membrane protein is responsible for restoring the original concentration of Na+ and K+?

The NA+/ K+ pump is responsible for restoring the original concentration.

1. What happens when the action potential reaches the end of the axon at the axon terminals? How does one neuron communicate with another neuron and complete the circuit?

When the action potential reaches the end of the axon terminal, it transfers the message to another neuron. The dendrites of the other neuron pick up the message to send down its axon.