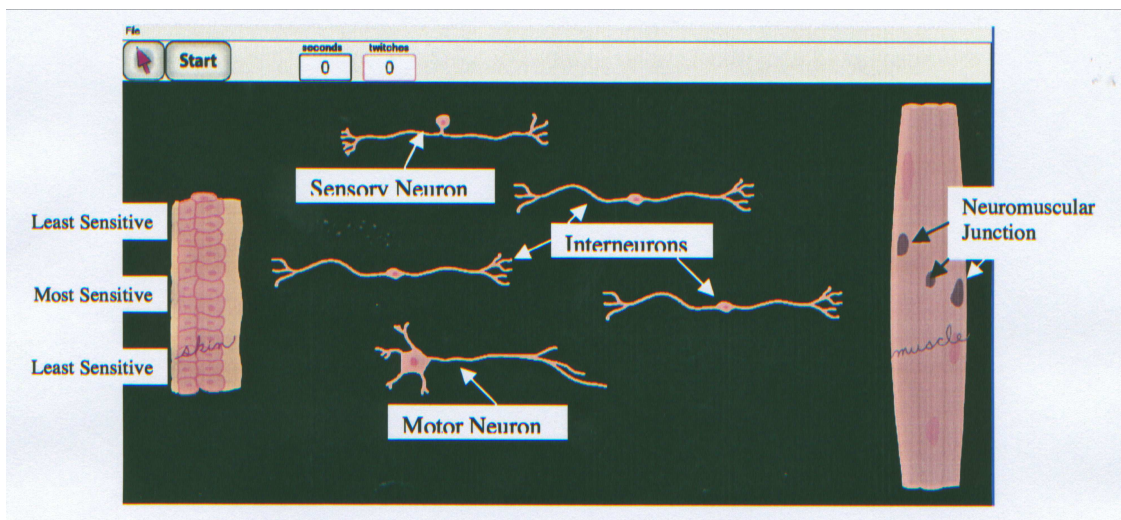


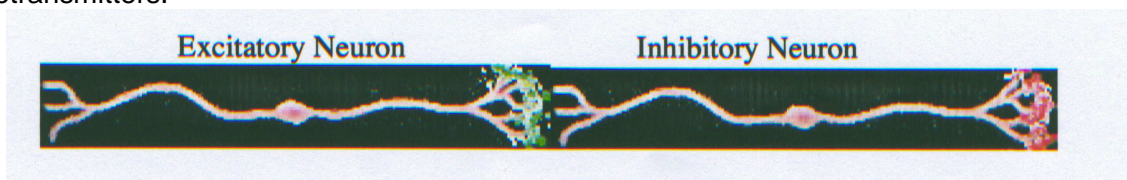


Description of the Virtual Neuron Software Features

The initial window that opens up has a skin picture on the left side of the screen, a muscle picture on the right side of the screen, and five neurons in between -- one sensory neuron, one motor neuron, and three interneuron [two excitatory and one inhibitory].



- The purpose of this window is to get a message from the skin to the muscle via a neuron circuit.
- The neurons and skin can be moved around by clicking on the neuron or skin and dragging it to a new location. The skin and neurons can only be moved when the circuit is inactive. The muscle cannot be moved.
- To activate the circuit, click the start button. To inactivate the circuit, press the stop button.
- When the circuit is active, the amount of seconds the circuit is running and the number of times the muscle twitches is recorded.
- The axon of the sensory neuron must come into contact with the skin cells. The center skin cells are the most sensitive and will cause the sensory neuron to send the most signals in a set period of time. The outer skin cells are less sensitive and will cause the sensory neuron to send fewer signals in a set period of time.
- The axons of the motor neuron must come into contact with the neuromuscular junction.
- The excitatory neurons emit green neurotransmitters and the inhibitory neurons emit green neurotransmitters.





Description of the Virtual Neuron Software Features

Other features can be added by holding the Shift key and then pushing the S key (Shift-S). Enter the password **teacher** which causes a new window to appear.

Choose the number of each type of neuron option.

More Sensory Neurons, Excitatory Neurons, and Inhibitory Neurons can added.

Check the boxes to enable extra features.

Change Neuron Shape



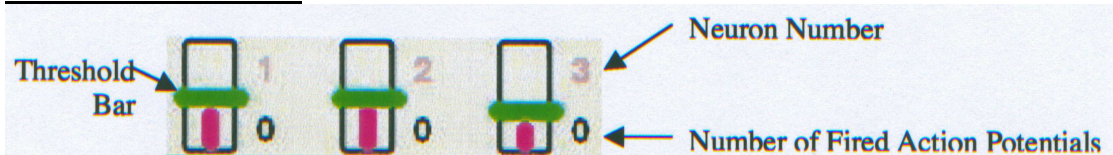
After activating and saving this feature, a new button with a pink wand will appear to the left of the start button. To change the shape of the neuron, click on the pink wand button and then click on a neuron. This causes a new window to appear with two neuron shapes. Click on the different shape.

To get out of the Change Neuron Shape feature, click on the pink arrow button.



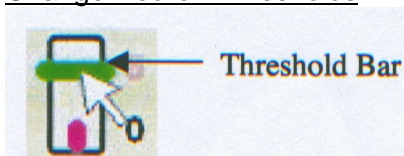
Advanced Neuron Shapes – to activate this feature, the Change Neuron Shape feature must be activated. Steps to select more advanced neuron shapes is the same as above, only more than two neuron shapes will appear in the new window.

Action Potential Meters



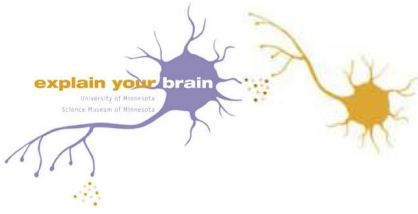
After activating and saving this feature, action potential meters for each neuron will appear at the top, center of the screen. In addition, the neuron number will appear by the neuron's cell body. The action potential meter records the number of times an action potential is fired. When the red line reaches the top of the meter, the neuron releases neurotransmitter. The green line across the meter indicates the neuron's threshold.

Change Neuron Thresholds



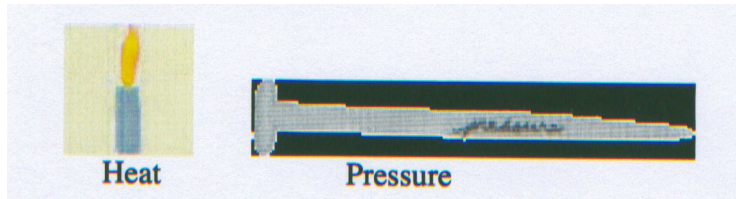
To activate this feature, the Action Potential Meters feature must be activated. Once the Change Neuron Thresholds feature is activated, the threshold for each neuron can be increased or decreased. The circuit must be inactive to change the threshold.

The neuron threshold can be changed using two different methods. One way is to click and hold the mouse on the green bar and slide the bar up or down to a new location. The other way is to click the mouse in the meter space, and the bar will move to that location.



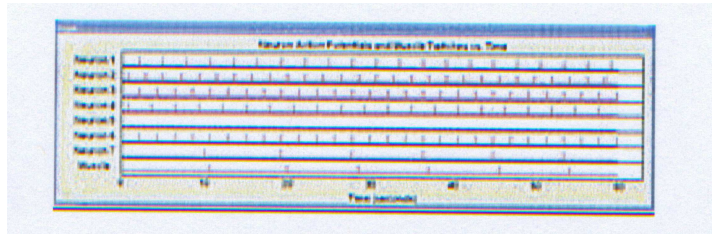
Description of the Virtual Neuron Software Features

More Sensory Inputs - After activating and saving this feature, a Sensory Input menu will appear. The circuit cannot be running to change the sensory input.



To change the sensory input, click on the Sensory Input menu, and select either heat or pressure. Then press the start button to activate the circuit and cause a picture of the sensory input to appear. The sensory input will disappear when the circuit is inactive.

Graph - After activating and saving this feature, a Graph menu will appear. The graph shows the neuron action potential and muscle twitch vs. time while the circuit is running.



Each action potential and muscle twitch is recorded as a spike in the graph line. To get the graph to appear, click on the Graph menu and select Show. The graph will remain on the screen after the circuit is stopped. To get the graph to disappear, click on the Graph menu and select Hide.