3-D Molecular Designs
...where molecules become real ™

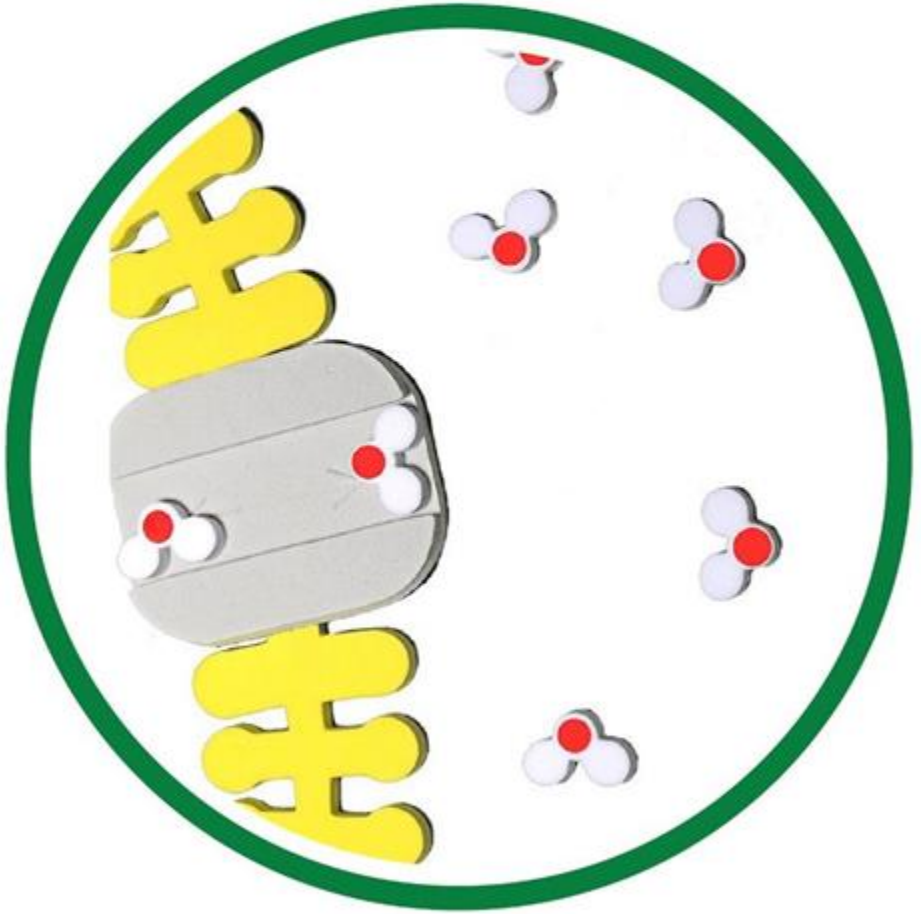
MSOE UNIVERSITY Center for BioMolecular Modeling

MODELING MARVELS

2022 EDUCATORS WEBINARS

- **KIM PARFITT**
  Keep Your Head Above Water:
  Constructing & Crossing Cell Membranes

- **TIM HERMAN, PhD**
  Transmembrane Proteins:
  Transporting Potassium



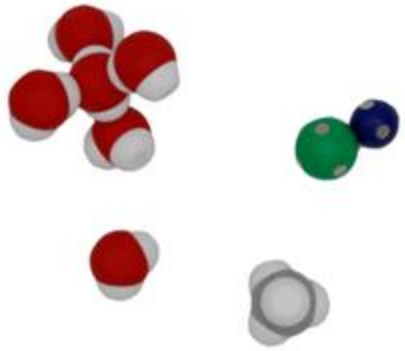
WATER & MEMBRANES WEBINAR

TUESDAY | FEB 15 6:30 - 8 PM CST

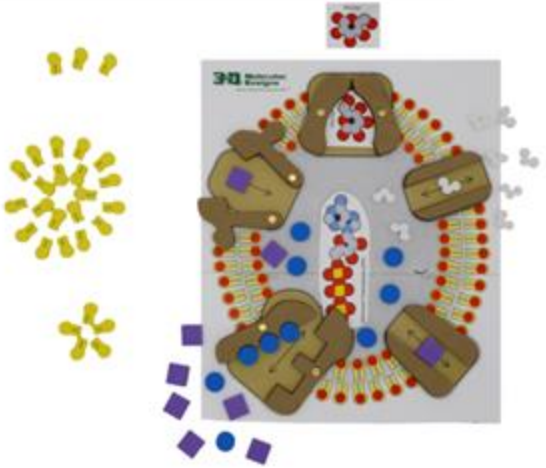
3-D Molecular Designs ...where molecules become real™

MSOE UNIVERSITY Center for BioMolecular Modeling

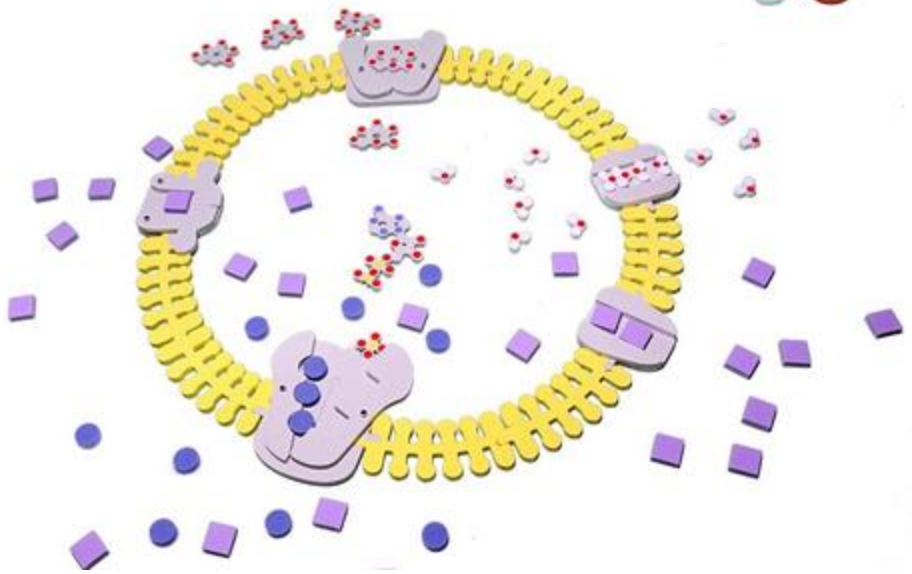
Water Student Modeling Pack



Water Kit



Membrane Student Modeling Pack



Phospholipid and Membrane Transport Kit

3-D Molecular Designs

...where molecules become real ™

WATER & MEMBRANES WEBINAR

TUESDAY | FEB 15 6:30 - 8 PM CST

PRESENTER:

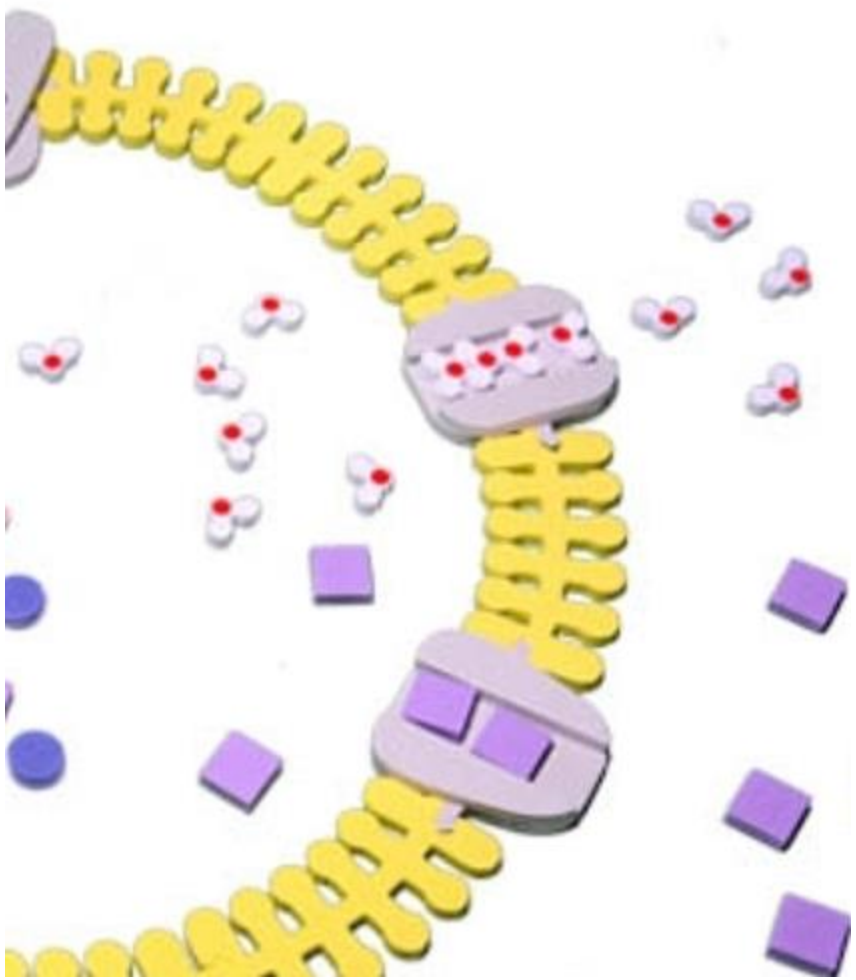
KIM PARFITT

3D Molecular Designs

Keep Your Head Above Water: Constructing & Crossing Cell Membranes

MODELING MARVELS

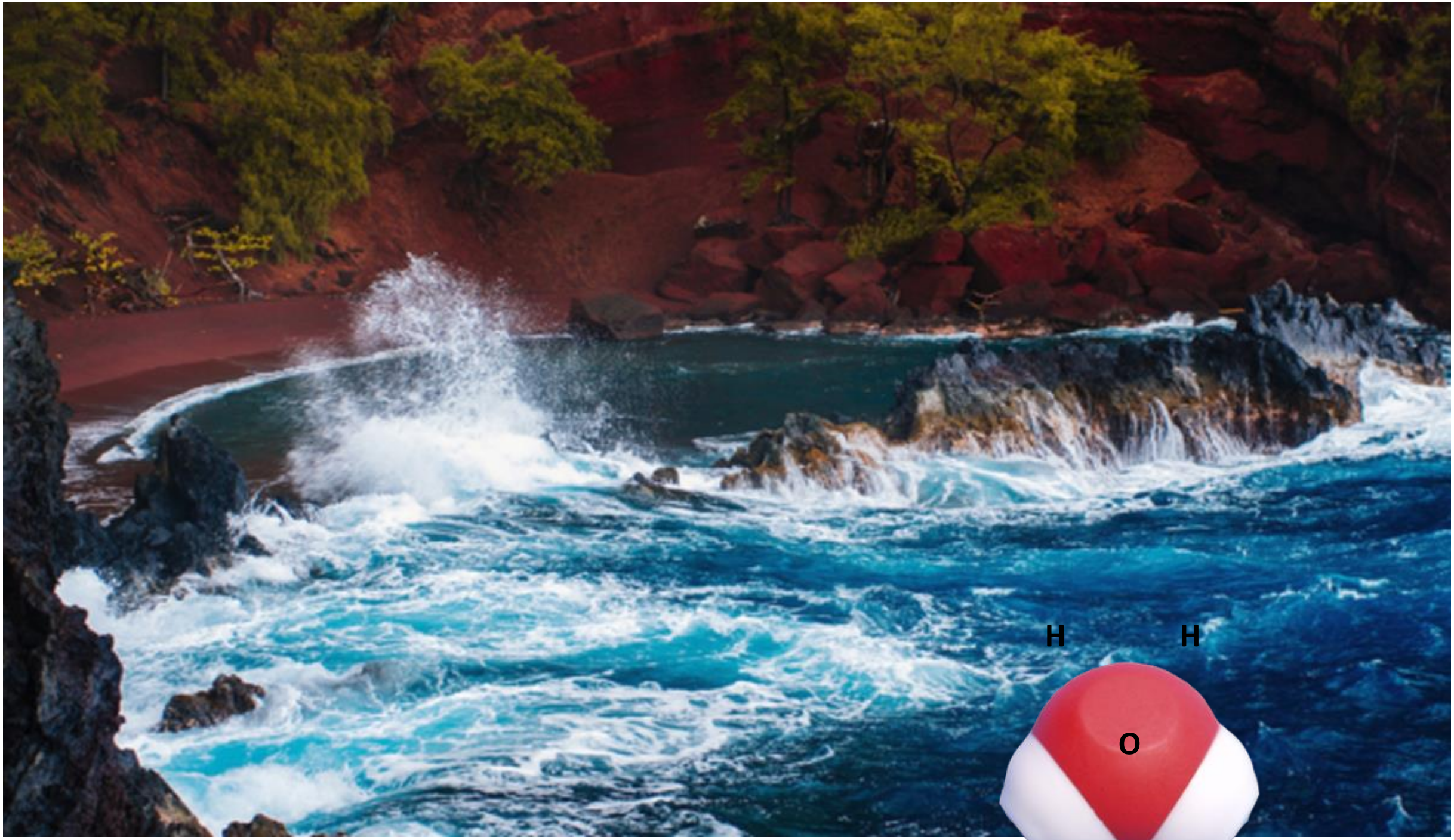
2022 EDUCATORS WEBINARS



Workshop Learning Goals

- ✓ Identify how the polar nature of the water molecule is a result of its structure.
- ✓ Describe how the function of th is related to the structure of the molecule.
- ✓ Explore how using and revising mod student thinking.

In the chat:
tells us your name, where you are located in the world, and what you teach!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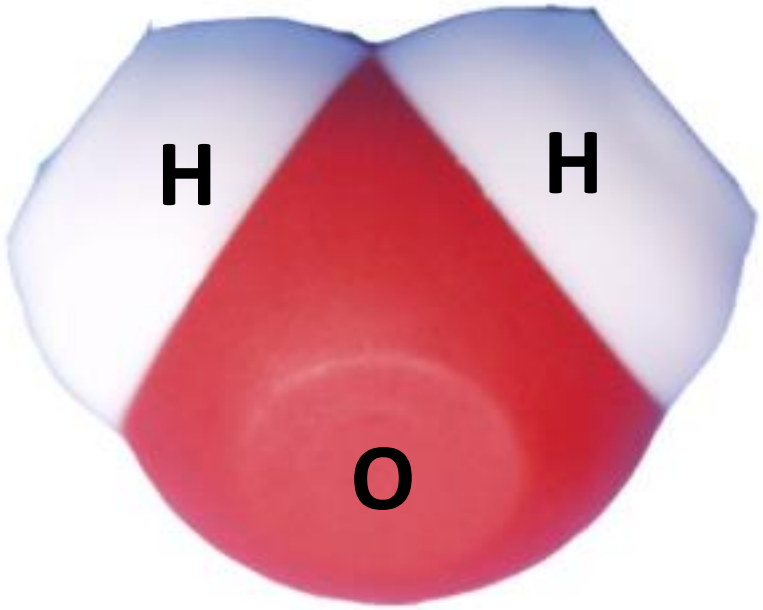
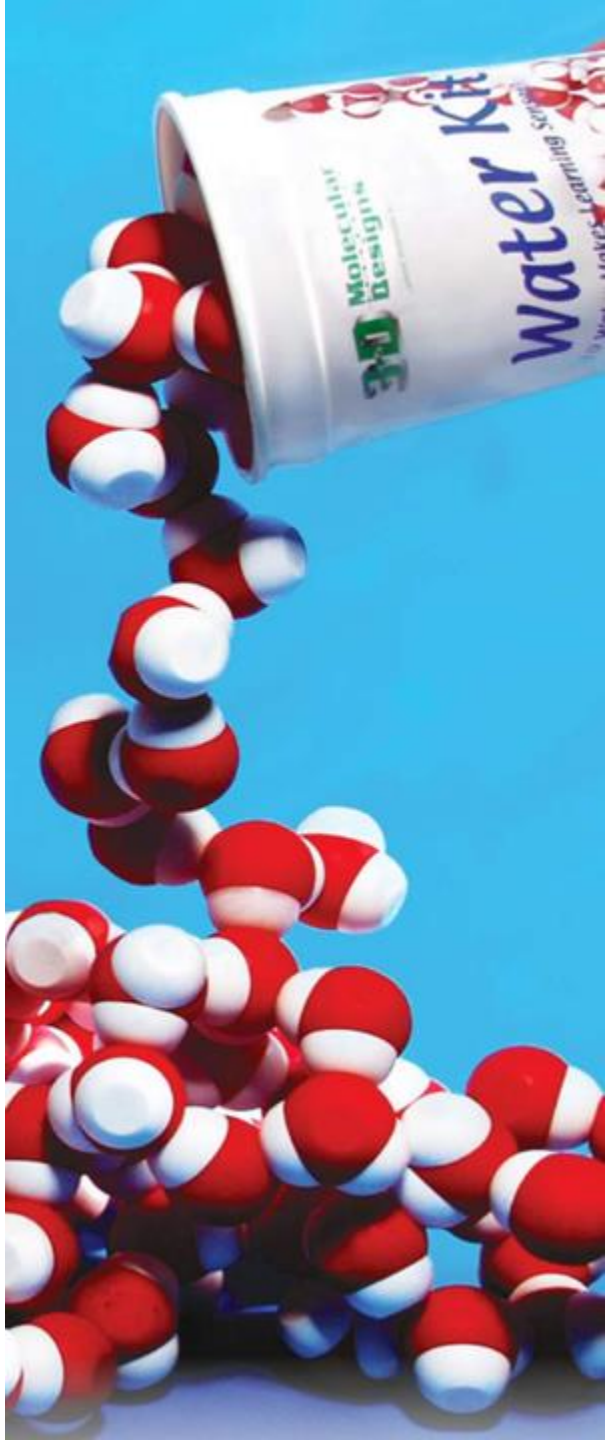
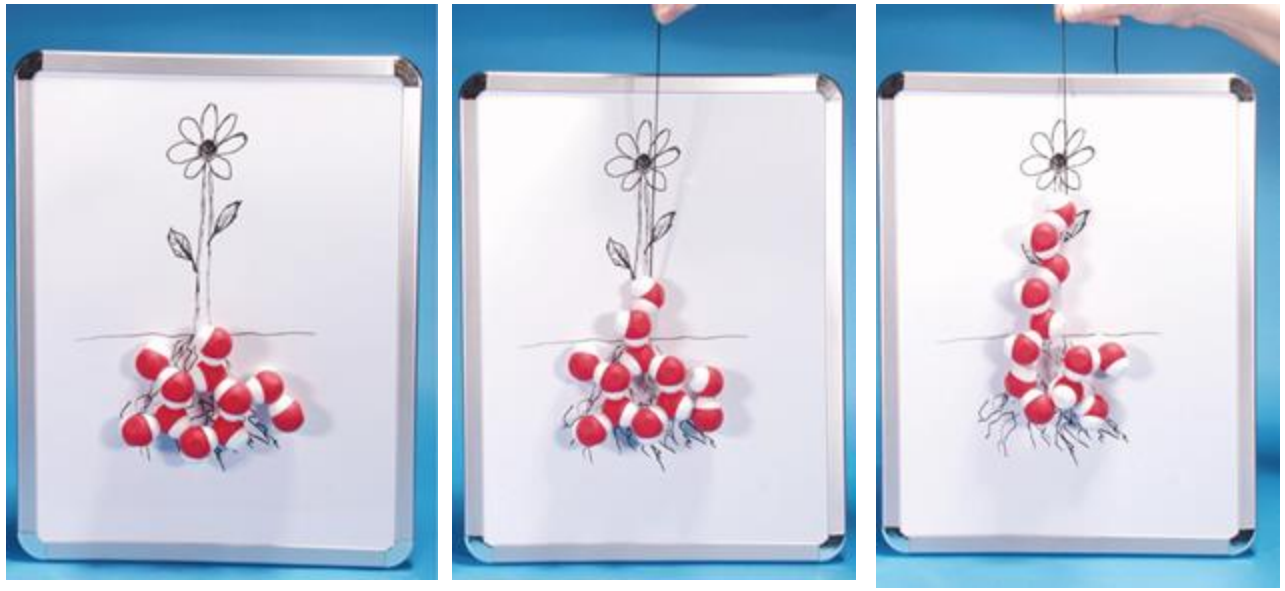


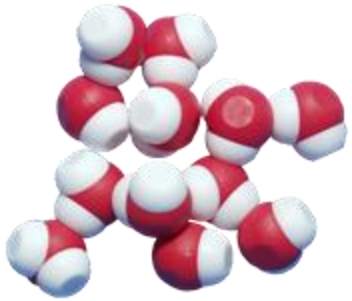
Concepts I count on:

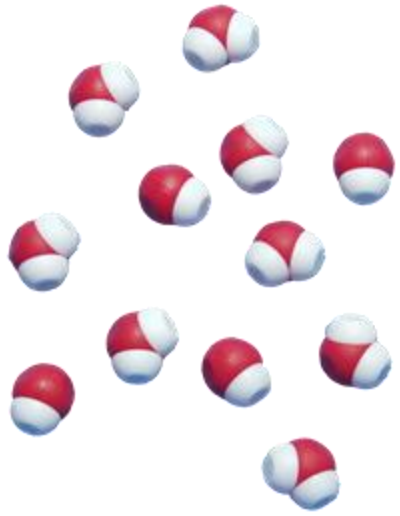
- Polar molecule
- Covalent bonds are atoms sharing an electron
- Hydrogen bonds are weaker attractions between molecules
- Adhesion and cohesion made possible
- Color scheme in modeling
- First transfer of 3D model into science notebook
- How to manage materials in our classroom



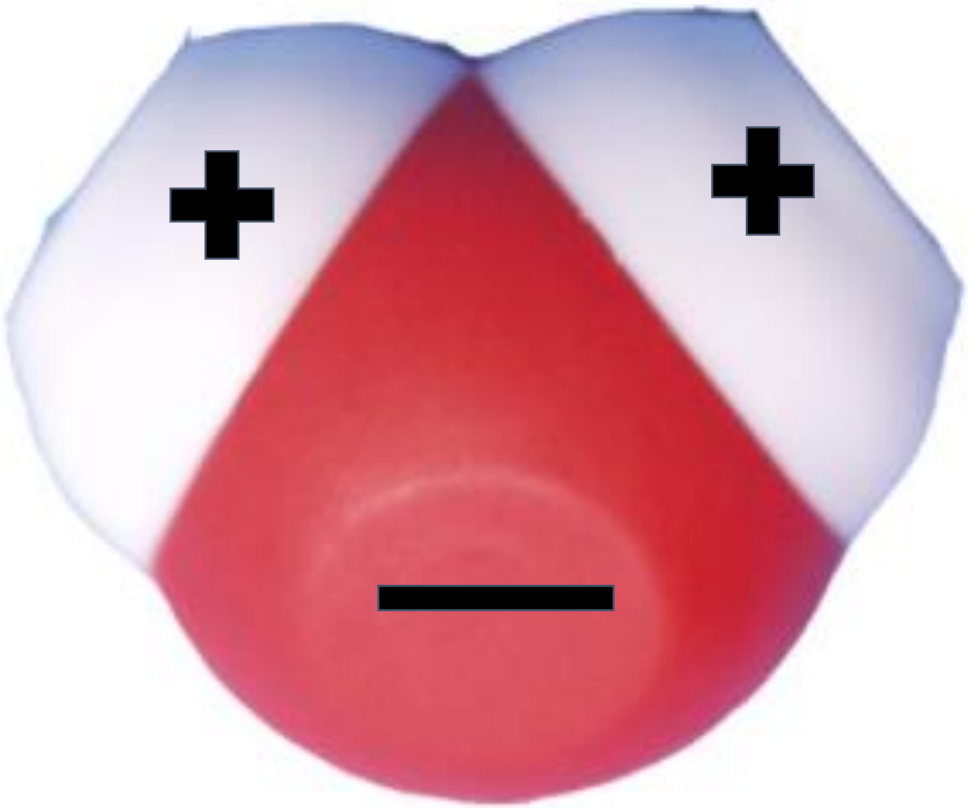
They hydrogen bonds that allows water to be so amazing is made possible because of the polar nature of the water molecule.







Polar Covalent Molecule

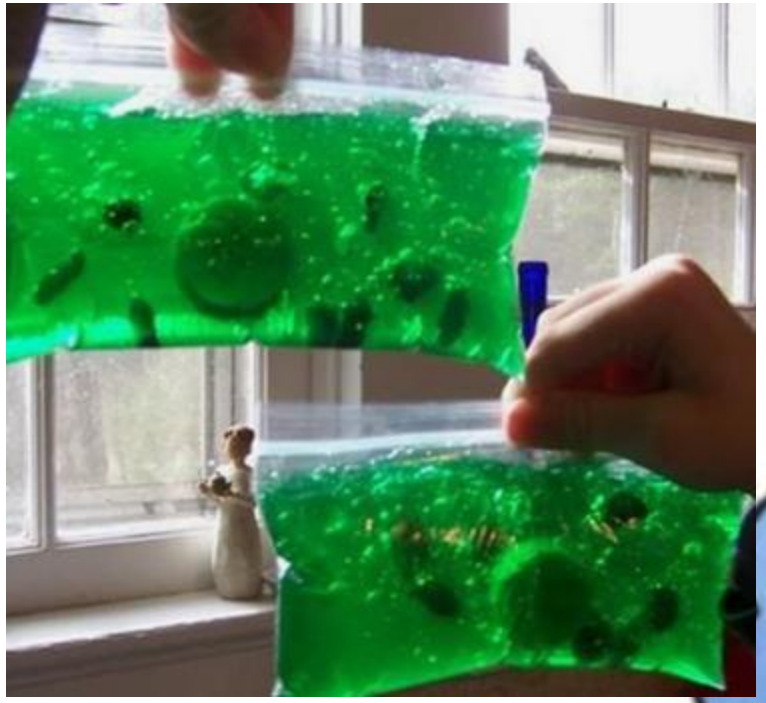


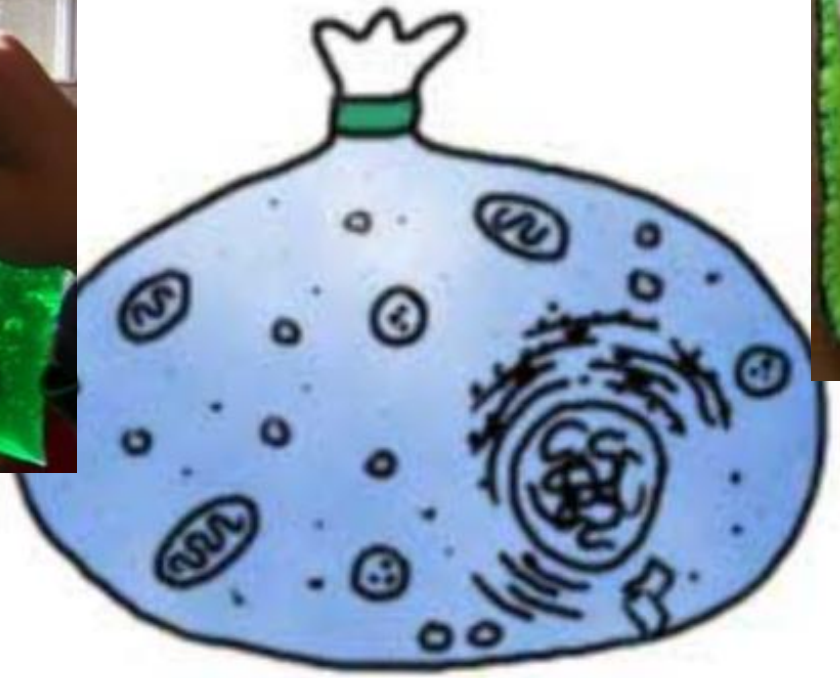
➔ Unequal sharing of electrons between the atoms

➔ Unsymmetrical shape of the molecule

This means that a water molecule has **two poles** - a positive charge on the hydrogen pole and a negative charge on the oxygen pole.

Consider the models our students have seen about cells and cell membranes.

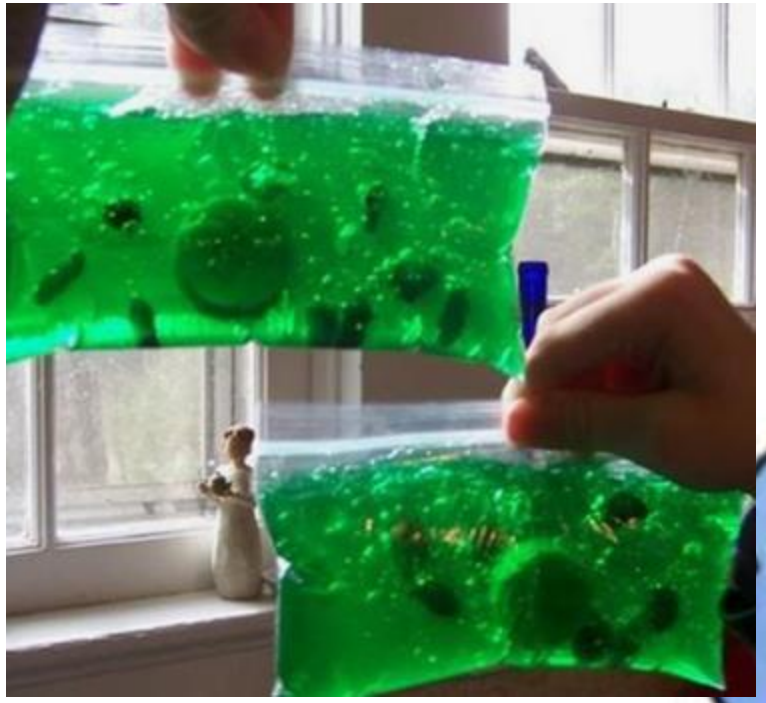


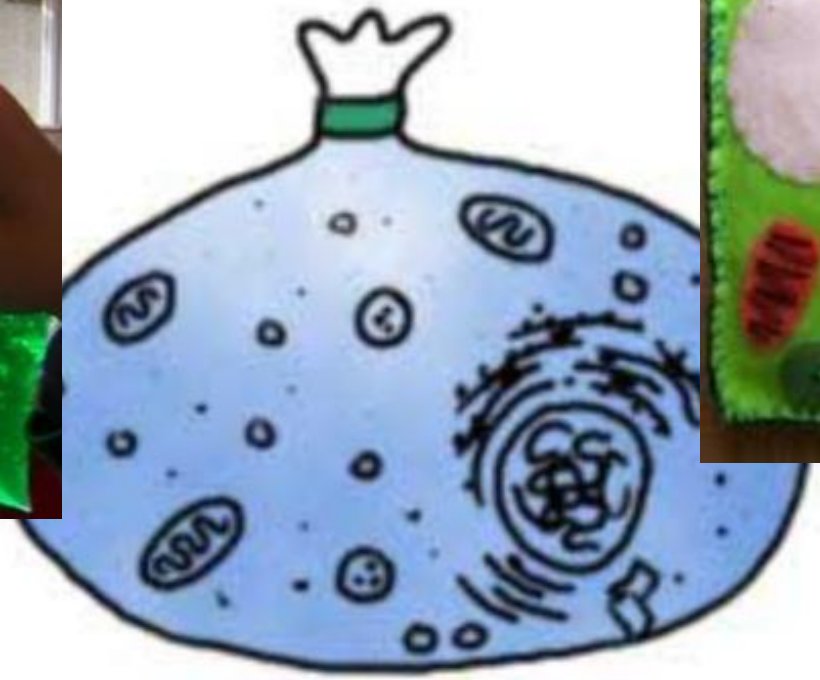


What ideas might they carry with them into our classrooms?

Chat waterfall:

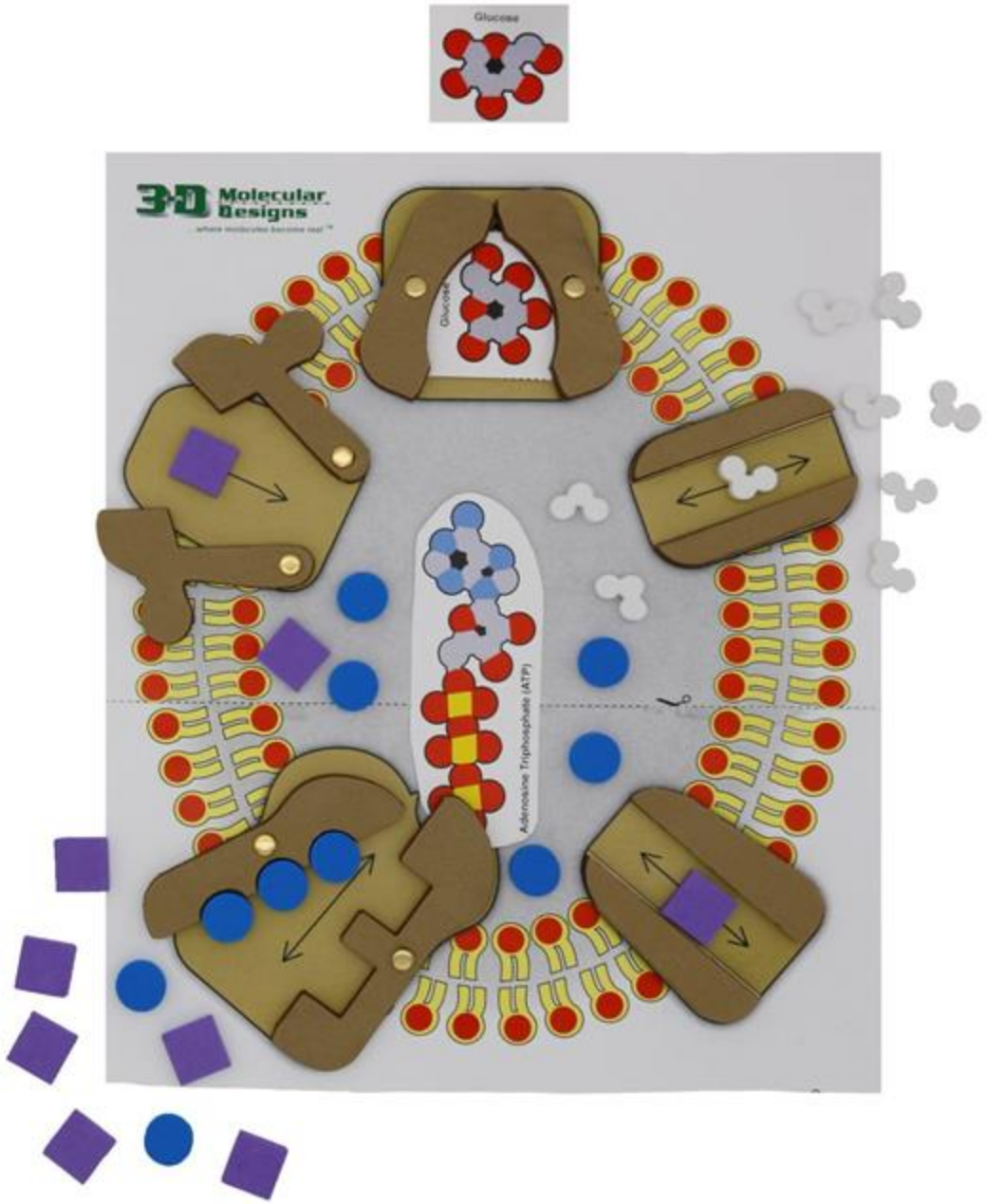
wait until you see the chat water molecule to hit send, this allows people to have time to craft their answer.





Hit enter and share your thinking.

Think about how the cell membrane works. Choose an image that is analogous to a cell membrane.



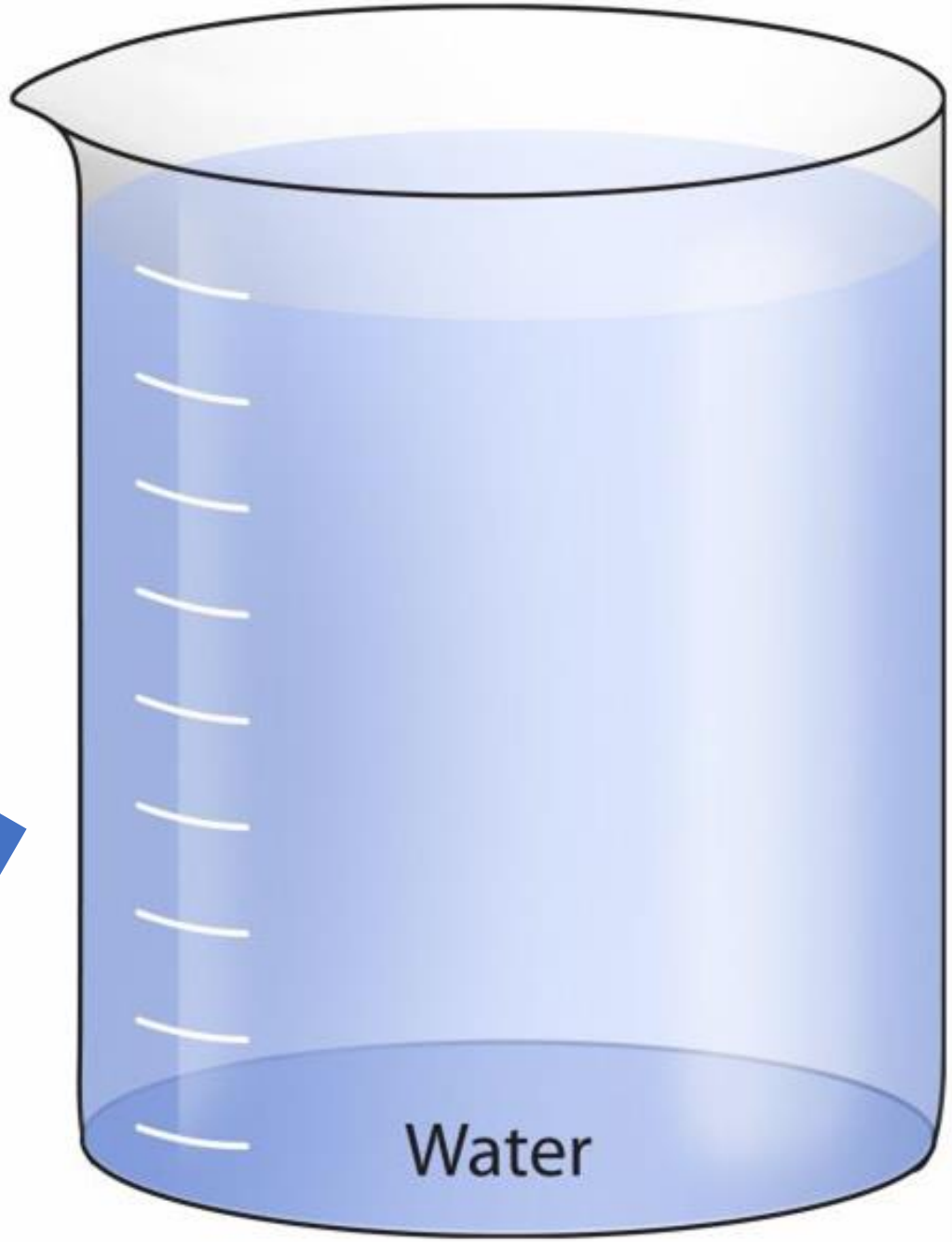
What we will work with next:

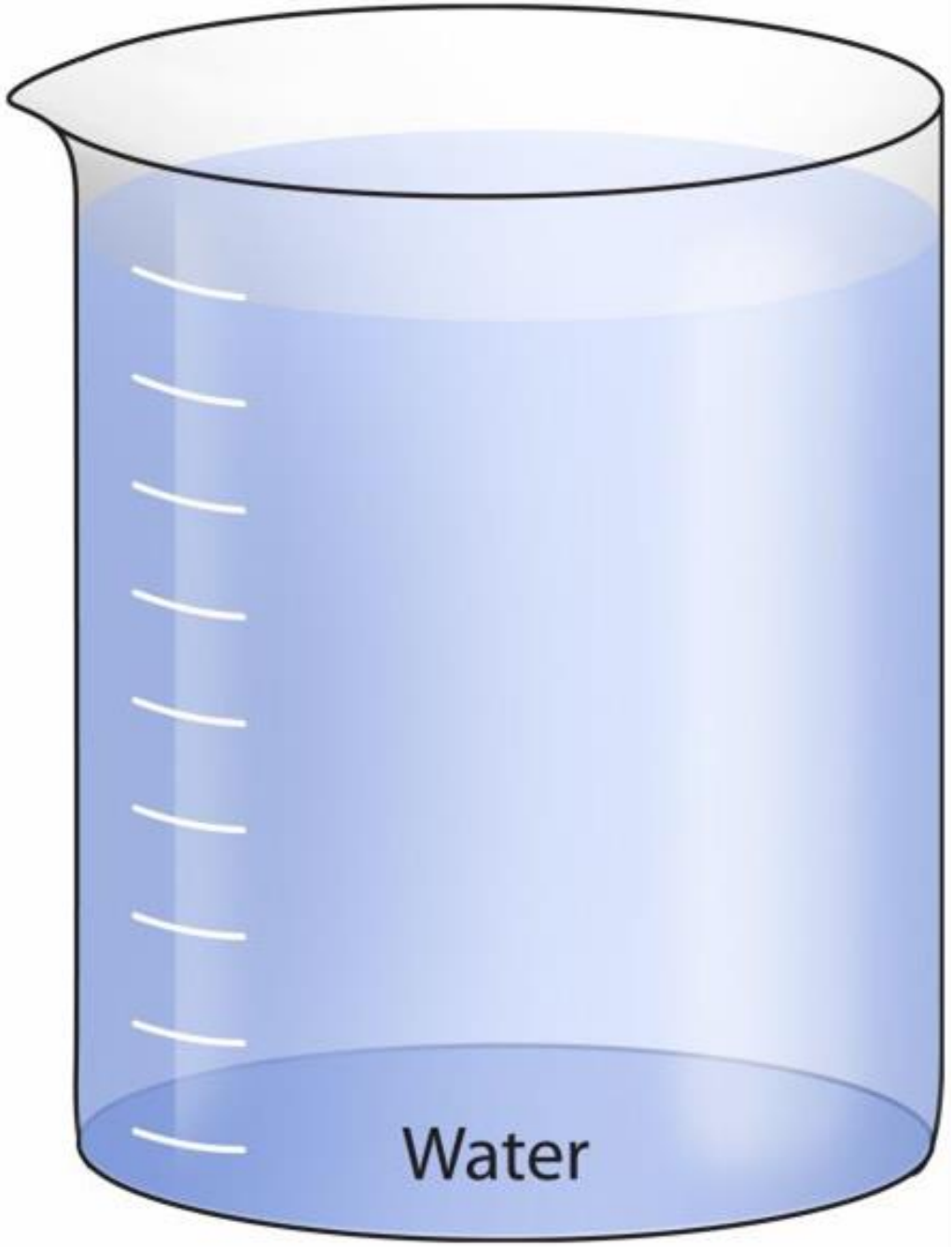
10 water molecules

30 phospholipid molecules

Your Turn

Use the beaker image you printed ahead of time or draw a beaker of water on paper. Place some of your **water molecules** in the beaker.





Your turn...

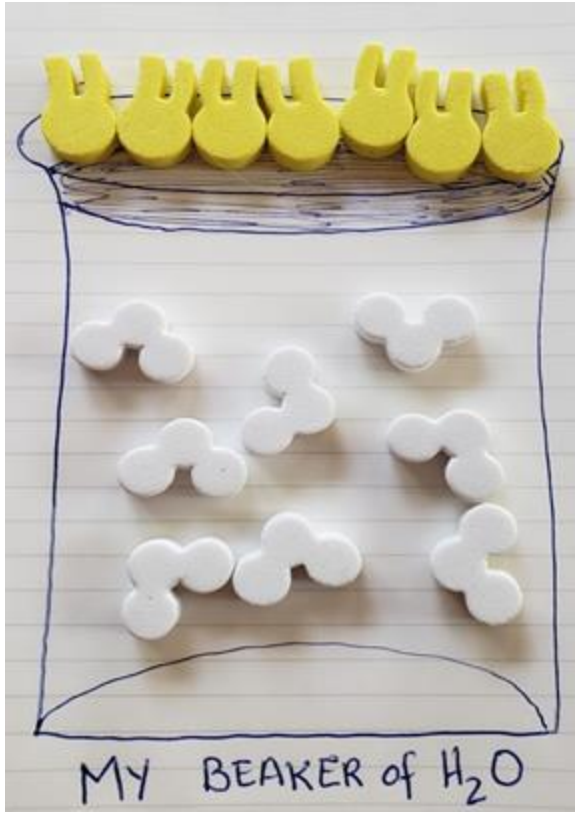
Based upon what you know about lipids, arrange ten phospholipid molecules to create a film on the surface of the water in the beaker.

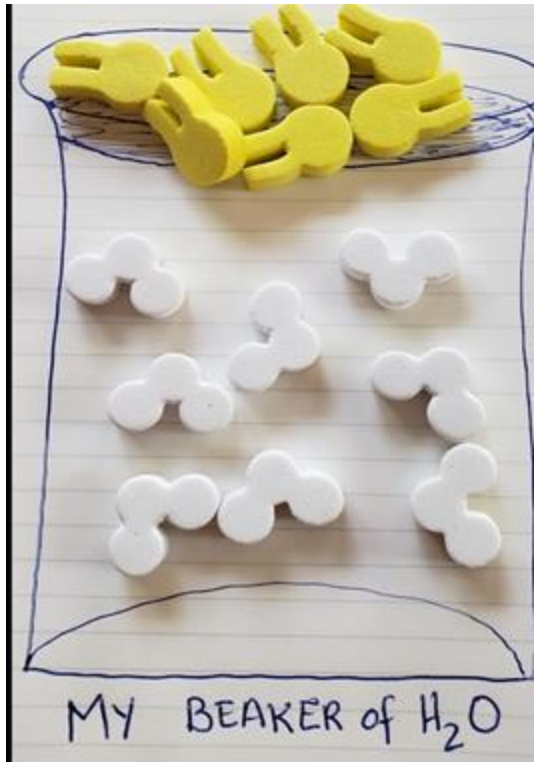
What does this initial model students created reveal to me as a teacher?

Chat waterfall:

wait until you see the chat water molecule to hit send, this allows people to have time to craft their answer.

Student A

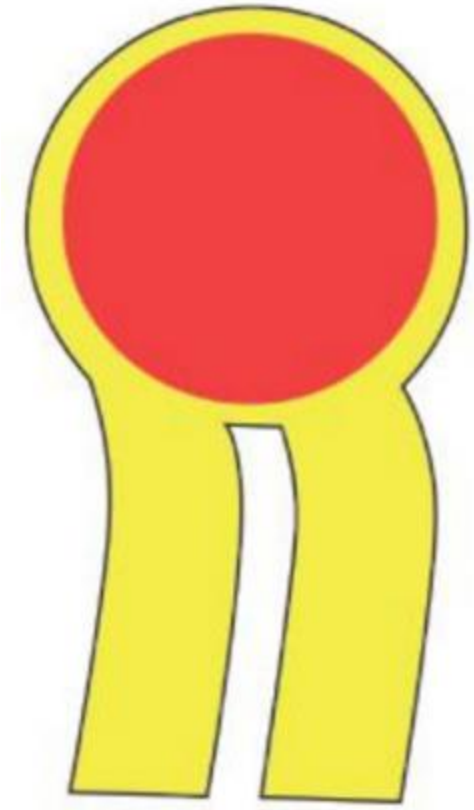


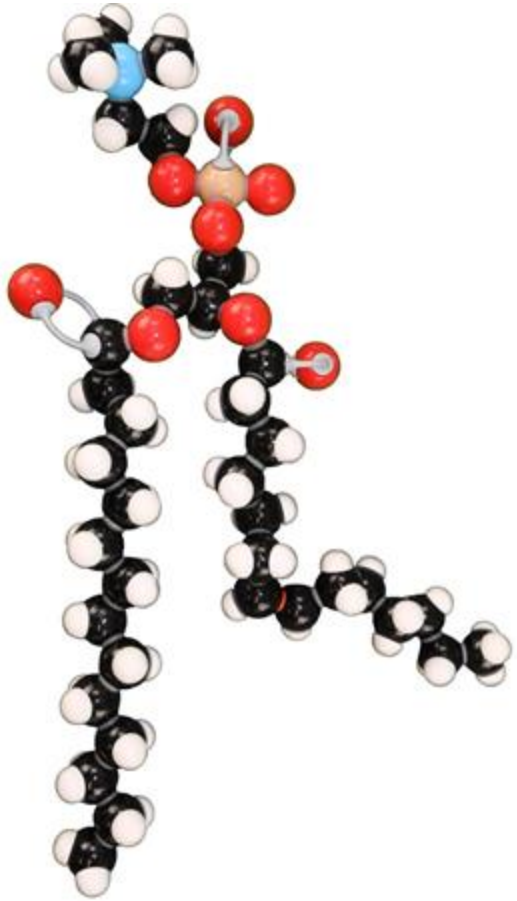


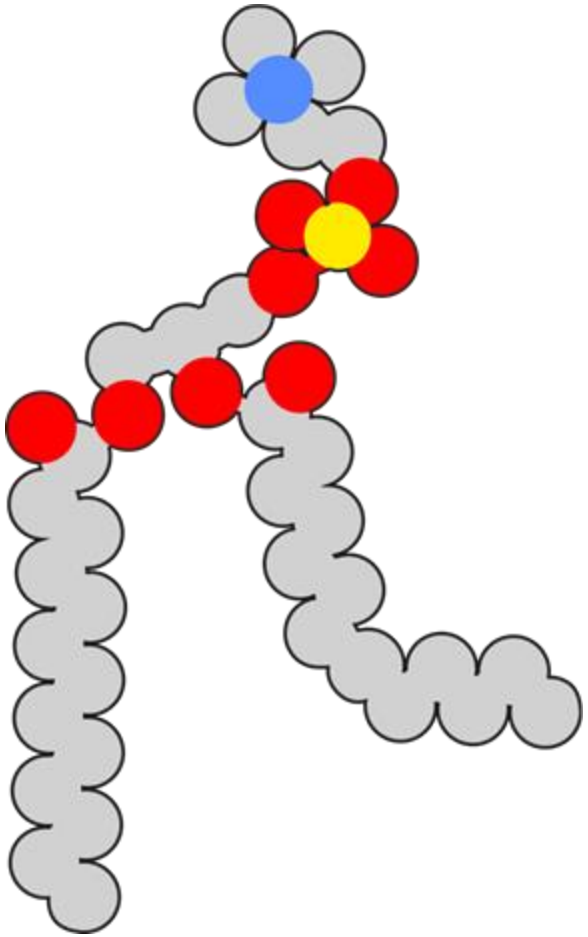
Student B

Hit enter and share your thinking.

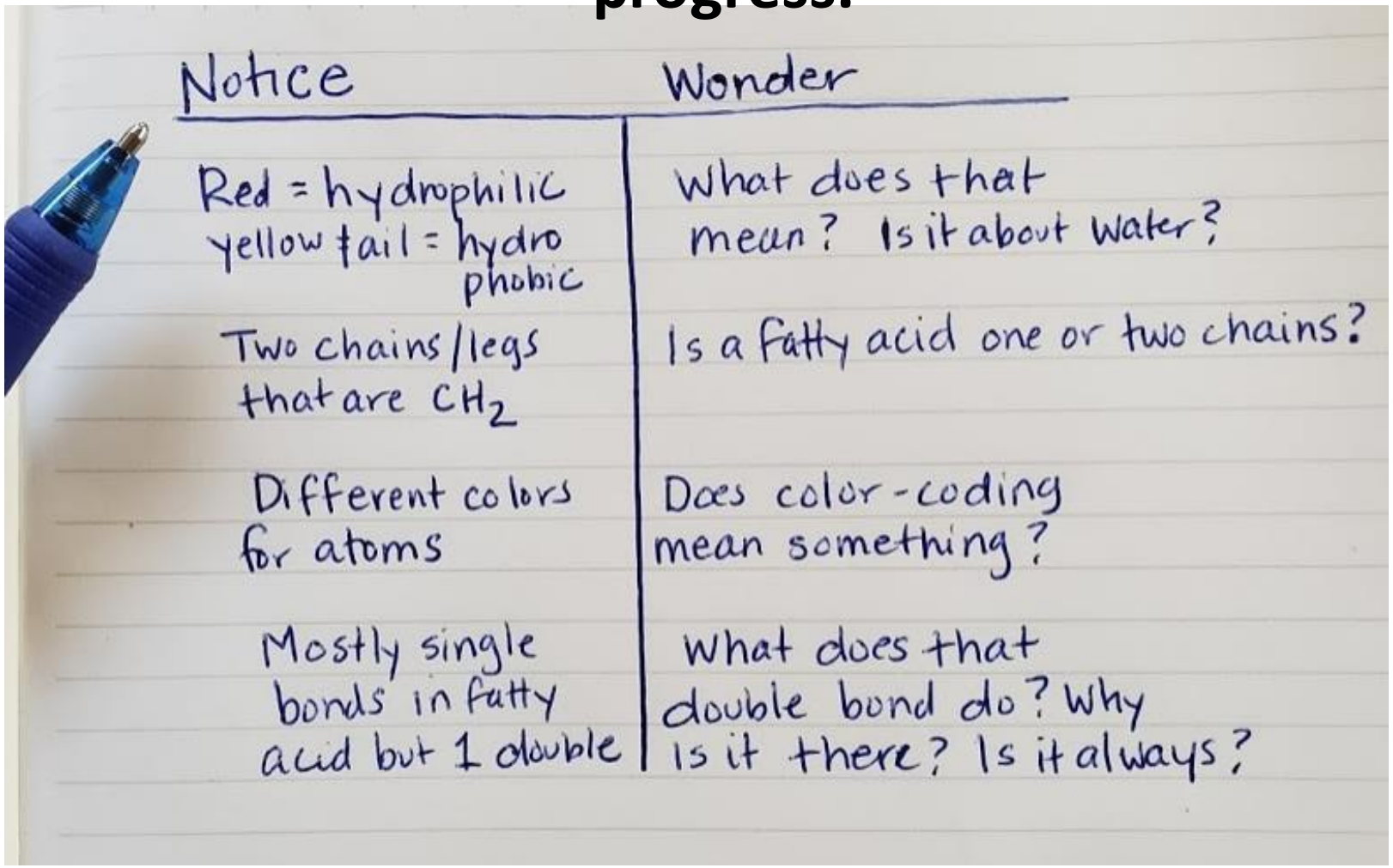
My students need more information to revise their model. Please create a T-chart labeled notice and wonder. Then, record what you notice and what you wonder.

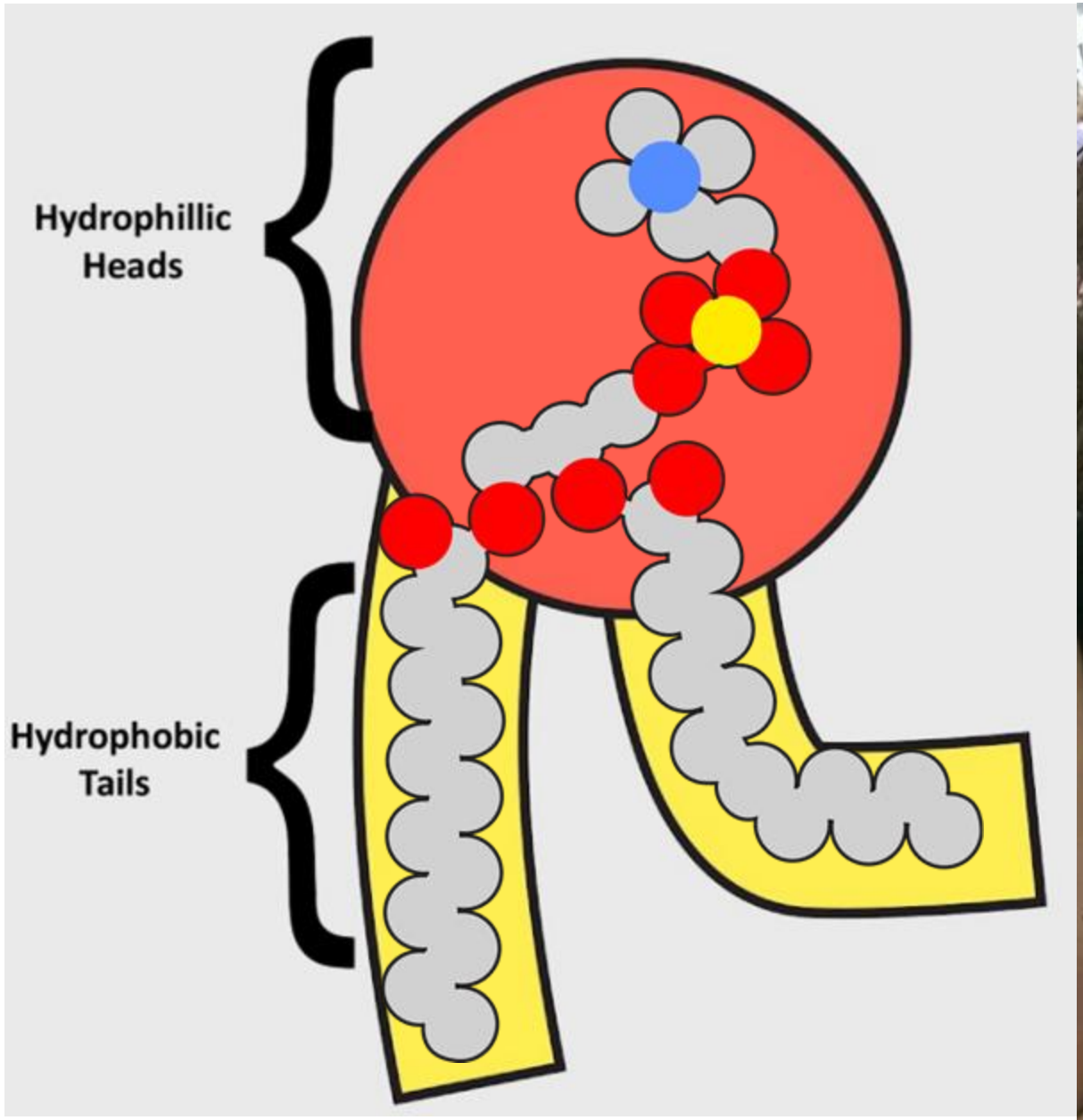


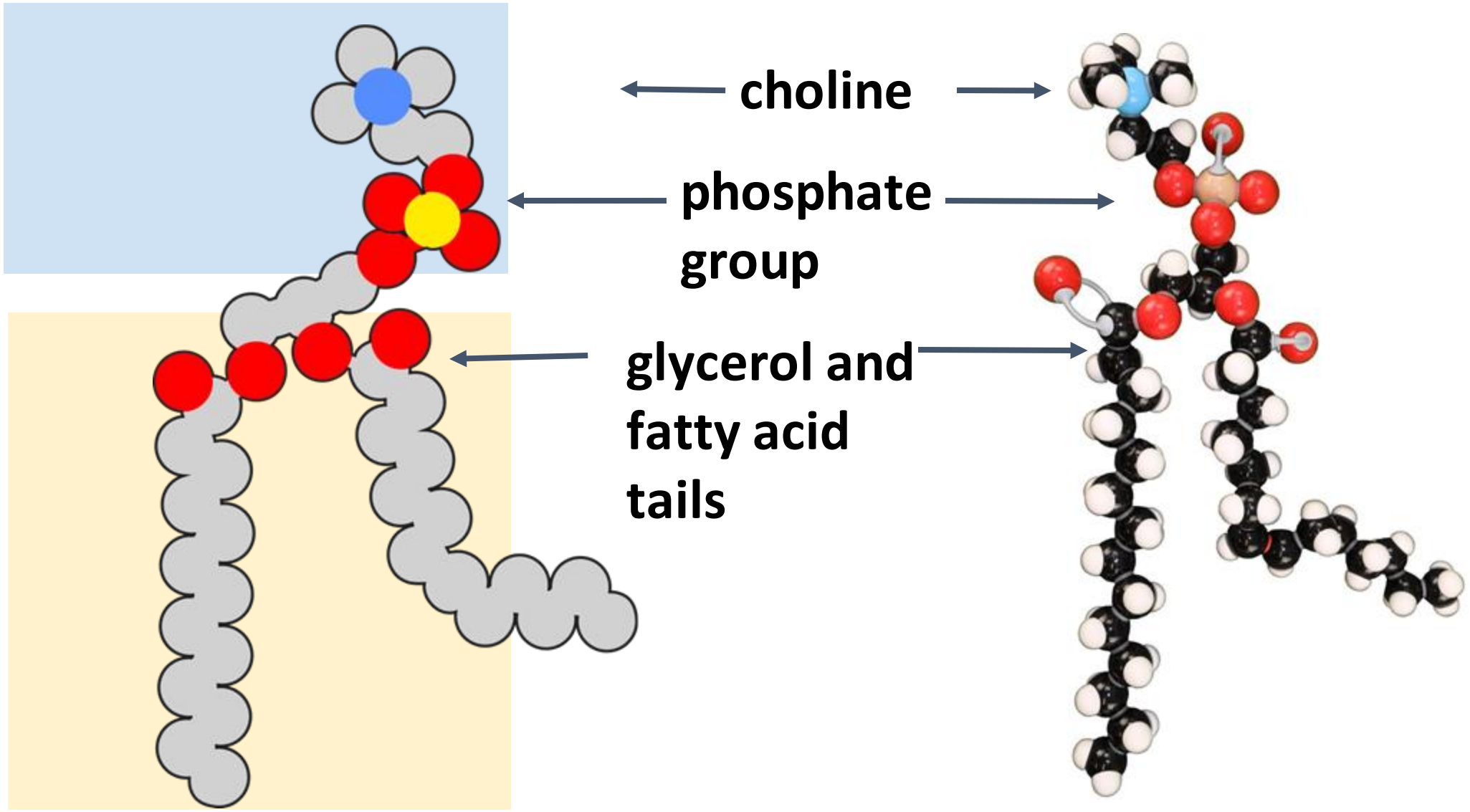


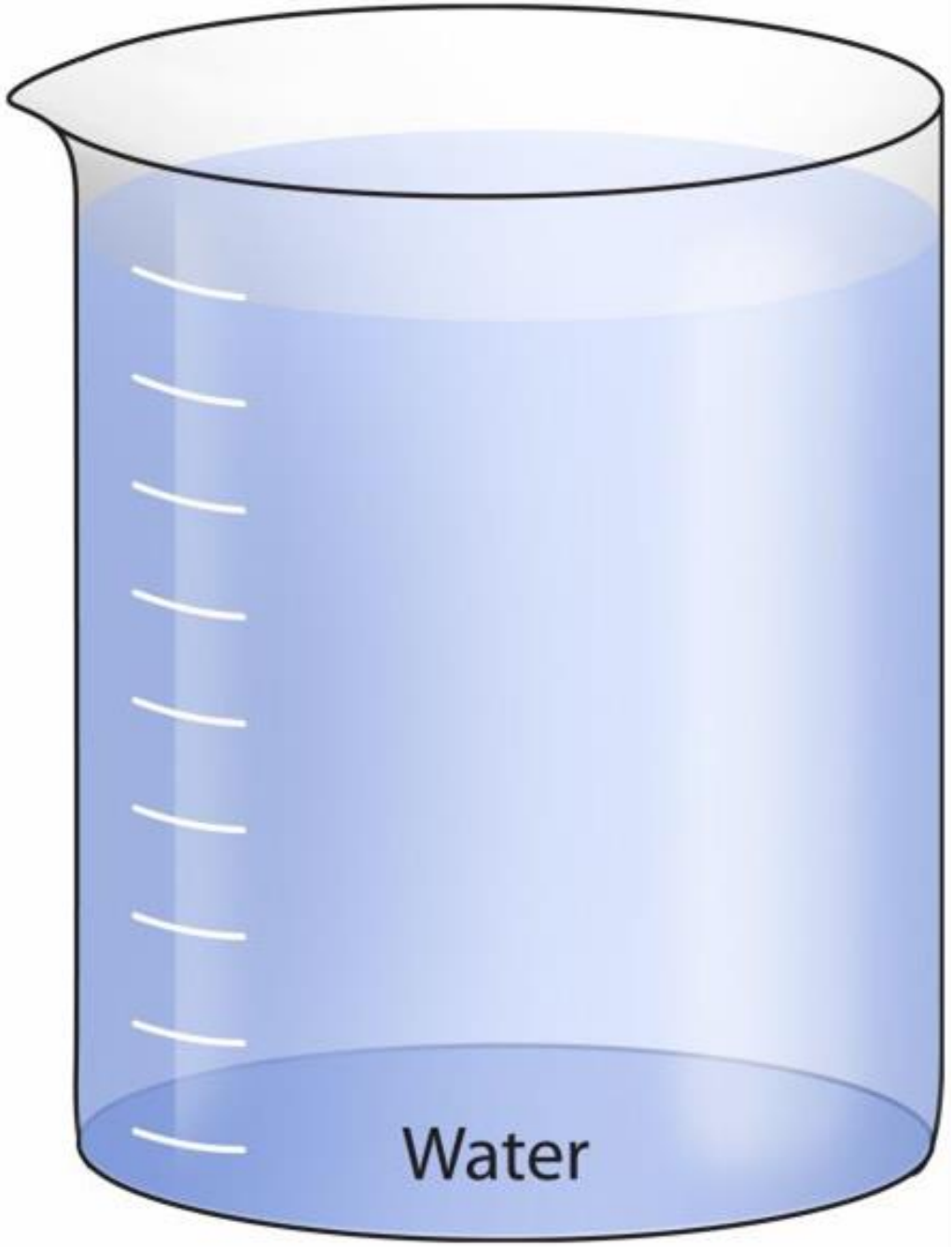


Record their thinking to use as a resource and to add to as they work through their modeling…AND see their learning progress.




Hydrophillic
Heads
Hydrophobic
Tails


choline
phosphate group
glycerol and fatty acid tails



Most cells are surrounded by water. And cells have water inside.

Your Turn Again!

Based upon what you know about phospholipids, arrange the molecules so they are like a cell.

(you can use more than 10 molecules)

What does these revised student models reveal to me as a teacher? Chat waterfall

Student A

Student B

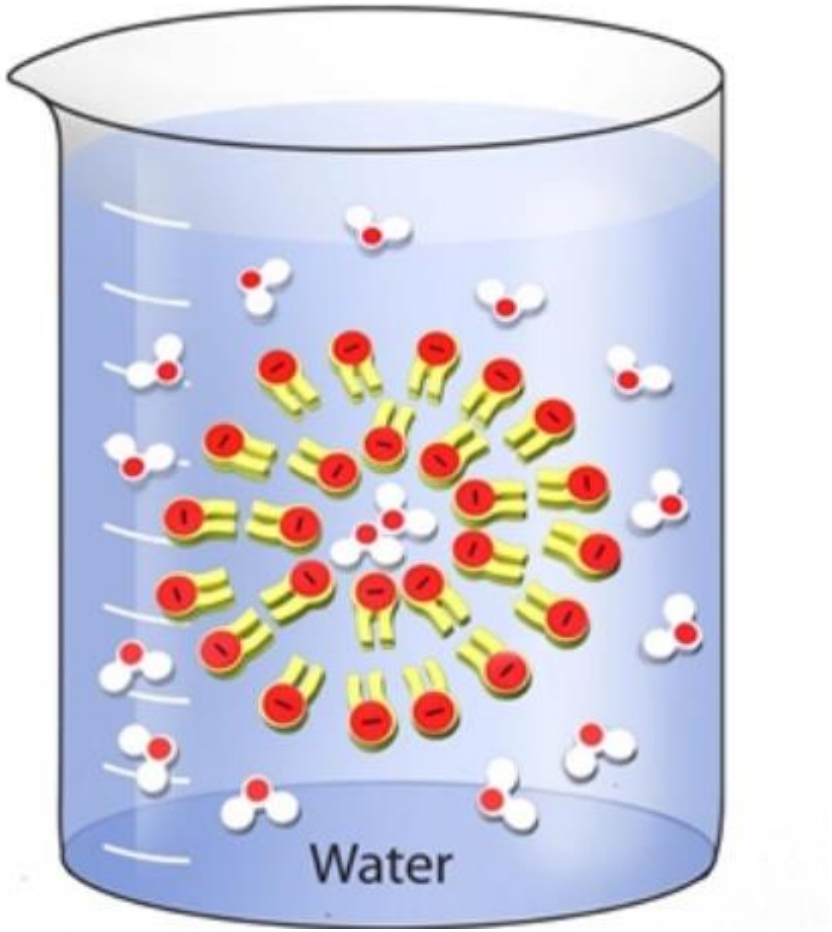
Hit enter and share your thinking.

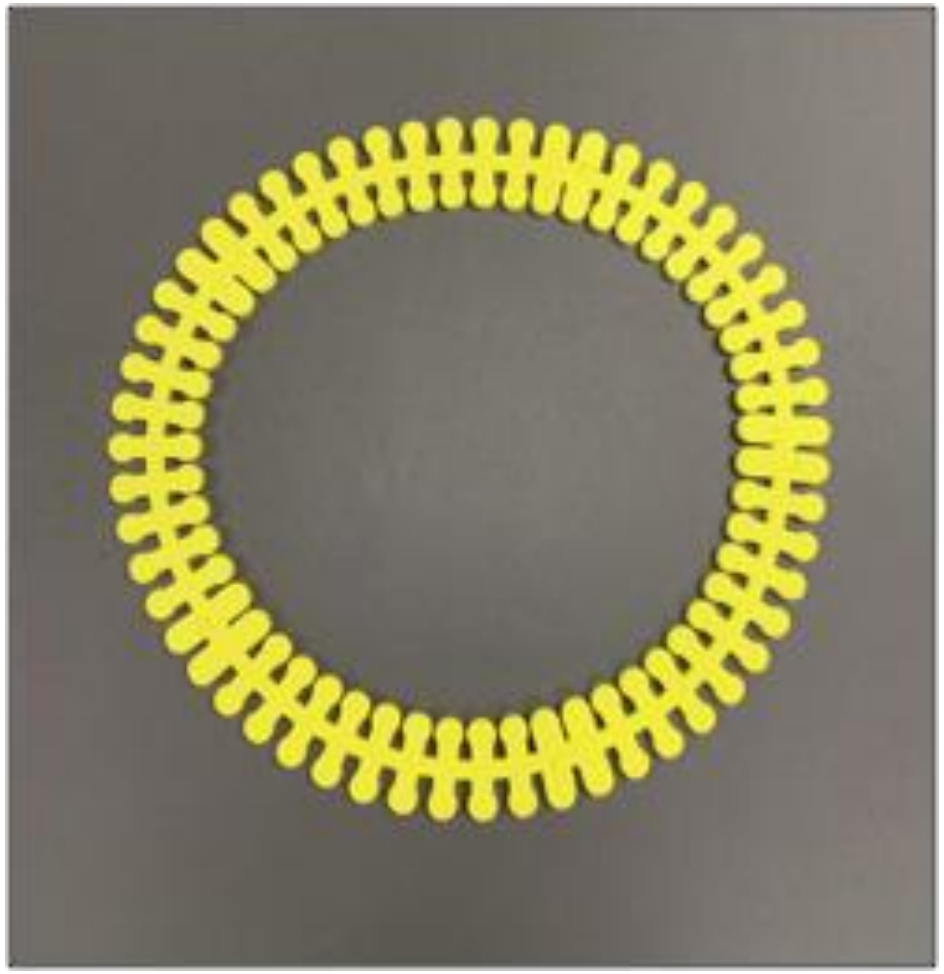
This is an invitation.

A conversation with this student would help me see what they are thinking so I can understand their reasoning.

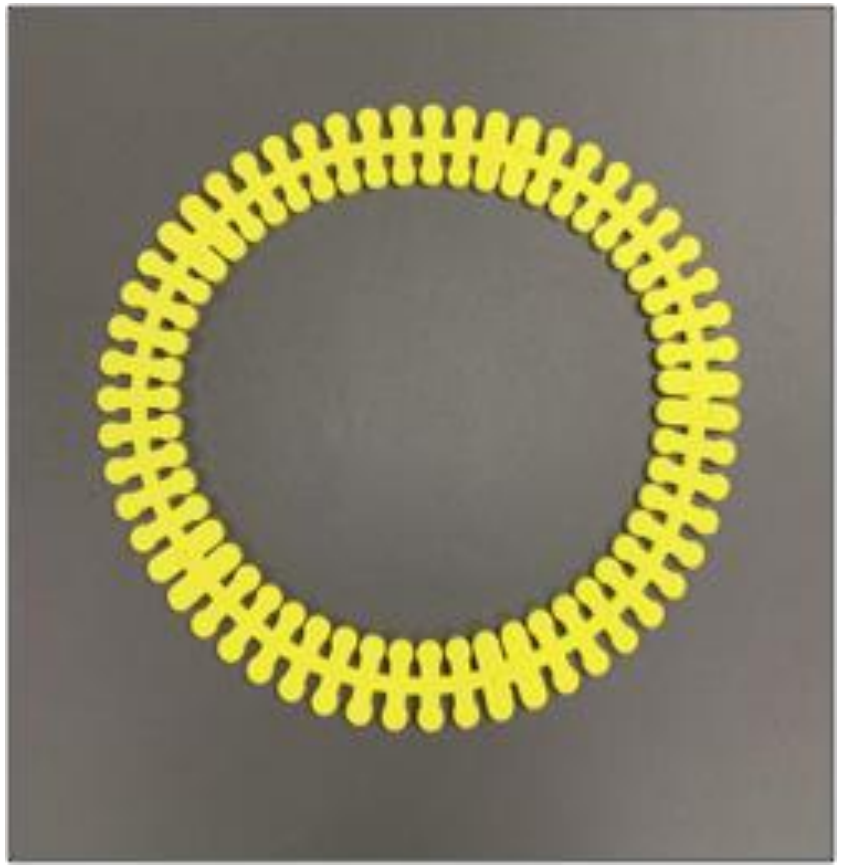
(and they get a chance to revise)

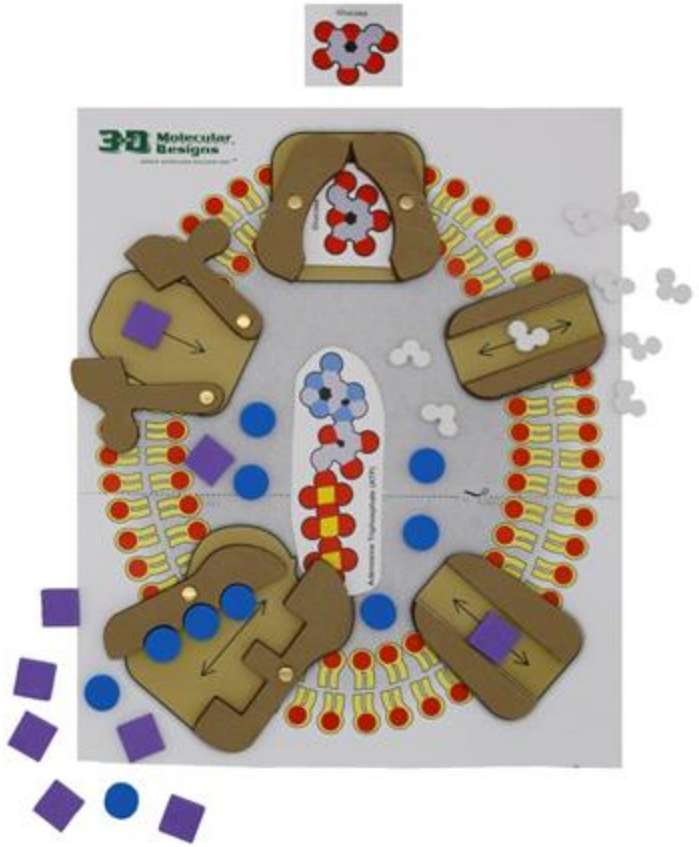
Multiple representations: always trade offs in models we use



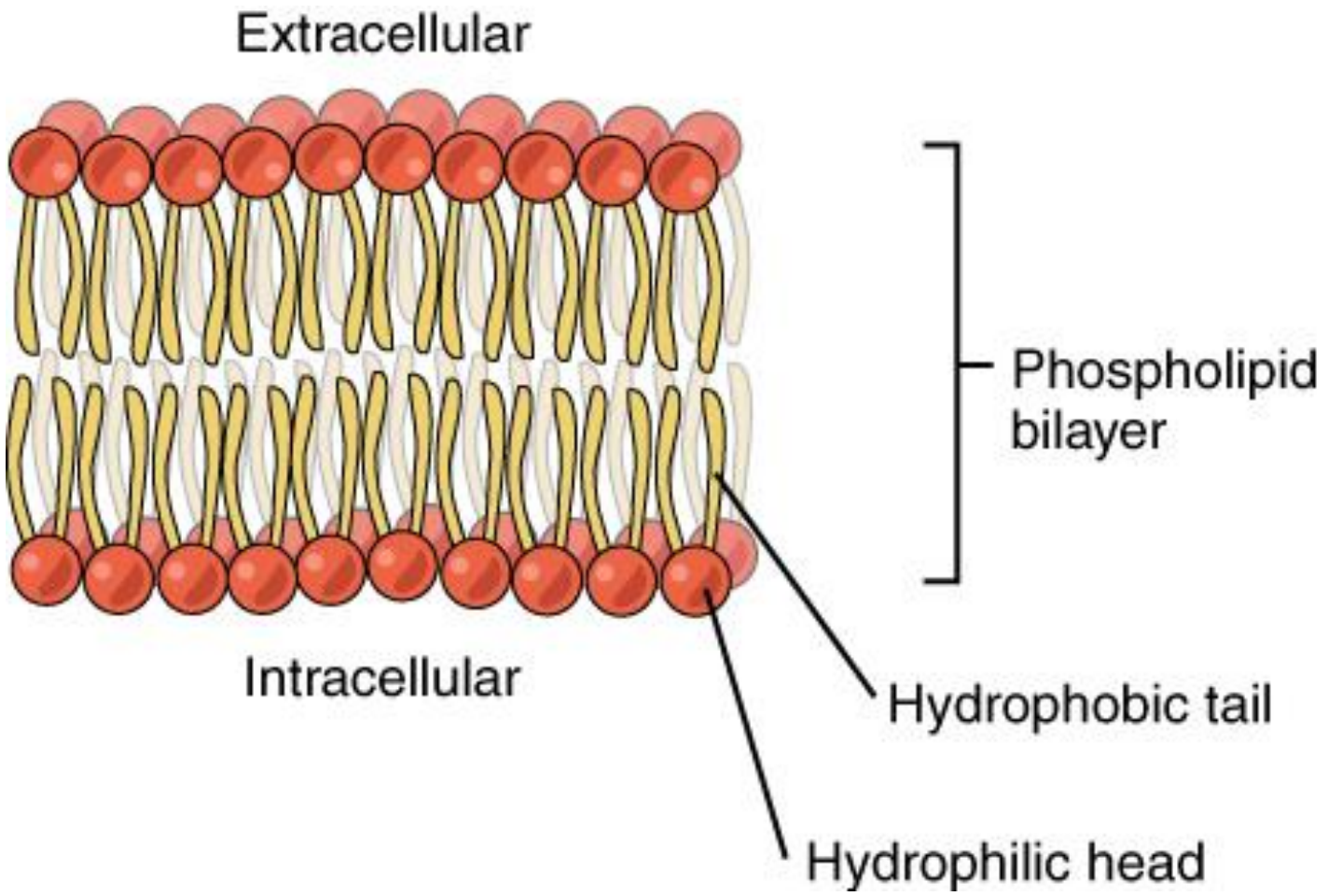


Compare the classroom model with your student modeling pack representation. What opportunity does the arrangement of the phospholipids provide? Chat waterfall



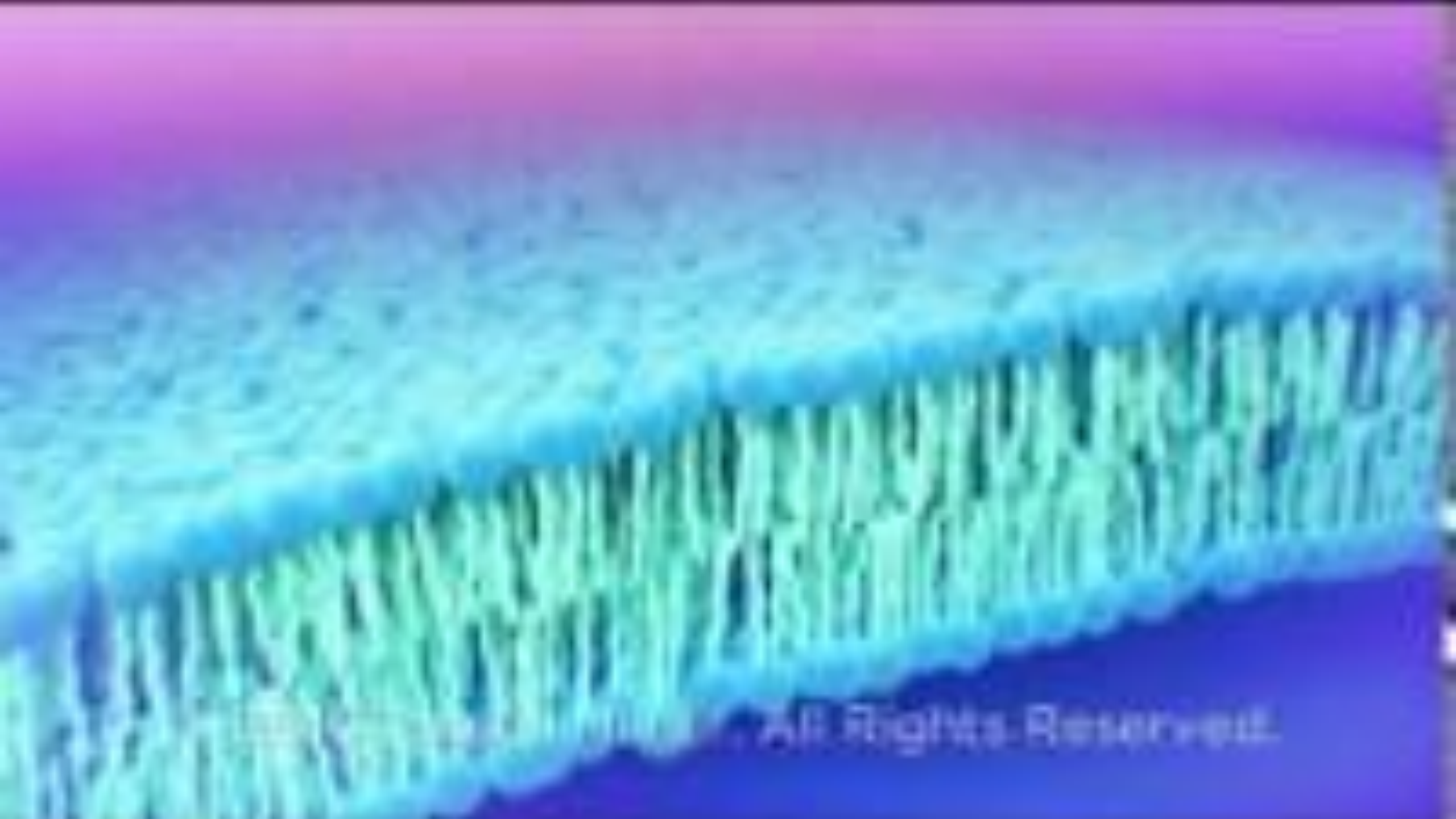


Hit enter and share your thinking.



This whole structure, this marvelous collection that holds life together is not covalently bonded!

Stay squishy my friends.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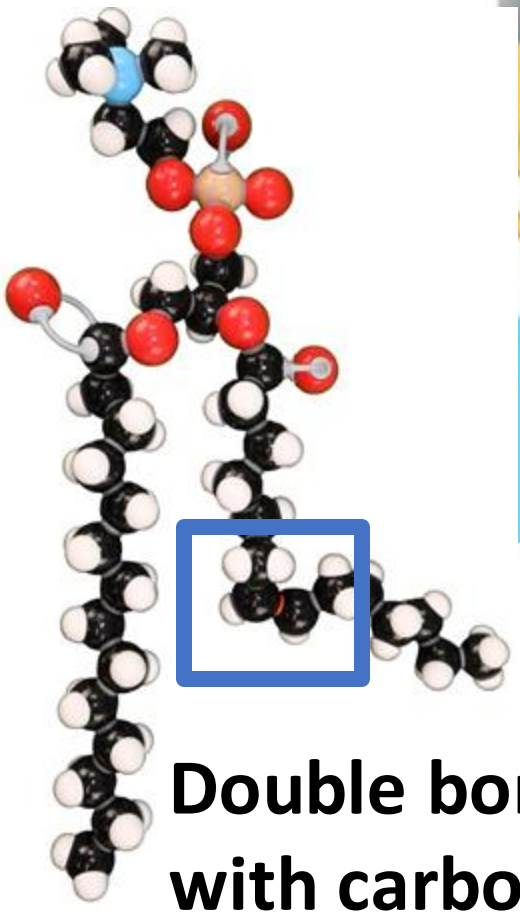
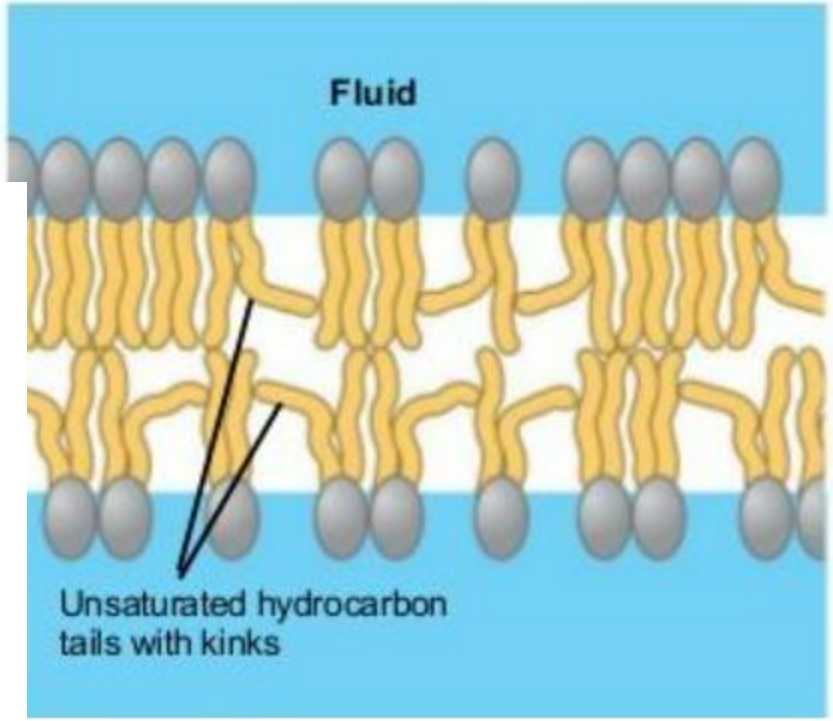
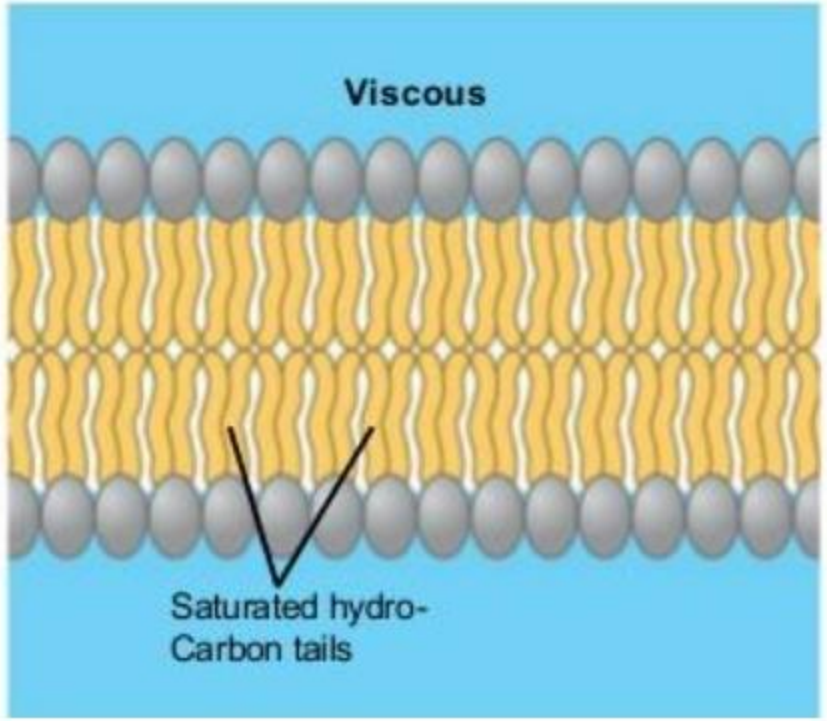
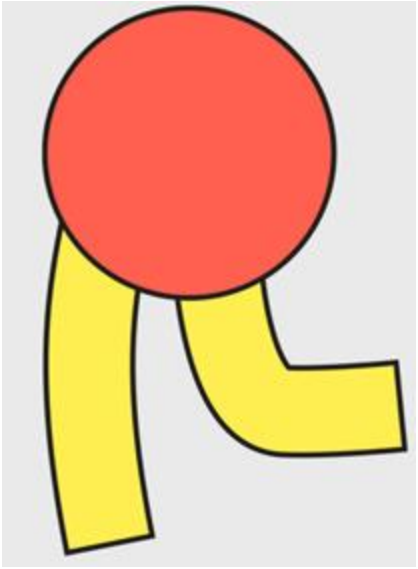
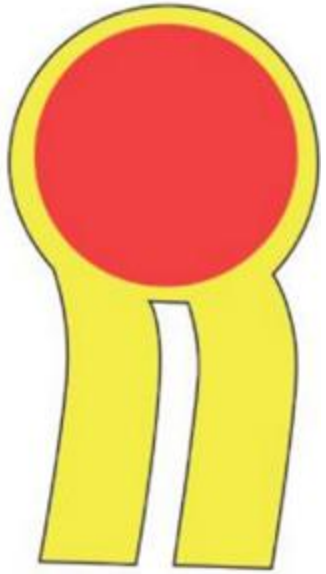


Double bond with carbon atoms

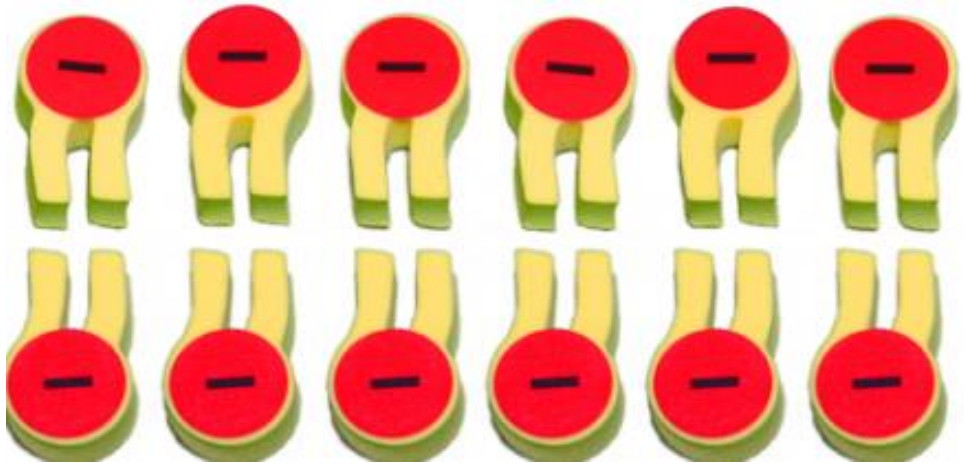






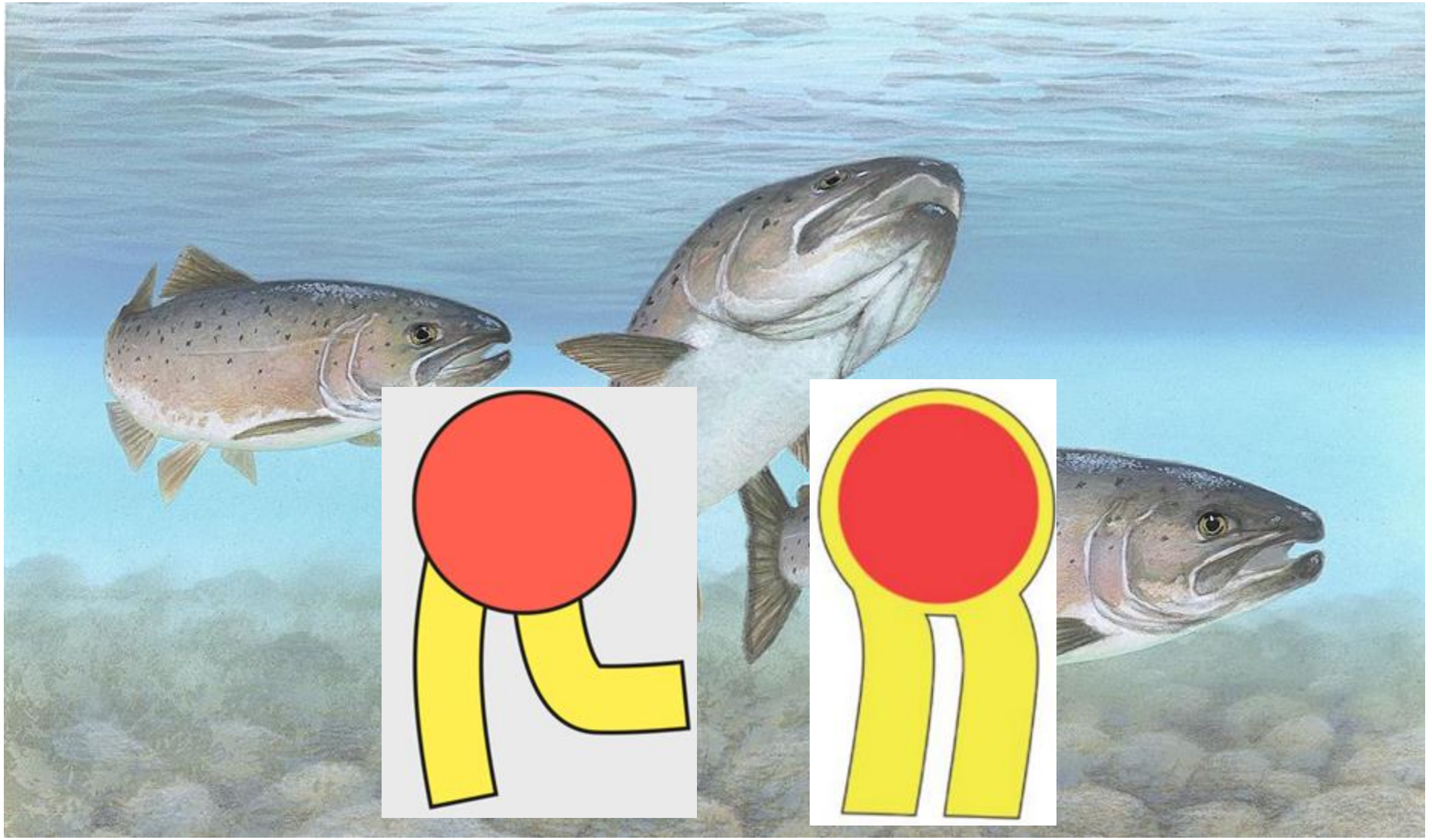


Do the phospholipids ever change in a cell membrane?



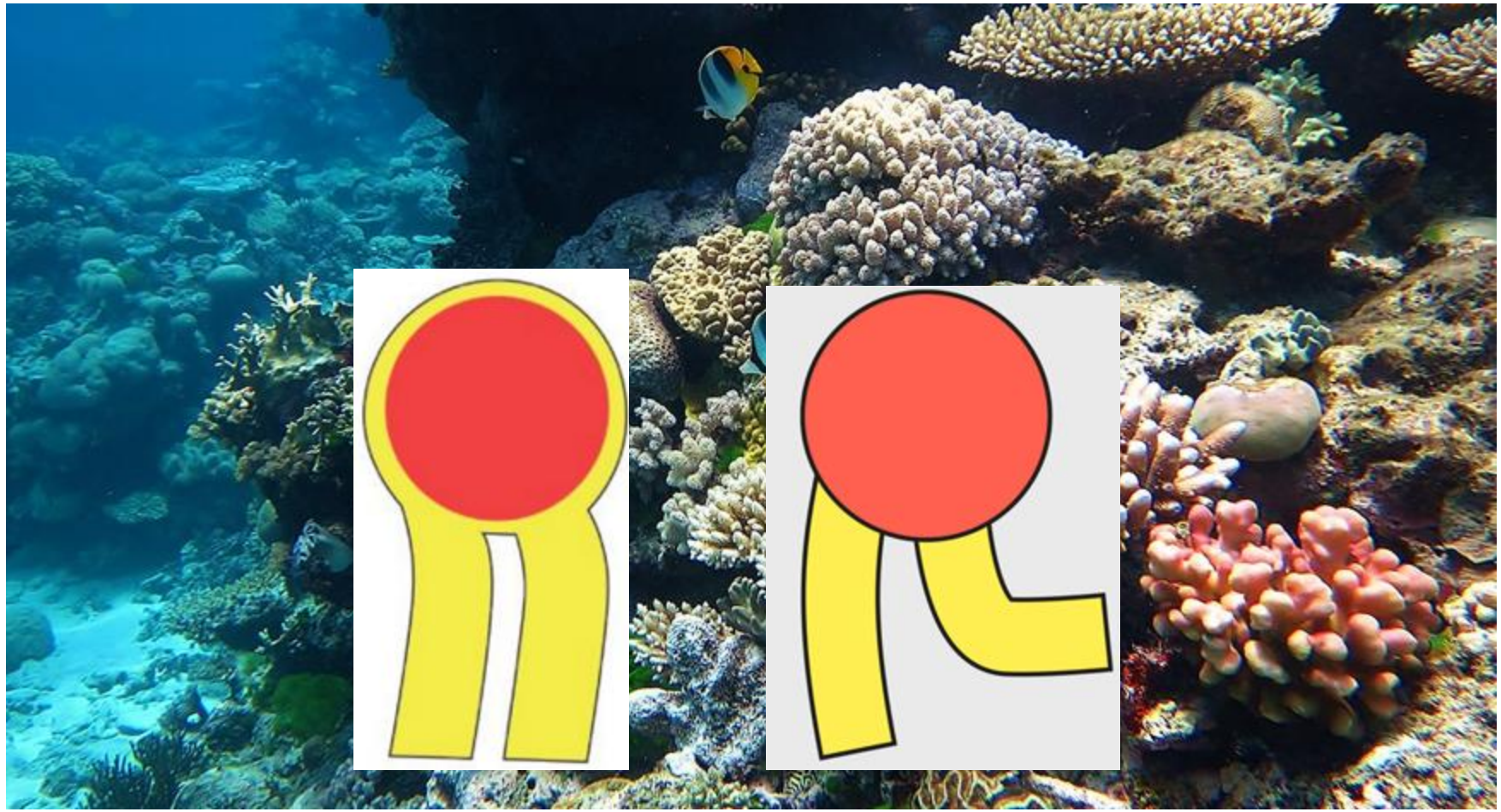
Please arrange 12 phospholipids as a bilayer on your workspace.

How might animals that are ectothermic survive the loss of the fluid nature of their cell membranes in cold conditions?

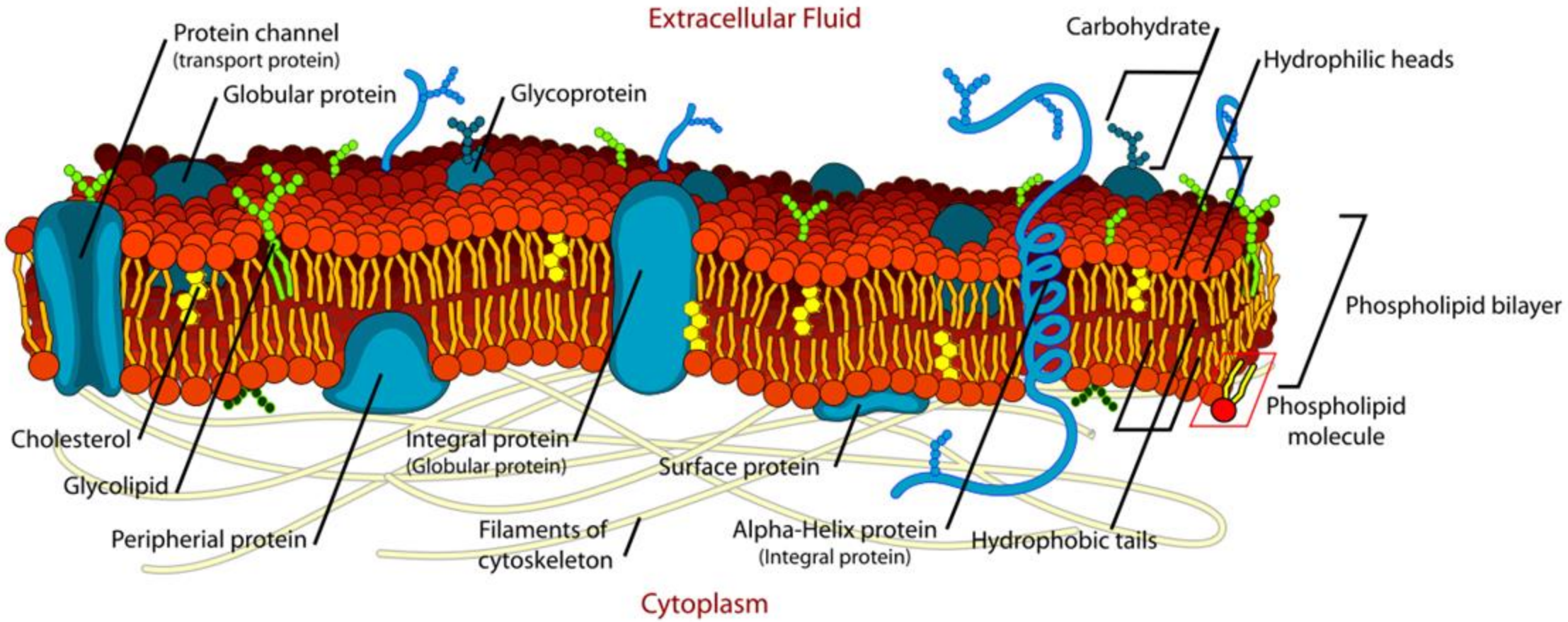


Timothy Knepp, U.S. Fish and Wildlife Service, Public domain, via Wikimedia Commons

How might animals that are ectothermic survive too much fluidity of the cell membrane in higher temperatures?



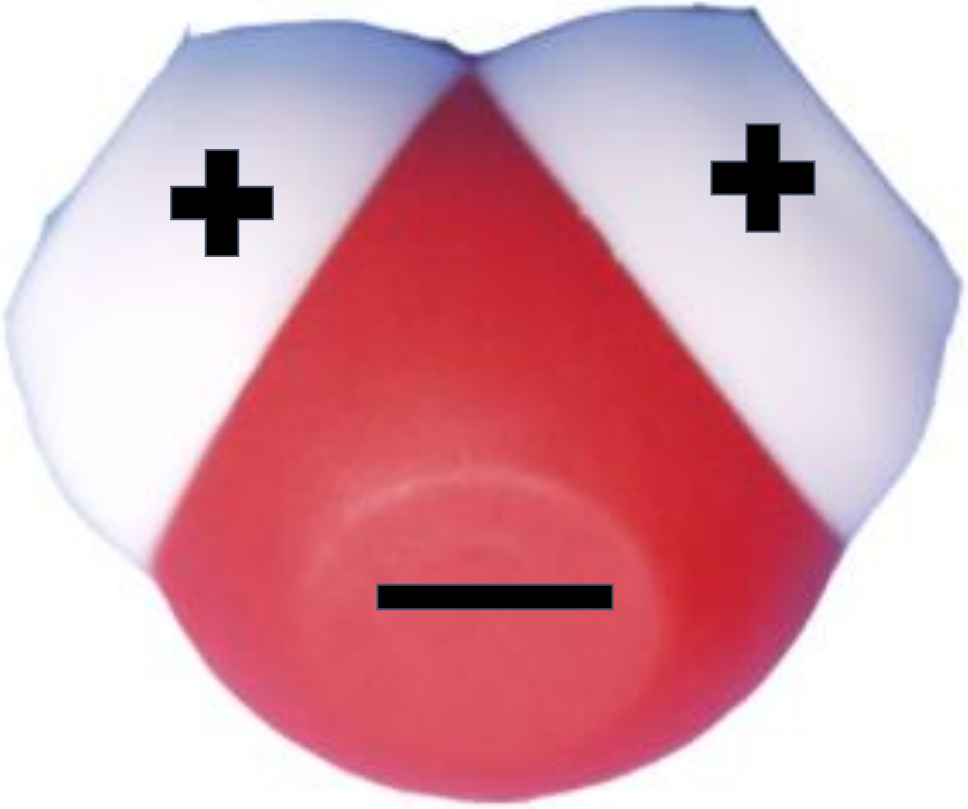
A cell membrane is not JUST phospholipids. And things need to get in and out.



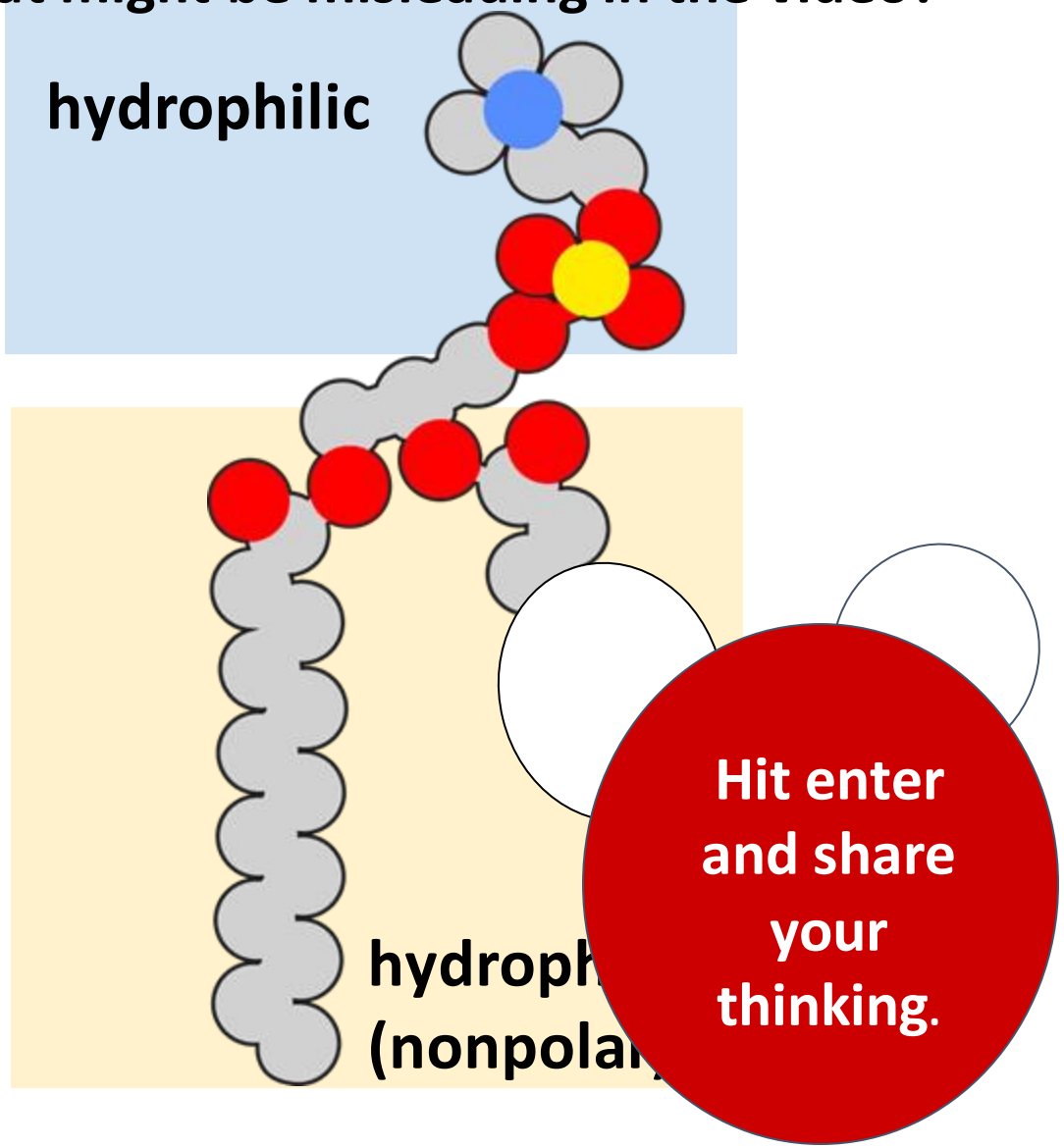
LadyofHats, Public domain, via Wikimedia Commons

Semipermeable, mosaic lipid bi-layer

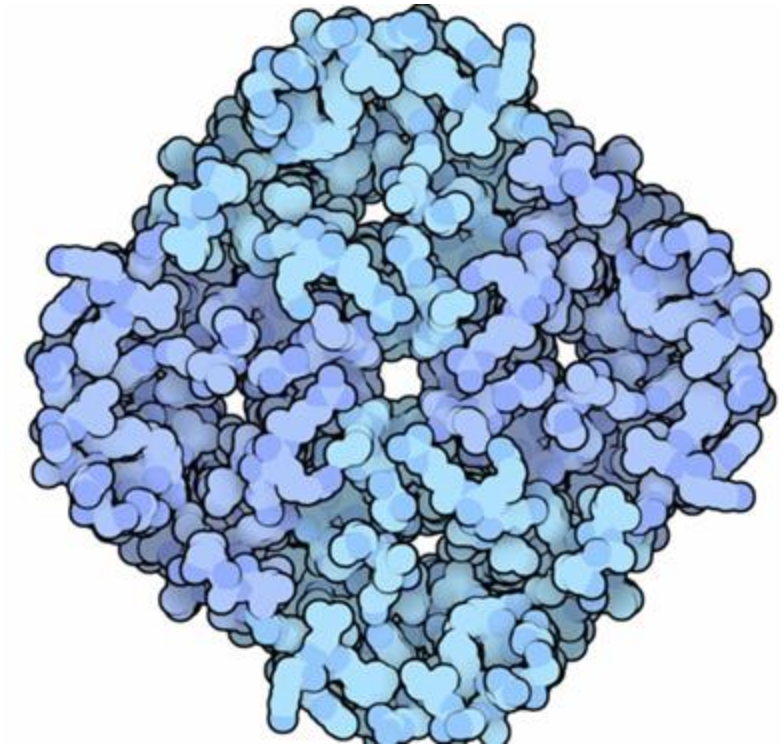
Knowing what you now know about polar molecules and the hydrophobic (nonpolar) nature of the inside of the cell membrane, what might be misleading in the video?



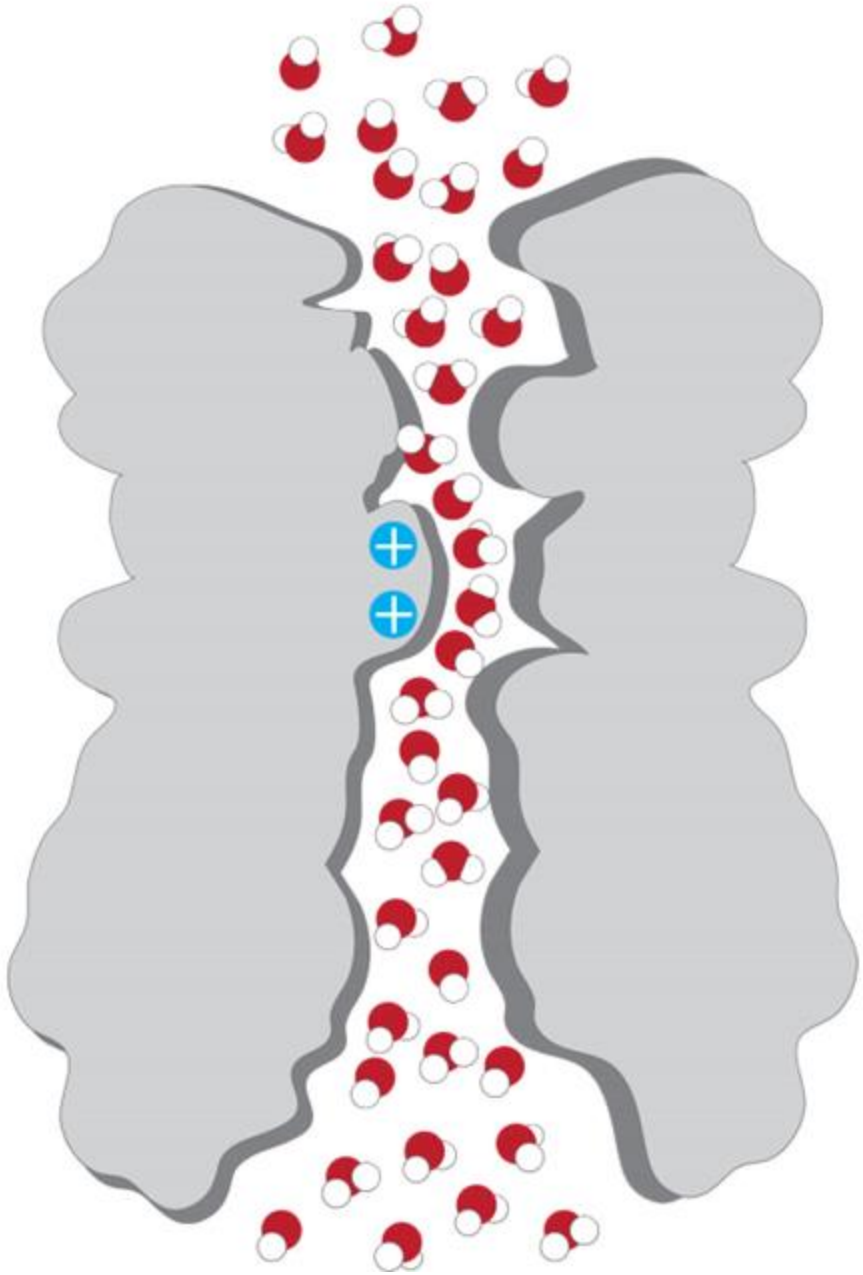
Polar



Protein transport channel: Aquaporin

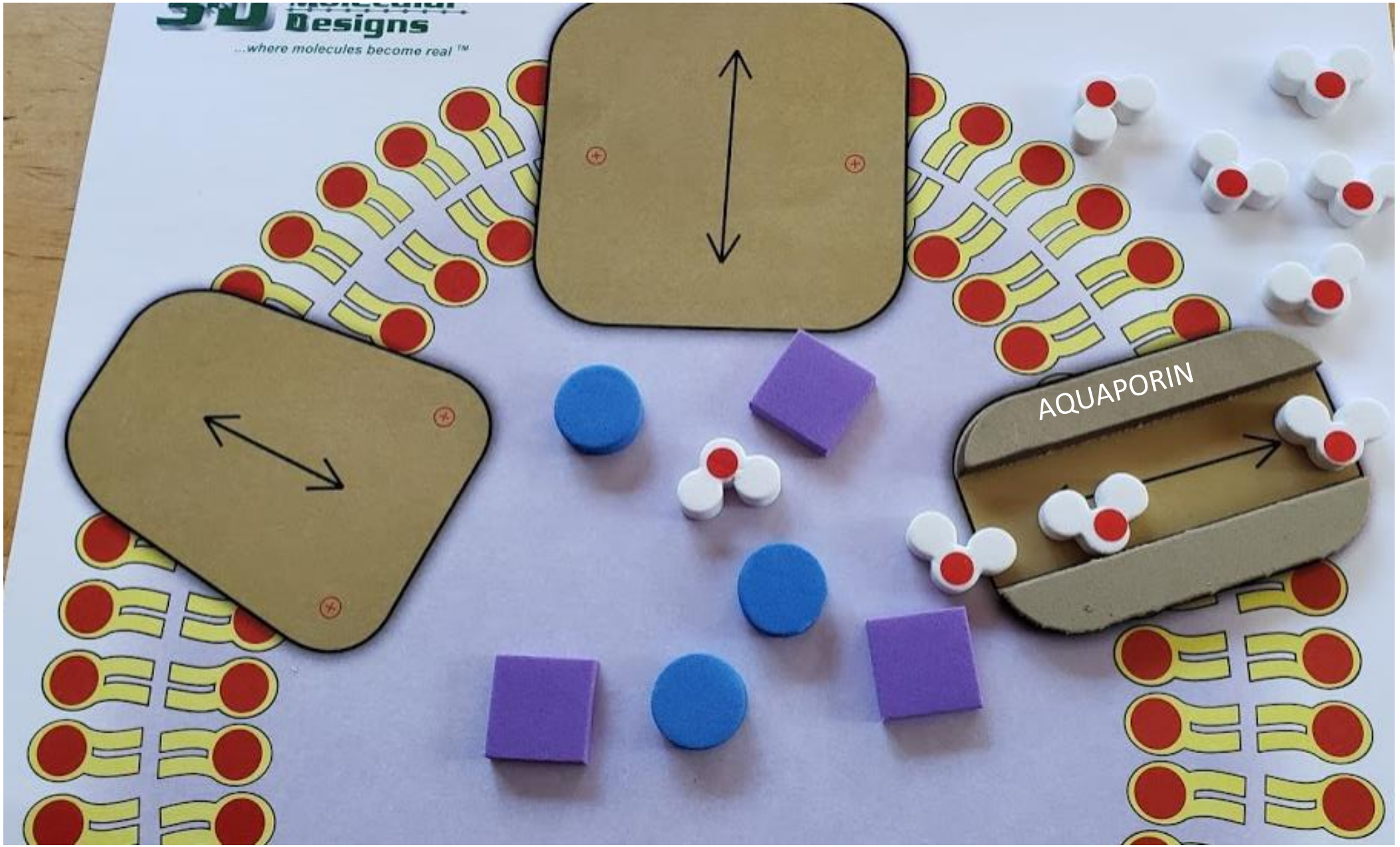


RCSB PDB
PROTEIN DATA BANK

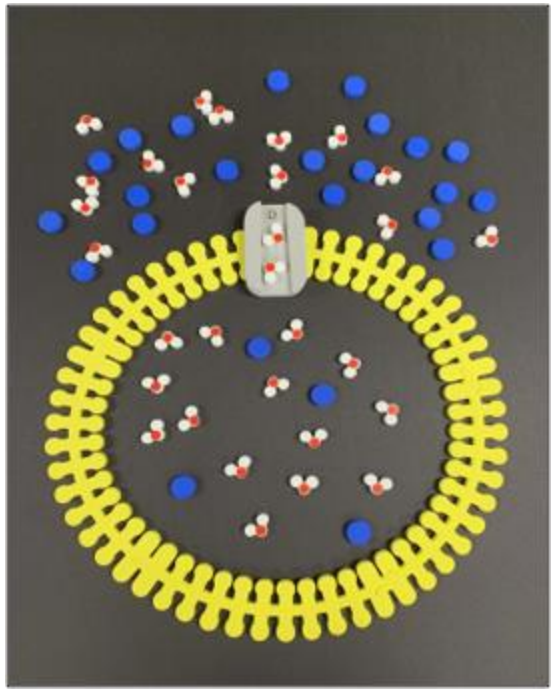


Look closely: What do you notice happens to the water molecule as it passes through the aquaporin.

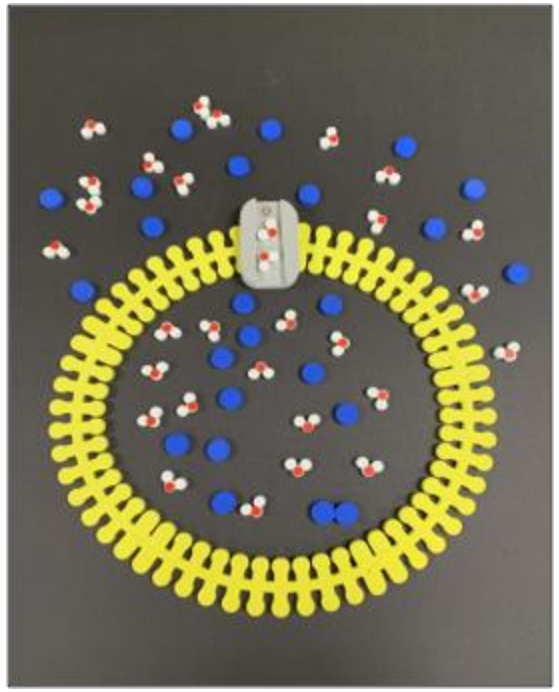
three-amino-acid sequence, termed the *asparagine–proline–alanine (NPA) motif.*


Designs
...where molecules become real ™
AQUAPORIN

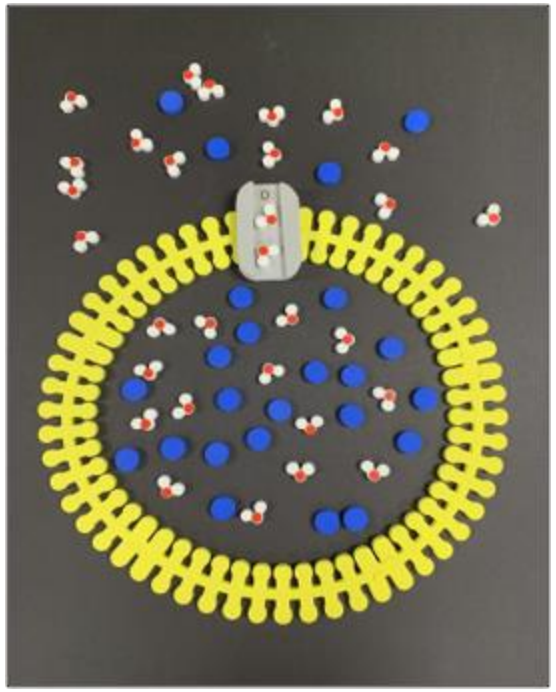
Use the blue sodium ions and the water molecules to show different conditions and how they impact water moving into or out of a cell.



hypertonic concentration of the solute is greater outside the cell than inside

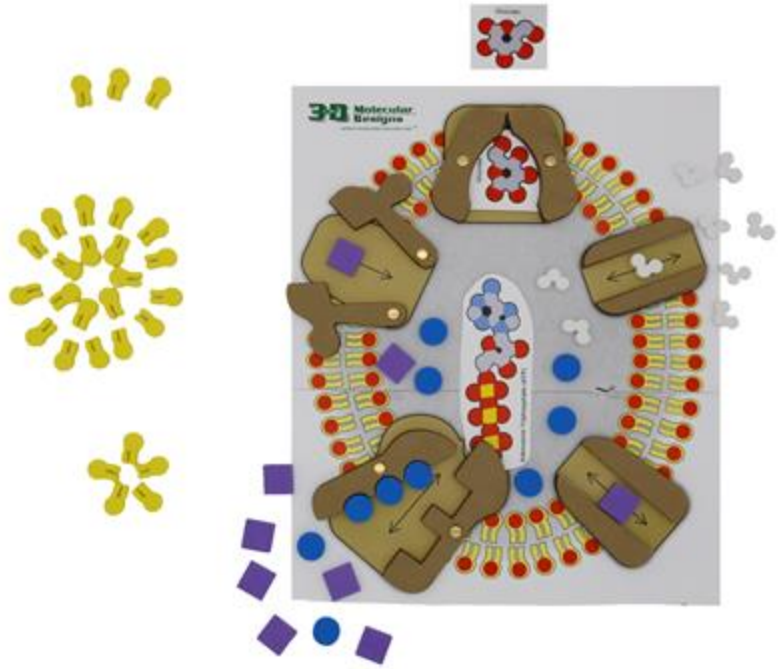


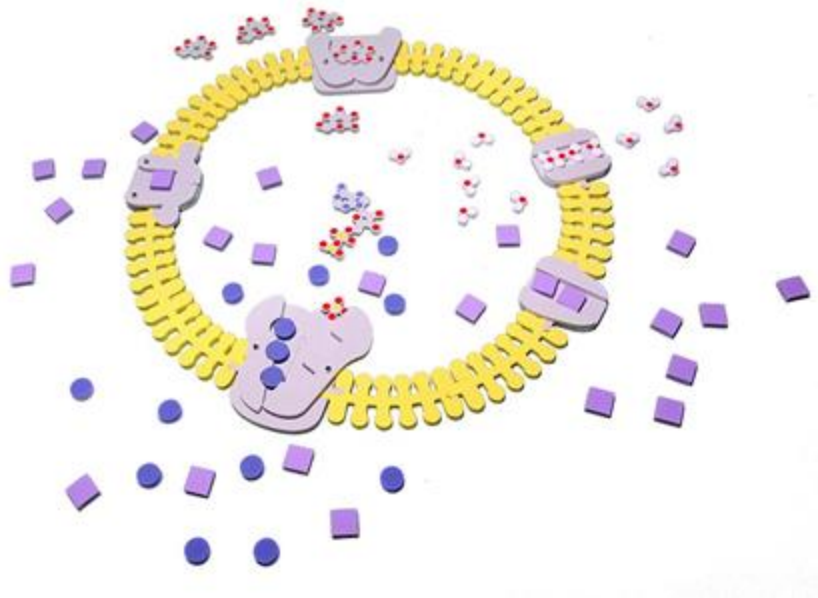
isotonic concentration of the solute is equal inside and outside the cell
(water still moves, it just moves at an equal rate)



hypotonic concentration of the solute is greater inside the cell than outside

The aquaporin shows us passive transport but active transport can also be shown with both the student modeling pack and the classroom kit. With active and passive transport, the molecular structure of these proteins is a part of the story we will get to next.





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Workshop NGSS Connections

SEPs	CCCs	DCIs
Asking questions	**Cause and effect**	**LS1.A: Structure and function**
Developing and using models	**Structure and function**	**PS1.A: Structure and properties of matter**
Constructing explanations		**PS1.B: Chemical reactions**

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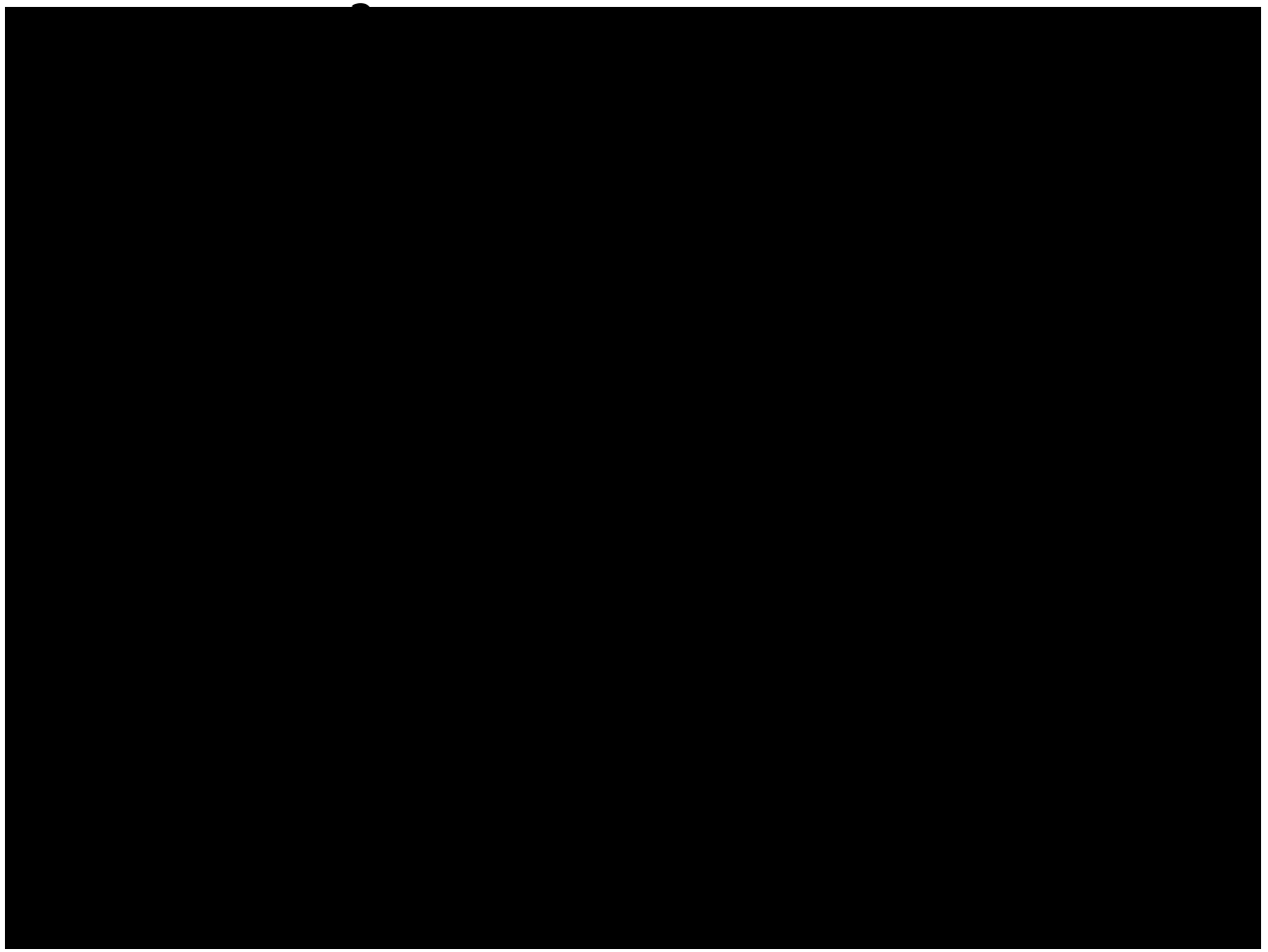
Break Time

Have you tried our free digital



03:00

3-D Molecular Designs
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MSOE UNIVERSITY Center for BioMolecular Modeling

WATER & MEMBRANES WEBINAR

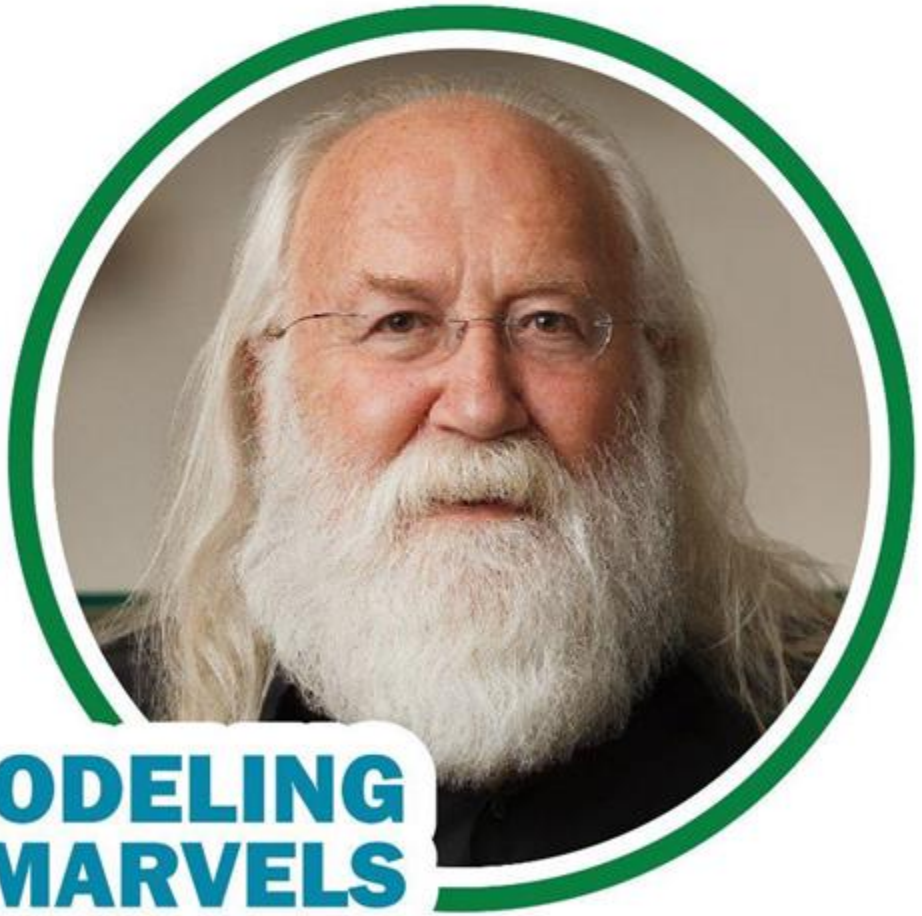
TUESDAY | FEB 15 6:30 - 8 PM CST

PRESENTER:

TIM HERMAN, PhD

MSOE Center for BioMolecular Modeling &
3D Molecular Designs

Transmembrane Proteins: Transporting Potassium



MODELING MARVELS
2022 EDUCATORS WEBINARS

3-D Molecular Designs ...where molecules become real™

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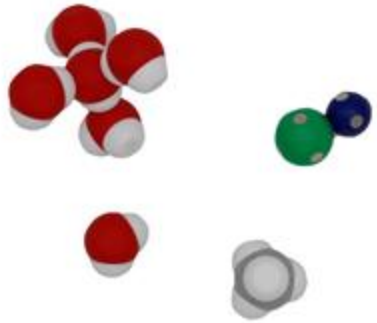
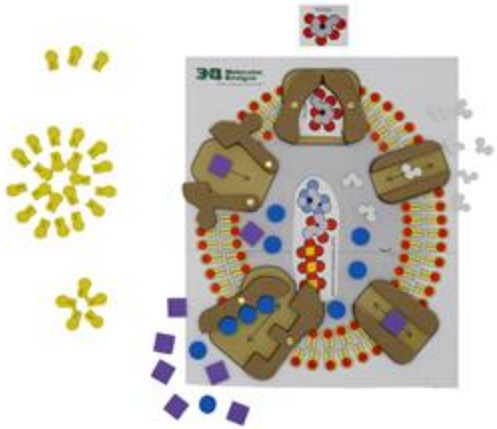
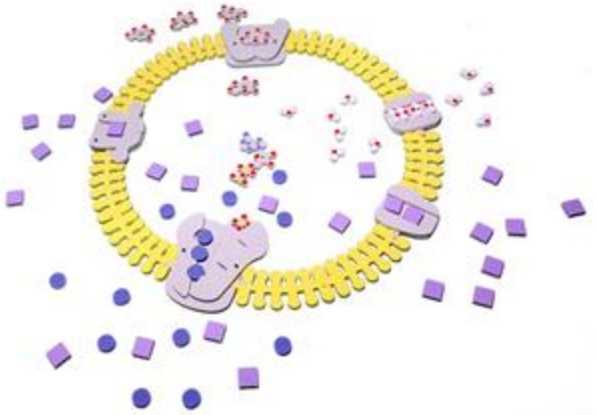
THANK YOU FOR ATTENDING!

Kits and models used in this session:







Purchase kits at **3dmoleculardesigns.com**.

Use discount code **WEBINAR20** to receive 20% off most items in our catalog. *Student Modeling Packs are not eligible for discount.*