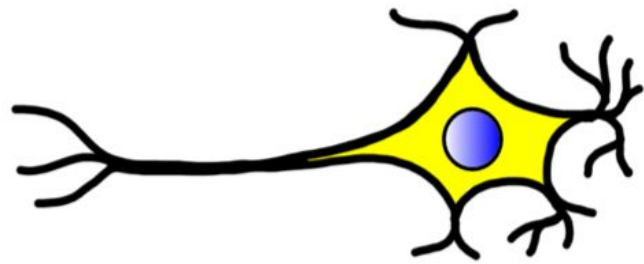


Experiments in Information Processing and Neurophysiology

Simulation at jondarkow.com



The dependent variable in the simulation is the membrane potential of Neuron 1 and Neuron 2. The membrane potential is measured at the axon hillock of each neuron (units are in millivolts.)

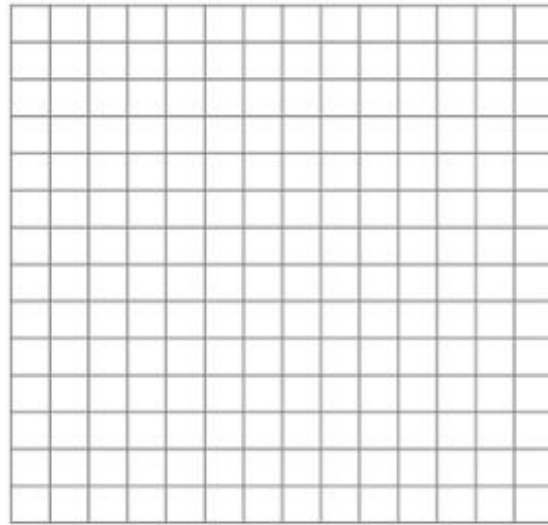
I. Experiment 1: Information Processing

Neurons modify signals by receiving neurotransmitters from multiple neurons. Some can be inhibitory, others excitatory. Assume the neurons in the simulation originate in the sacral region of the spinal cord (Neuron 1), and innervate the *rectus femoris* muscle (Neuron 2). When Neuron 2 sends a signal to the *rectus femoris* muscle, the muscle contracts extending the leg at the knee.

Using the simulation determine which neurotransmitter is excitatory, and which is inhibitory, GABA or glutamic acid.

(a) **Create** a labeled table to record your data. Because the simulation allows for randomness, be sure to run each condition 5 times, and calculate the mean.

(b) **Create** an appropriately labeled graph or table illustrating how each neurotransmitter affects the depolarization of the neurons.



(c) **Justify** which neurotransmitter is excitatory, and which is inhibitory by referring to your graph/table.

(d) **Explain** which neurotransmitter would be released to extend the knee at this neural pathway?

(e) **Explain** which neurotransmitter would be released to flex the knee at this neural pathway?

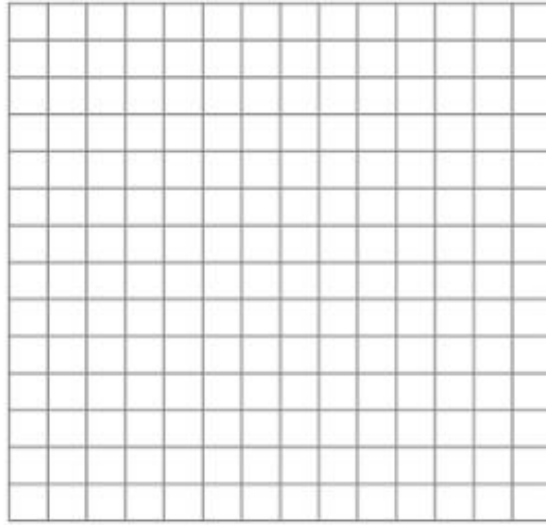
II. Experiment 2: Neurotoxins

Neurotoxins interfere with neuronal function. Like any toxin though, dosage matters. The EPA sets limits on the acceptable amounts of different toxins that humans can be exposed to in the environment. In this simulation choose one of the neurotoxins and determine what the acceptable amount of the molecule can be exposed to neurons without causing harm.

Set GABA to 0, and glutamic acid to 60. Choose one of the neurotoxins to experiment with (TTX, Botulinum toxin, and Sarin nerve gas). Using the simulation determine the toxicity of the neurotoxin.

(a) Create a labeled table to record your data. Because the simulation allows for randomness, be sure to run each condition 5 times, and calculate the mean.

(b) Create an appropriately labeled graph/table illustrating how the neurotoxin affects the depolarization of the neurons.



(c) What limit you would propose is acceptable exposure to the neurotoxin on neurons? Refer to your data to justify your response.

(d) Explain how the neurotoxin interferes with the molecular biology of the neurons. Use your data to justify your response.