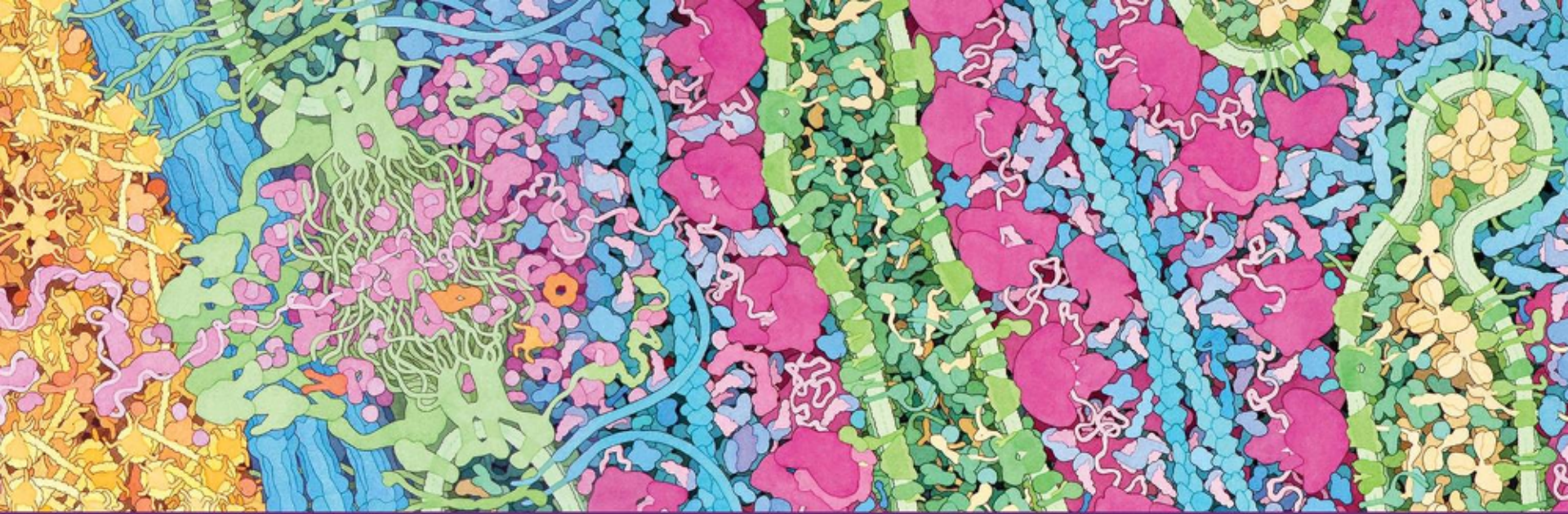




3d molecular
designs

Transforming Science Learning

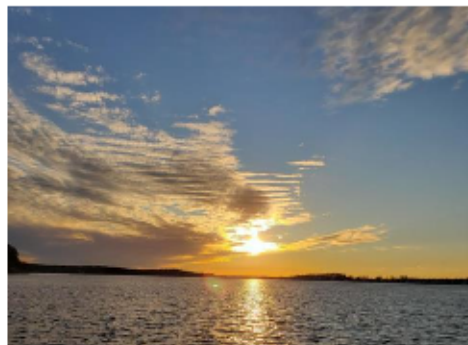
Dan Williams

BS, MA Biology

High School Teacher

NYS Master Teacher

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@Willida25



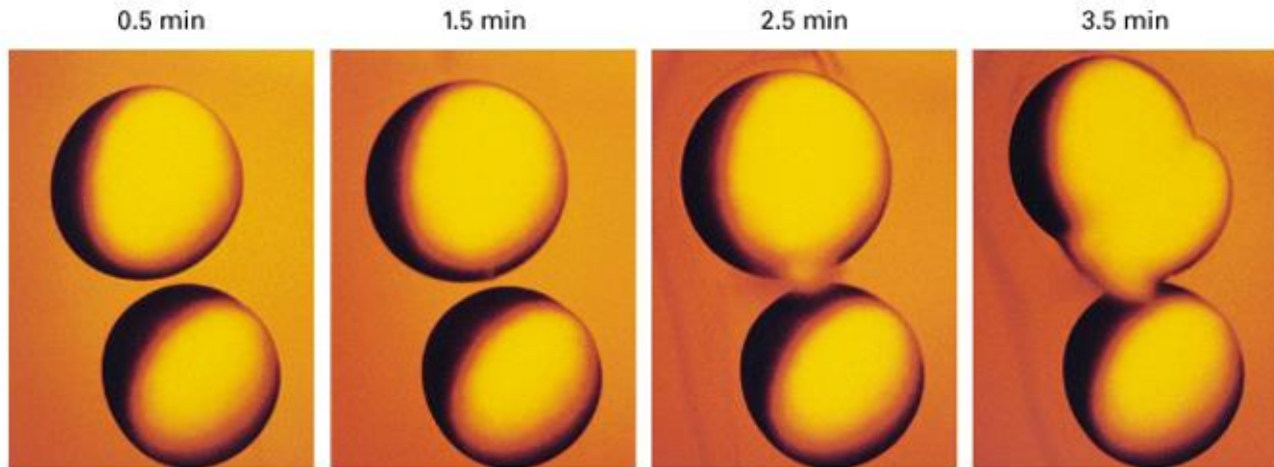
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SCIENCE TEACHERS ASSOCIATION OF NEW YORK STATE



What is happening to those eggs???



{Agre, 2003}

Back to the Exploding Frog Eggs...



- **Water**

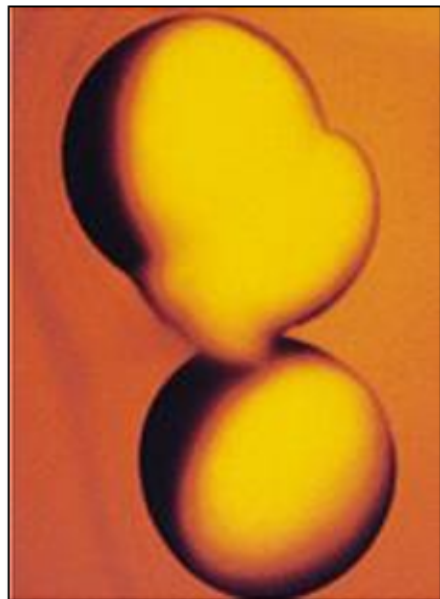
- How do the properties of water help us understand cells?

- **Membranes**

- How do membranes form and serve as barriers?

- **Proteins**

- How can protein structures allow for transport across membranes?



(Agre, 2003)

It all starts with water...

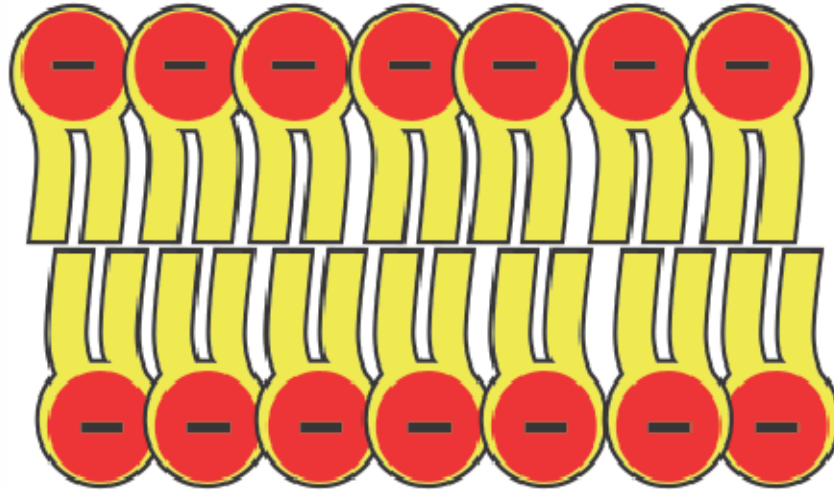
Water Kit

*"If there is magic on this planet, it is contained
in water."*

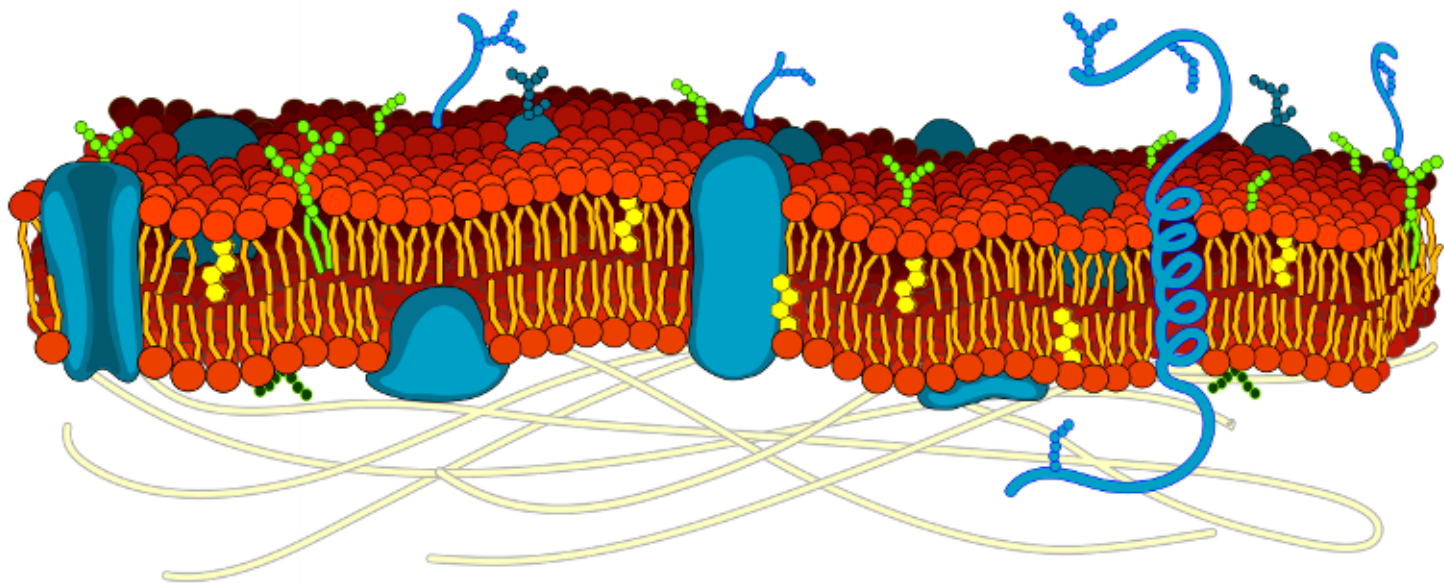
Loren Eiseley



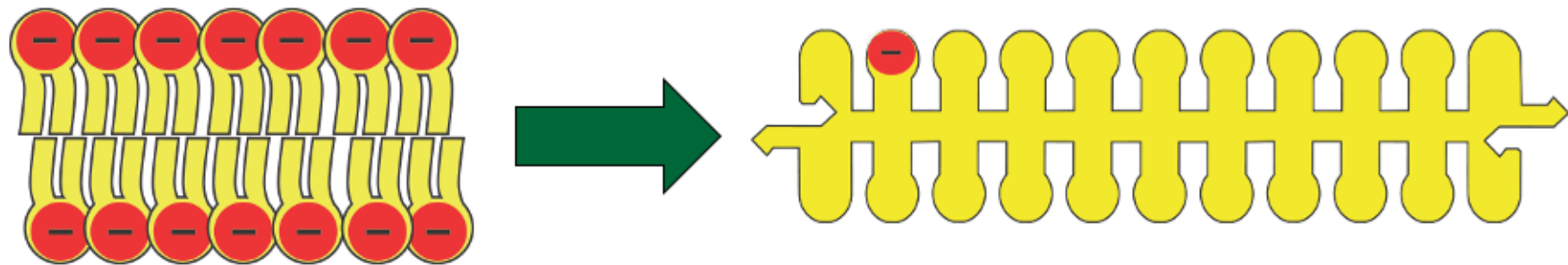
Simplified Cell Membrane Model



The Cell Membrane is Highly Complex!



Different Representations of a Membrane

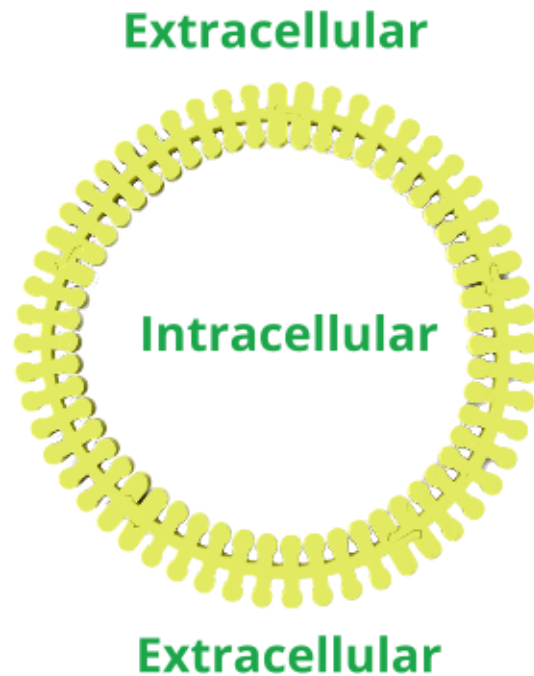
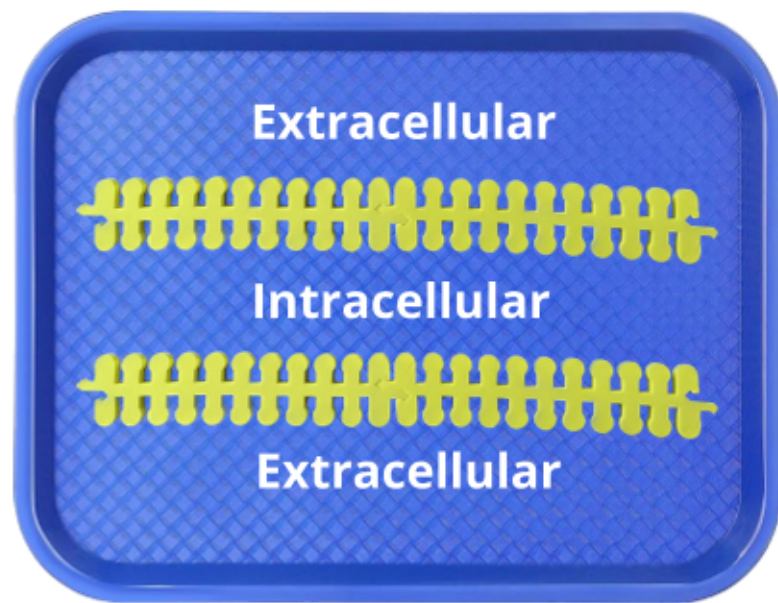


- What are the strengths of each model?
- What are the limitations of each model?

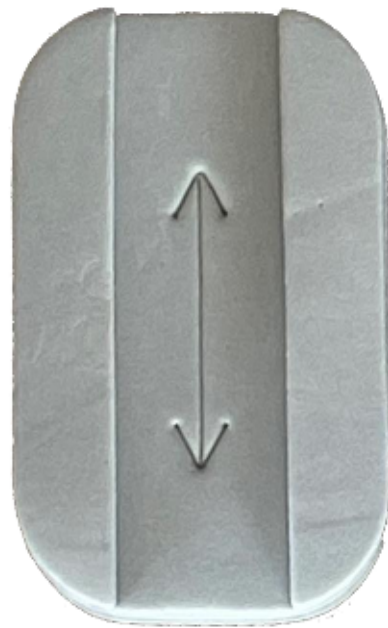
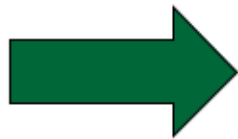
Cell Membrane Model



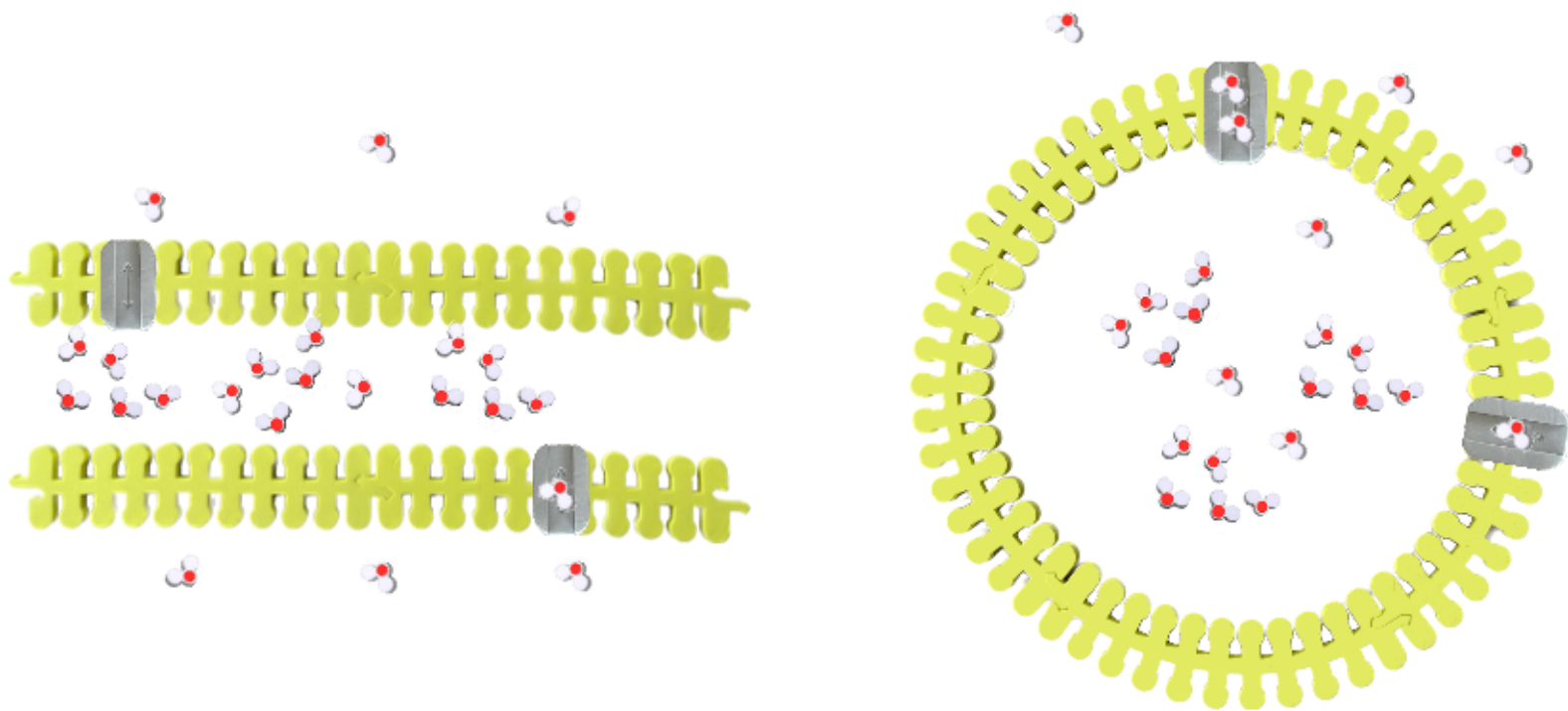
Modeling Options



Aquaporin = Channel Protein

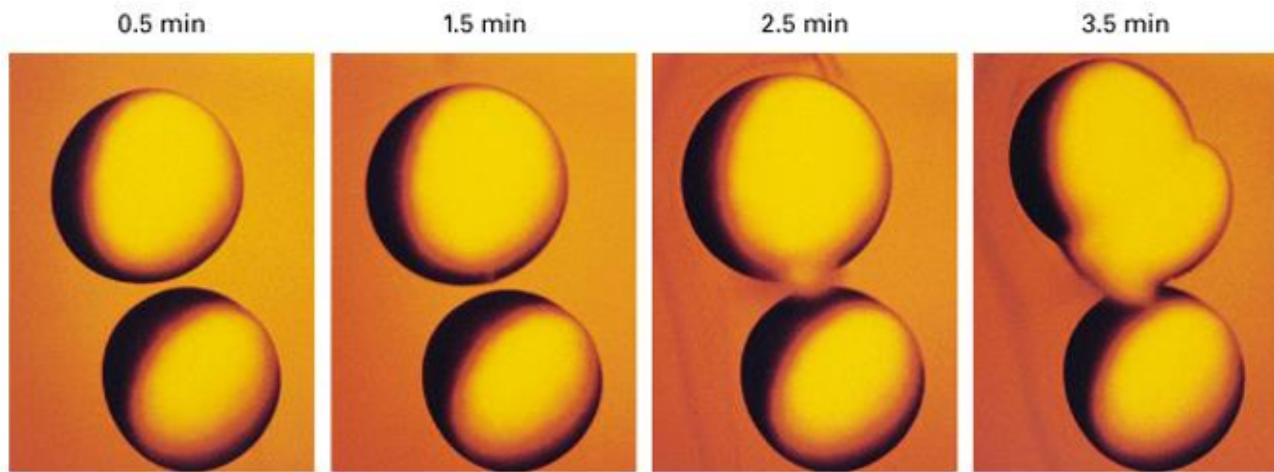


Osmosis: Transport of Water Through Aquaporins



What is happening to those eggs???

Construct a model to explain what is happening to the frog eggs.



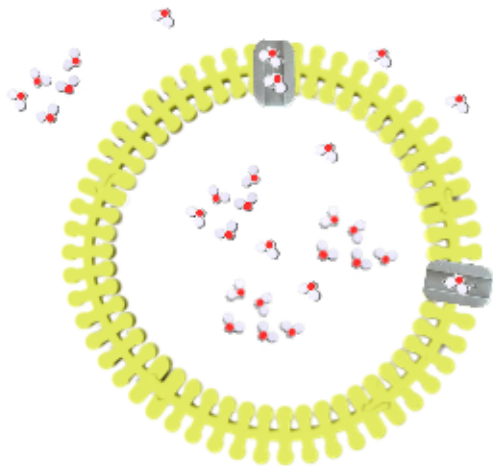
{Agre, 2003}



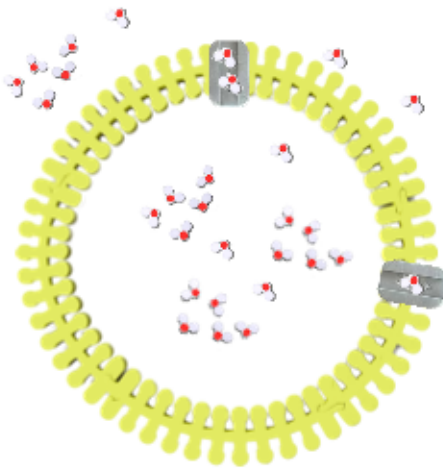
Model a cell in each of these environmental conditions.

● ← Solute (Example: Na^+)

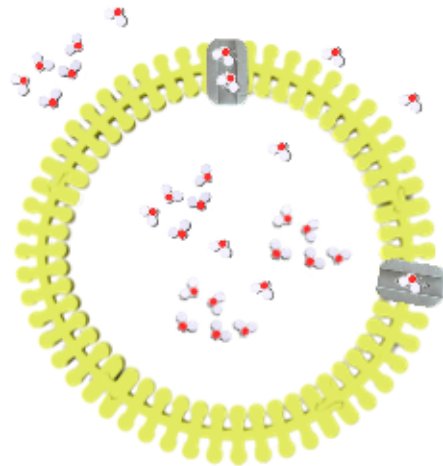
Hypertonic Solution



Isotonic Solution



Hypotonic Solution

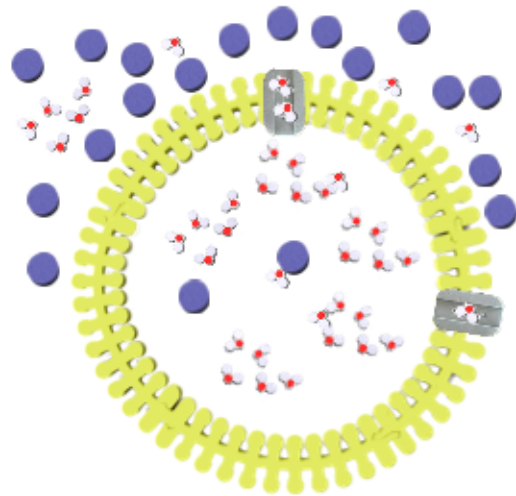




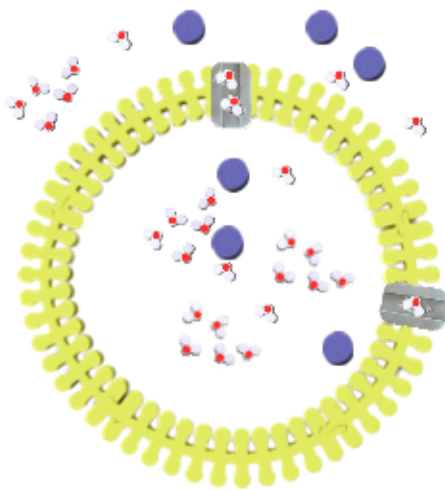
Model a cell in each of these environmental conditions.

● ← Solute (Example: Na^+)

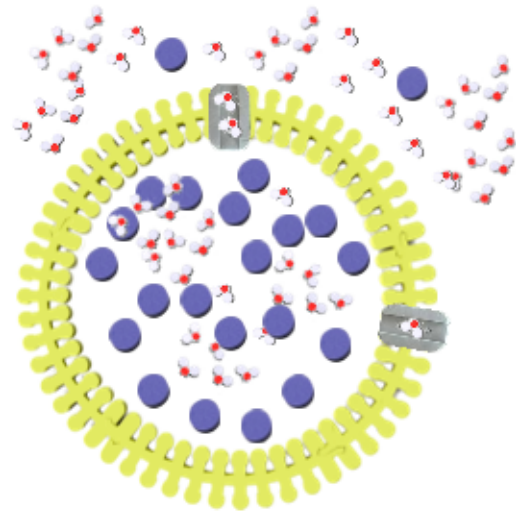
Hypertonic Solution



Isotonic Solution



Hypotonic Solution

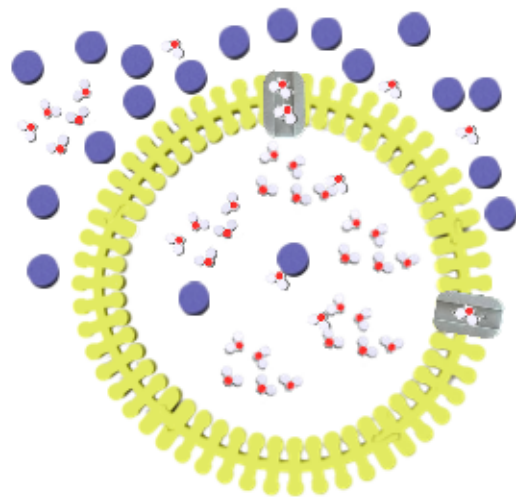


Remember: Water will *diffuse* from an area of **high water potential** (low solute concentration) to an area of **low water potential** (high solute concentration).

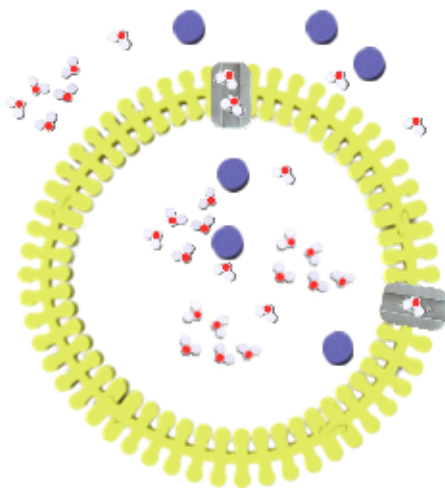


Which direction will water flow?

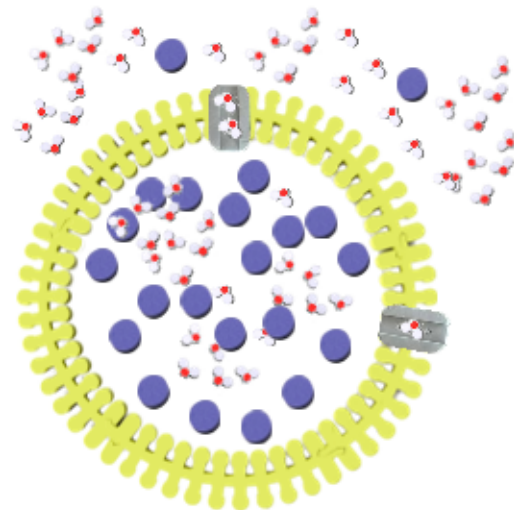
Hypertonic Solution



Isotonic Solution



Hypotonic Solution

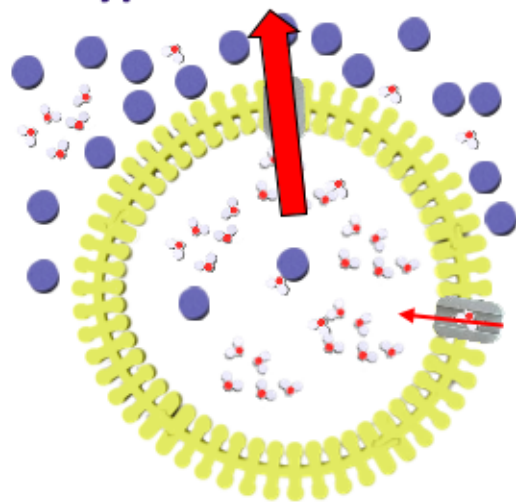


Remember: Water will *diffuse* from an area of **high water potential** (low solute concentration) to an area of **low water potential** (high solute concentration).

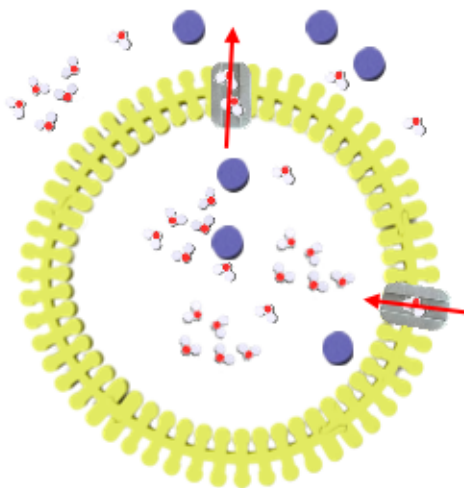


Which direction will water flow?

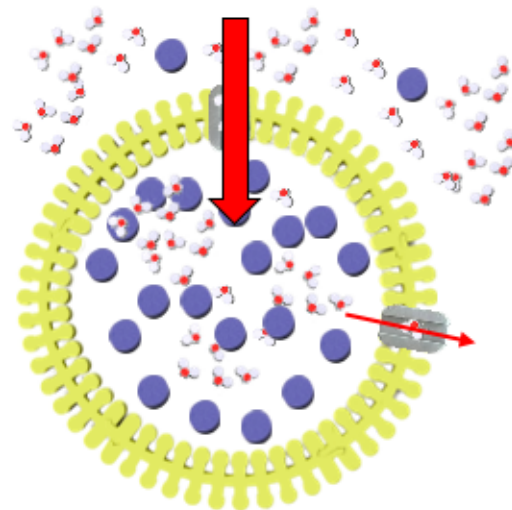
Hypertonic Solution



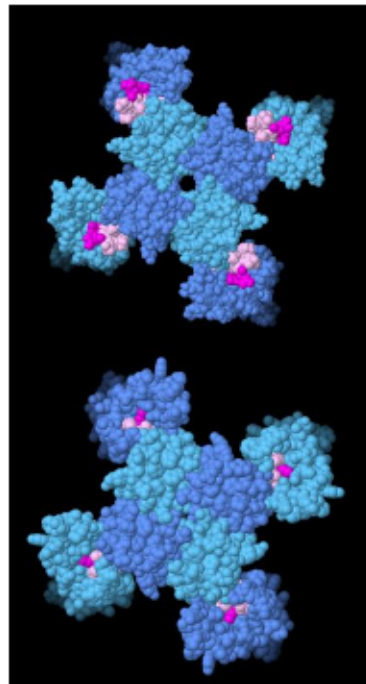
Isotonic Solution



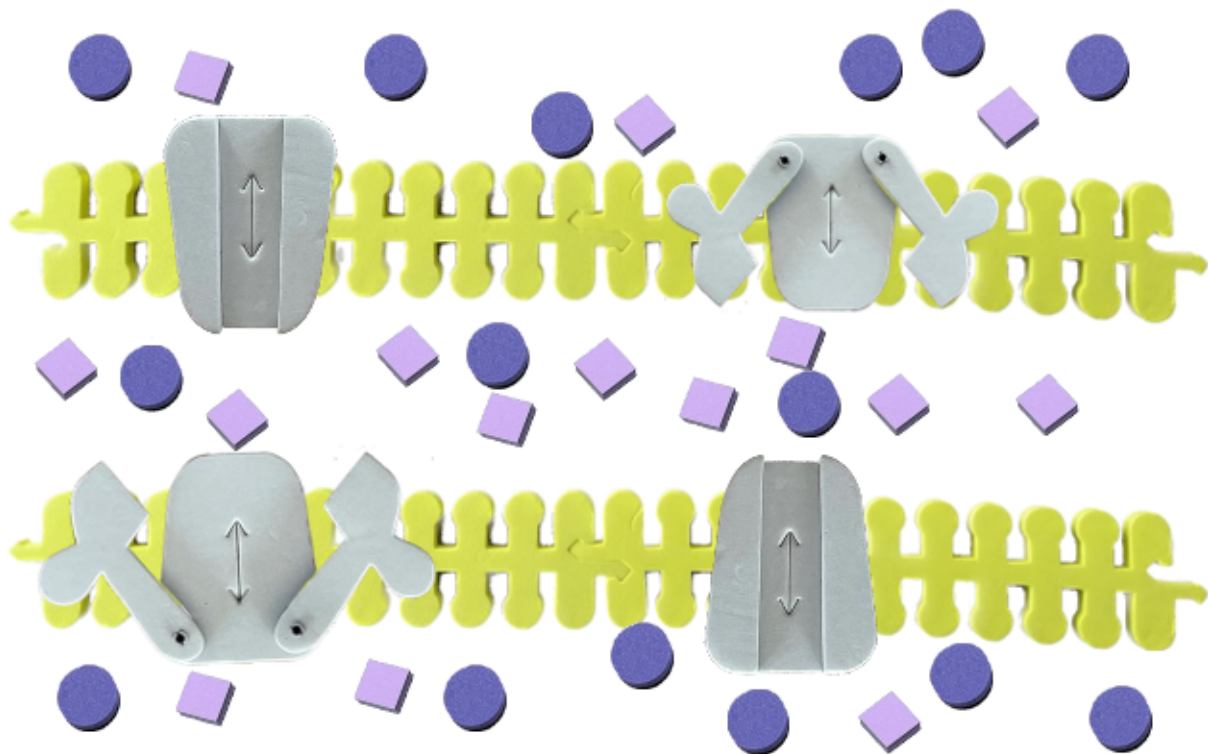
Hypotonic Solution



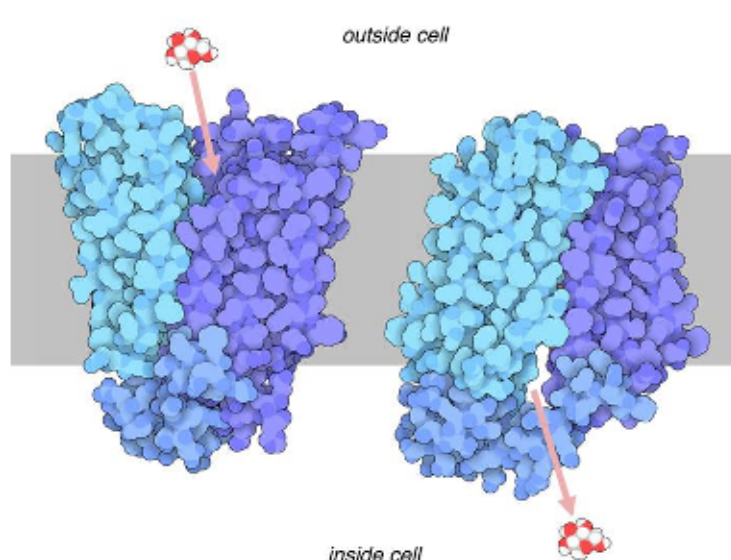
Voltage-Gated Sodium Channel



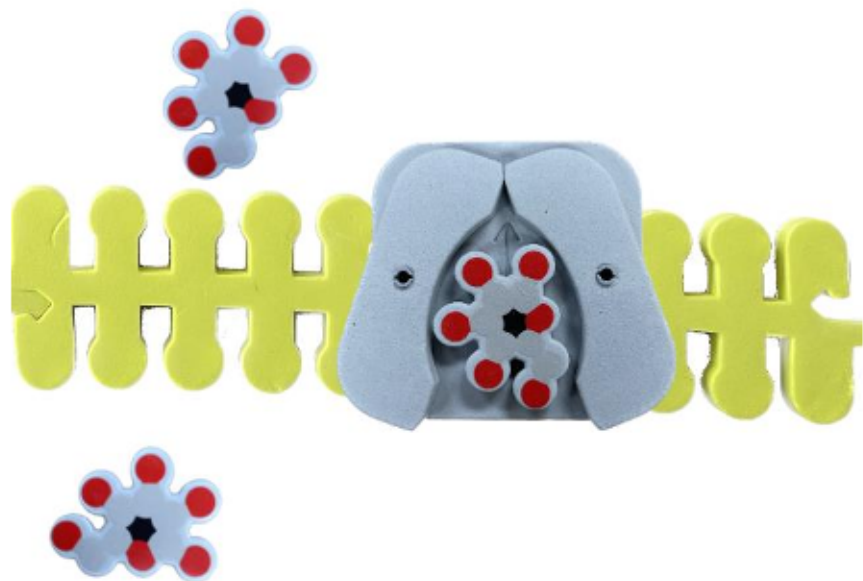
PDB ID: [5vb8](#), [6p6w](#)



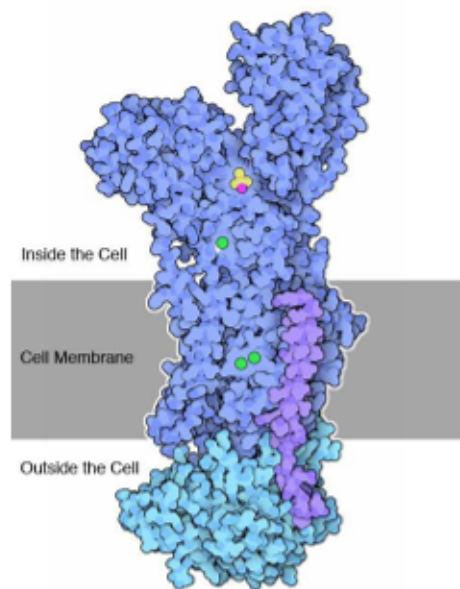
Glucose Transporter (Carrier Protein)



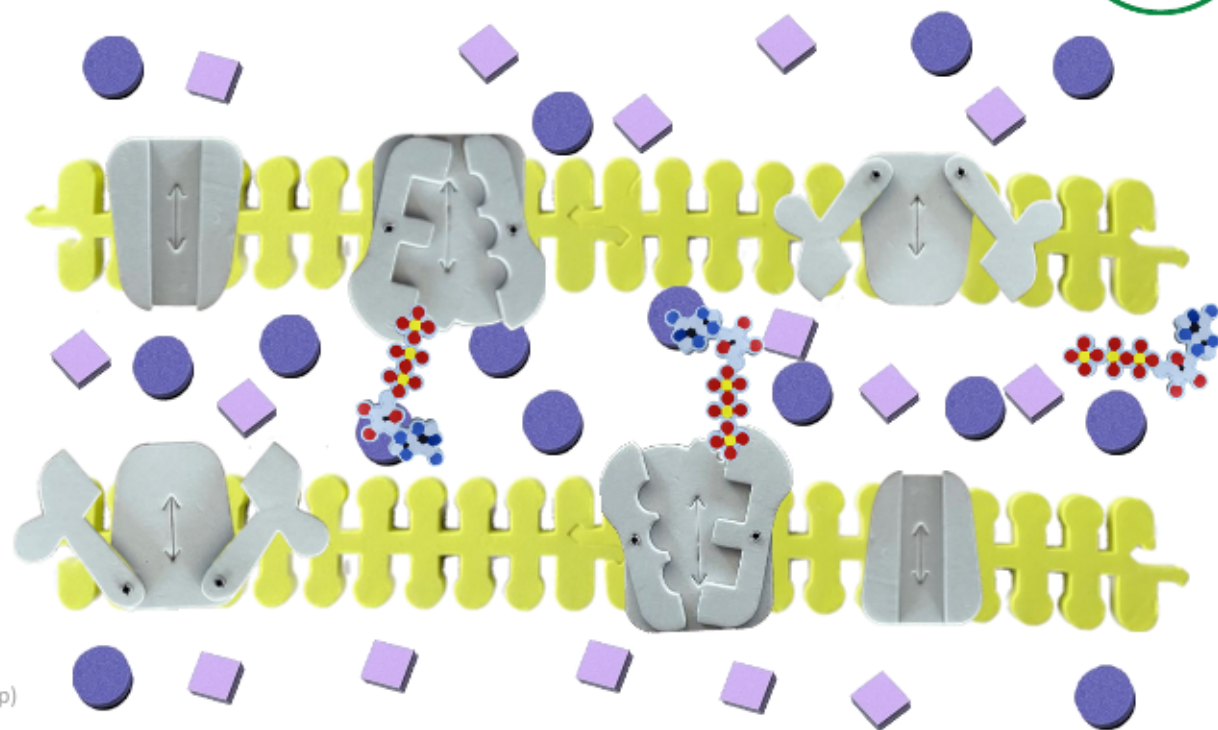
(PDB101: Molecule of the month: Glucose Transporters)



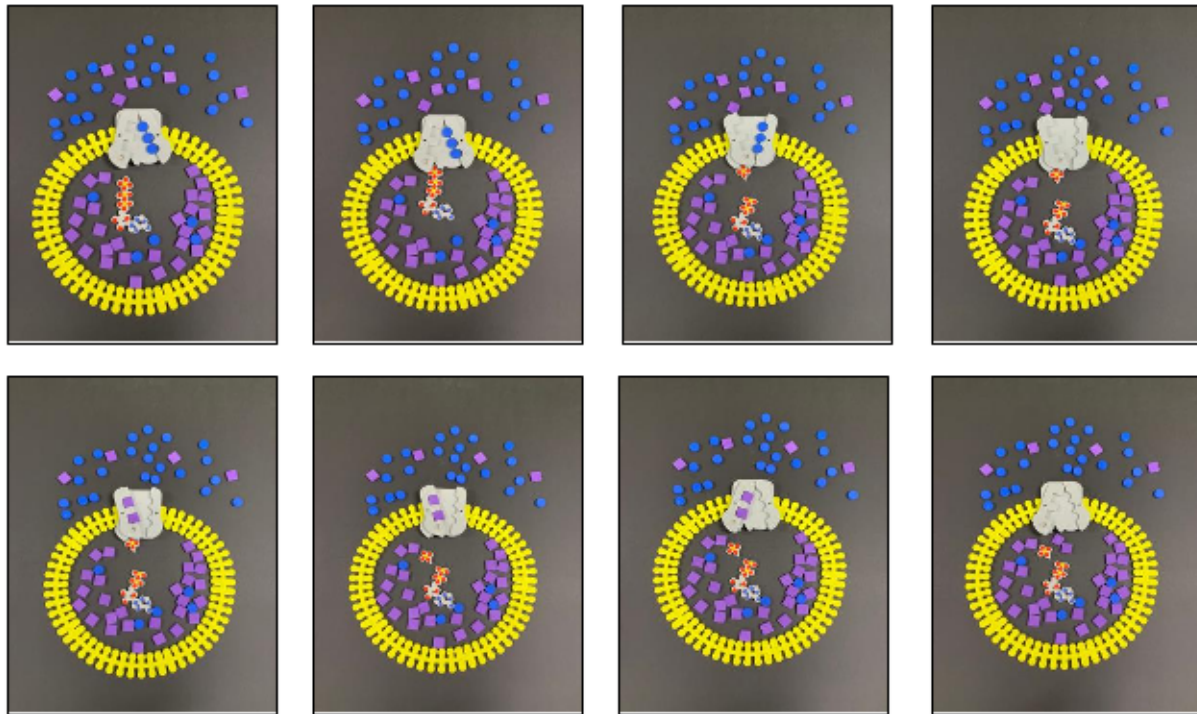
Sodium-Potassium Pump



(PDB101: Molecule of the month: Sodium-Potassium Pump)



Let's Model the Sodium/Potassium Pump



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