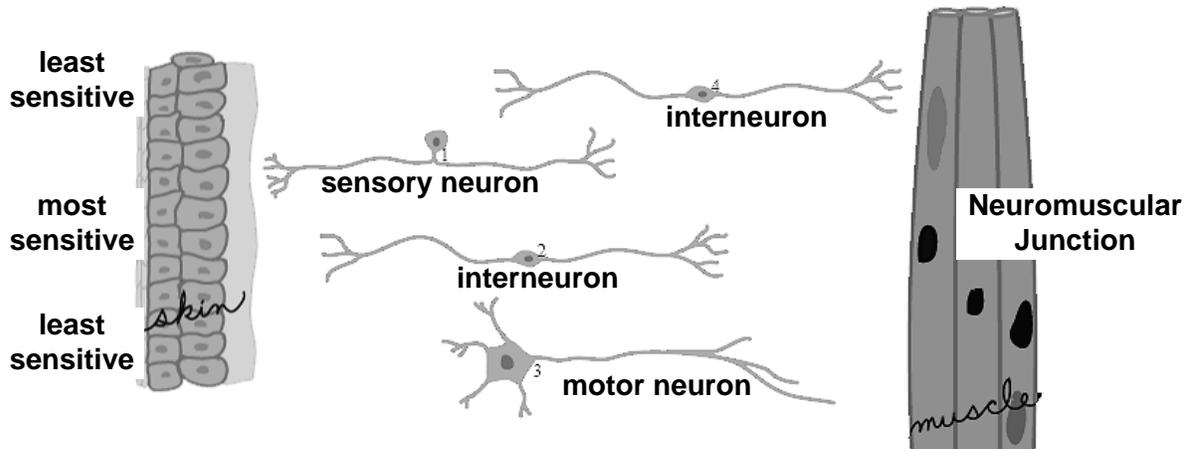


Description of the Virtual Neuron Software Features



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 four neurons in between -- one sensory neuron, one motor neuron, and two interneurons [one excitatory and one inhibitory].



Your goal in this window is to get a message from the skin to the muscle via a neuronal circuit.

The muscle, neurons, and skin can be moved around at any time by clicking on the image and dragging it to a new location. Click on the cell body to move the neurons.

To activate the circuit, click the Start/Resume button. To inactivate the circuit, press the Pause button.

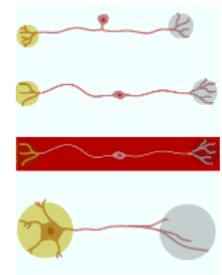
When the circuit is active, the number of seconds the circuit is running and how many times the muscle twitches is recorded and displayed just below the Start button.

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 red neurotransmitters.

You may add any type of neuron by clicking on the Add button and selecting from the panel which shows the 4 basic shapes (see image at right). From top to bottom, the images are: a sensory neuron, an excitatory interneuron, an inhibitory interneuron (with the red highlight), and a motor neuron.



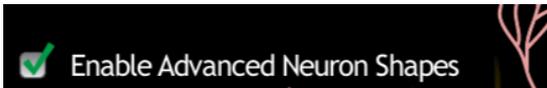
If you've activated Enable Advanced Neuron Shapes in the Settings screen, you'll see many neuron shapes when you click on the Change button and then click on the neuron that you want to swap out. **NOTE:** If you change the shape of an inhibitory neuron, the new shape will still be inhibitory.

Description of the Virtual Neuron Software Features

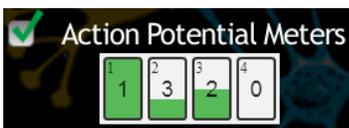


Features can be added at any time from the Settings screen. You may visit this screen by clicking the Settings button.

Check the boxes to enable the following features:

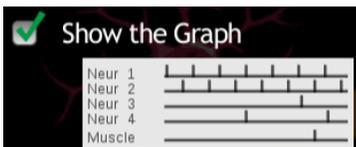


Virtual Neurons starts with a set of simple neuron shapes. Once you have enabled advanced neuron shapes, you may use the Change and Add buttons on the main screen to change the configuration of your neuronal network.



After activating this feature, action potential meters for each neuron will appear at the left of the screen below the Settings button. The small number in the upper left corner of the meter is the neuron number that appears by the neuron's cell body. The large number in the meter indicates the neuron's threshold; in the image above, neuron #1 has a threshold of 1. Since the meter is filled with green, that indicates that one action potential has fired, the threshold has been met, and neuron #1 will release neurotransmitter. Neuron #2 has a threshold of 3 and, as one-third of the meter is filled with green, that indicates that 1 action potential has fired. When 2 more action potentials fire, neuron #2 will release neurotransmitter.

At any time in the program, the threshold for each neuron can be increased or decreased by clicking inside the meter and changing the number (possible values 0-5). The circuit need not be inactive to change the threshold.



Activate this feature and click Continue to return to the main screen. At the bottom of the main screen you'll see a graph. The graph has a line for each neuron in your circuit. Shown are the neuron's action potential and the muscle twitches vs. time while the circuit is running.

Each action potential and muscle twitch is recorded as a spike in the graph line. The graph will remain on the screen after the circuit is stopped. To get the graph to disappear, go to Settings and deselect Show the Graph.

