**Membrane Channels**

**I. Introduction**

The cell membrane is a [biological membrane](https://en.wikipedia.org/wiki/Biological_membrane) that separates the [interior](https://en.wikipedia.org/wiki/Cytoplasm) of all [cells](https://en.wikipedia.org/wiki/Cell_(biology)) from the [outside environment](https://en.wikipedia.org/wiki/Extracellular_space) (the extracellular space) which protects the cell from its environment. The cell membrane consists of a [lipid bilayer](https://en.wikipedia.org/wiki/Lipid_bilayer), including [cholesterols](https://en.wikipedia.org/wiki/Cholesterol) (a lipid component) that sit between [phospholipids](https://en.wikipedia.org/wiki/Phospholipid) to maintain their [fluidity](https://en.wikipedia.org/wiki/Membrane_fluidity) at various temperatures. The membrane also contains [membrane proteins](https://en.wikipedia.org/wiki/Membrane_protein), including [integral proteins](https://en.wikipedia.org/wiki/Integral_protein) that go across the membrane serving as [membrane transporters](https://en.wikipedia.org/wiki/Membrane_transporter), and [peripheral proteins](https://en.wikipedia.org/wiki/Peripheral_protein) that loosely attach to the outer (peripheral) side of the cell membrane, acting as [enzymes](https://en.wikipedia.org/wiki/Enzyme) shaping the cell. The cell membrane [controls the movement of substances](https://en.wikipedia.org/wiki/Membrane_transport) in and out of cells and organelles. In this way, it is [selectively permeable](https://en.wikipedia.org/wiki/Semipermeable_membrane) to [ions](https://en.wikipedia.org/wiki/Ion) and [organic molecules.](https://en.wikipedia.org/wiki/Organic_molecule)

In this activity, you will use a simulation to illustrate how a cell membrane maintains a concentration balance of particles using leakage channels and gated channels.

**II. Procedure**

1. Start the activity by going to the following website :

<https://phet.colorado.edu/sims/cheerpj/membrane-channels/latest/membrane-channels.html?simulation=membrane-channels> .

2. IF NECESSARY, click on “Run Now!” and open the JNLP file. If not, just open the simulator.

3. Using the top pump, switch it to the green particles and pump in 50 green particles (using the

red button). Switch the bottom pump to the blue particles and pump in 50 blue particles.

4. Click on the “Show Concentrations” button to show the intracellular and extracellular

concentrations.

5. Record what happens to the particles after 1 minute.

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6. Reset the simulation and pump in 50 green and 50 blue particles. Then, drag two green

leakage channels and two blue leakage channels to the membrane.

7. Record what happens to the particles after 1 minute.

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8. Reset the simulation and pump in 50 green and 50 blue particles. Then, drag two green

gated channels and two blue gated channels to the membrane.

9. After 20 seconds, open the green gates and let the simulation run for 1 minute. Record results.

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10. Then, close the green gates and open the blue gates for 1 minute. Record results.

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**III. Analysis & Conclusions**

1. If the cell membrane is a solid barrier and not selectively permeable, what would happen to a

cell (that needs to get rid of wastes and bring in substances)?

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2. How do leakage channels and gated channels enable a cell to maintain a homeostatic balance?

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3. Do particle concentrations diffuse from “high to low” or “low to high” concentrations?

Choose One : High To Low Low To High

4. Why would a cell membrane open or close specific gated channels?

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5. How does a cell membrane act as security guard?

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