

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

<http://phet.colorado.edu>

[Membrane Channels](#) Sim Description: Insert channels in a membrane and see what happens. See how different types of channels allow particles to move through the membrane.

Learning Goals: Students will be able to:

- Predict when particles will move through the membrane and when they will not.
- Identify which particle type will diffuse depending on which types of channels are present.
- Predict the rate of diffusion based on the number and type of channels present.
- Use evidence to defend their ideas.

Pre-lesson: You may want to read the [Teachers' Guide](#) to understand the model used in the sim which was to allow students to understand basic cellular diffusion. The concentrations graphs are meant to give students qualitative, relative information to help them understand diffusion.

Lesson:

- 1. Facilitate a class discussion before using the sim.** *Here are some ideas that I might use:*
 - a) Ask:** What do you think of when you hear the word “diffusion”? *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. Another idea: You could have something aromatic and ask “How can you smell this even though it is far from you?” Most students should be able to describe the dispersion of the molecules from an area of concentration to less concentration.*
 - b) Help extend the physical model of diffusion relates to living organisms:** You could have celery (or carrot sticks) soaking separately in water and a solution of sugar or salt. Ask about why the water one feels differently than the one soaked in solution. *Use a similar discussion format as above with students illustrating the model.*
 - c) Introduce the sim activity:** Say something like “We want to investigate if our ideas about diffusion work with living cells 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: [Neuron](#) and [Gene Machine: Lac Operon](#) are other sims that biology students might use for helping to understand underlying model.