PhET Tips for Teachers

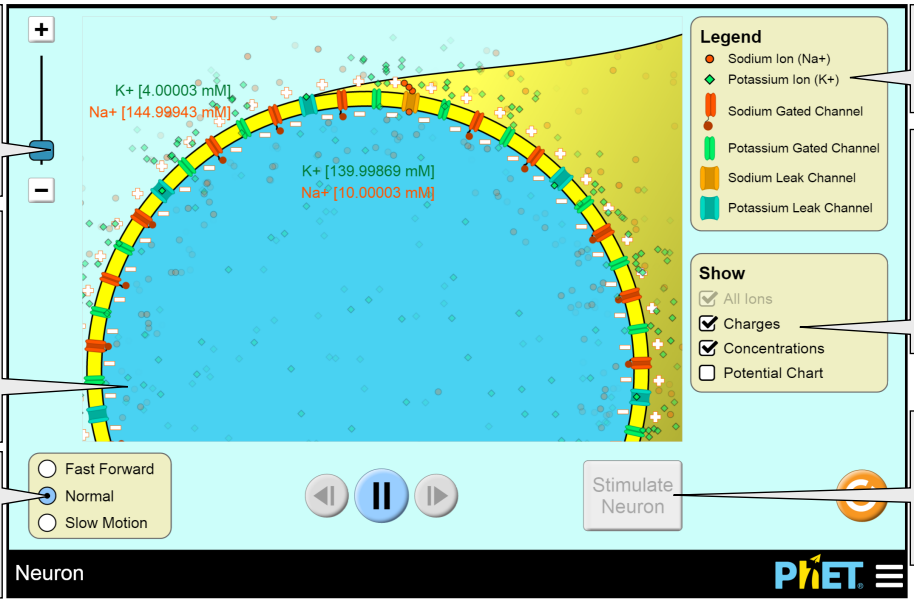
Neuron

In the **Neuron** simulation, students explore the movement of sodium and potassium ions across the cell membrane when the neuron is stimulated or at rest.

ZOOM to see a close up view of the cell membrane.

MONITOR changes that occur when a neuron is stimulated.

CHANGE the speed of the simulation.



IDENTIFY ions and channels

CHOOSE to show or hide ions, charges, concentrations, or a graph.

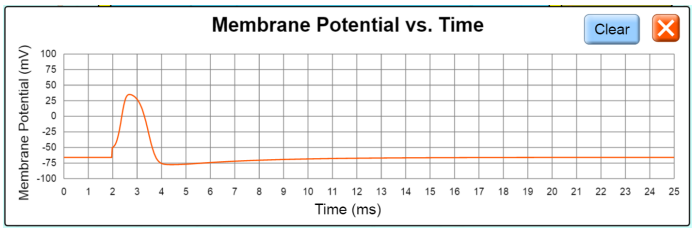
SEND an action potential down the neuron.

Model Simplifications

- When the Charges box is checked, the size of the + and – symbols is proportional to the membrane potential. If the membrane potential is zero, no net charge exists and the + and – symbols are not visible.
- Potential is measured relative to the inside of the cell. A negative potential corresponds to an excess of positively charged ions outside the cell and an excess of negatively charged ions inside the cell. A positive membrane potential corresponds to excess positive charge inside the cell and an excess of negatively charged ions outside the cell.
- While the Na^+/K^+ pump plays a role in the long term maintenance of membrane potential, it is not represented in this simulation. Only the gated and leak channels that play a role in depolarization and repolarization of the neuron are shown.

Insights into Student Use

- The Potential Chart graphs the membrane potential in real time and displays the potential relative to the inside of the cell. Some students needed clarification of how membrane potential was measured to help them understand the information presented in the chart.



Hanson, March 2016

Suggestions for Use

Sample Challenge Prompts

- If sodium and potassium ions are both positively charged, what causes the negative membrane potential in a resting neuron?
- What happens if you try to stimulate the neuron right after the action potential reaches the end of the neuron? Why? What must happen to be able to stimulate the neuron again?
- What is the difference between a gated ion channel and a leak channel? Explain the role of each type of channel in neuronal cell function.
- Explain the sequence in which ion channels open and close to propagate an action potential.
- Draw a sketch of the Potential Chart that shows an action potential. Label the chart to show where sodium and potassium gated channels open and close.
- What happens to the concentration of sodium and potassium ions inside the cell when the neuron is stimulated? How does this concentration change result in an action potential?
- In the cell, where does the greatest change in ion concentration take place when the neuron is stimulated? Explain how this allows an action potential to be propagated down an neuron.

See all published activities for Neuron here.
For more tips on using PhET sims with your students, see Tips for Using PhET.