

## Lesson for [Neuron](http://phet.colorado.edu): Brief Inquiry activity

<http://phet.colorado.edu>

**From the Design doc:** This simulation will let students explore how a neuron works. Specifically, how membrane permeability and ion movement creates potential differences across the neuron membrane. Overall goal is student understanding of the mechanism behind an action potential and the sequence of membrane channel opening/closing that creates the potential.


**Neuron Sim Description:** Stimulate a neuron and monitor what happens. Pause, rewind, and move forward in time in order to observe the ions as they move across the neuron membrane

**Learning Goals:** Students will be able to:

- Describe why ions can or cannot move across neuron membranes.
- Identify leakage and gated channels, and describe the function of each.
- Describe how membrane permeability changes in terms of different types of channels in a neuron.
- Describe the sequence of events that generates an action potential.
- Use evidence to defend their ideas.

**Teacher notes:** You may want to have students do [Trish Loeblein's Membrane Channels](#) to help understand the model for diffusion. This sim is more complex because the channels are opened and closed by stimuli. This activity could be begun in class and then assigned for homework. The students may need



to use the Zoom  to see how the gates open and close. Also, they may need to use the Potential chart. I would expect that most students have heard of neurons, but don't understand how they function on a molecular level. *I am not a biologist, I had to discuss the purpose of this sim with the design team; I also learned very interesting and useful information from <http://en.wikipedia.org/wiki/Neuron> (accessed 8/11/12)*

### Lesson:

- 1. Facilitate a class discussion before using the sim.** *Here are some ideas that I might use:*
  - a) Say:** If you touch something very hot, you know to pull away. How do you think information travels through your body to tell you what to do? *Students should be encouraged to describe their ideas in an informal fashion using their own words not scientifically. For example, they could discuss in small groups and share out or if the class is small allow students to share large group. I would ask them to illustrate their ideas as well. I believe students will use the word "neuron", if not you will need to introduce the vocabulary and perhaps show a model.*
  - b) Help extend the ideas:** What do you think a neuron transmits information? *Use a similar discussion format as above with students illustrating the model. Make sure that students understand that this simulation is about how a neuron works, not about how information transfers across a synapse.*
  - c) Introduce the sim activity:** Say something like "We want to investigate if our ideas about how neurons transmit using a simulation."
  - d)** Then, have the students play with the sim and tell them to write their ideas about the learning goals (you could make copies of the goals or have them projected) and encourage them to use illustrations. Students might prepare a presentation instead of turning the assignment in. Have them use the sim during their presentation to help explain their ideas.

**Post-Lesson:** Have a class discussion and encourage the students to use the sim. Maybe have students come up to the projected computer.

**Other thoughts:** [Gene Machine: Lac Operon](#) is another sim that biology students might use for helping to understand underlying models.