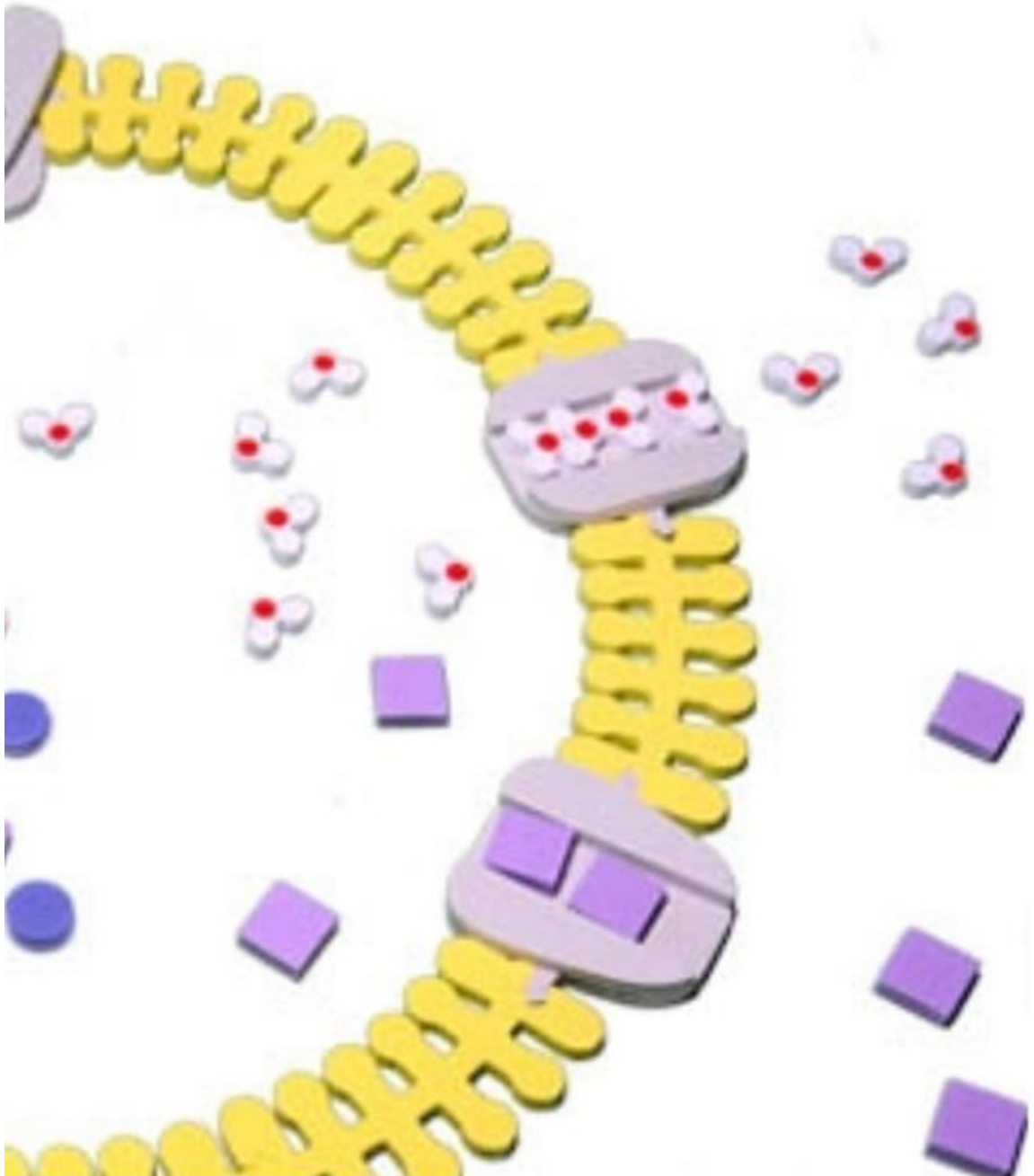

Inside & Out: Making Membranes Memorable with Models

Kim Parfitt

Taught for 18 years at Cheyenne Central High School

And after 11 years of using 3D models and attending CBM summer courses, I am now working full-time for this amazing company.

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NABT OBTA

National Board for Professional Teaching Standards

BSCS Science Learning Leadership Academy

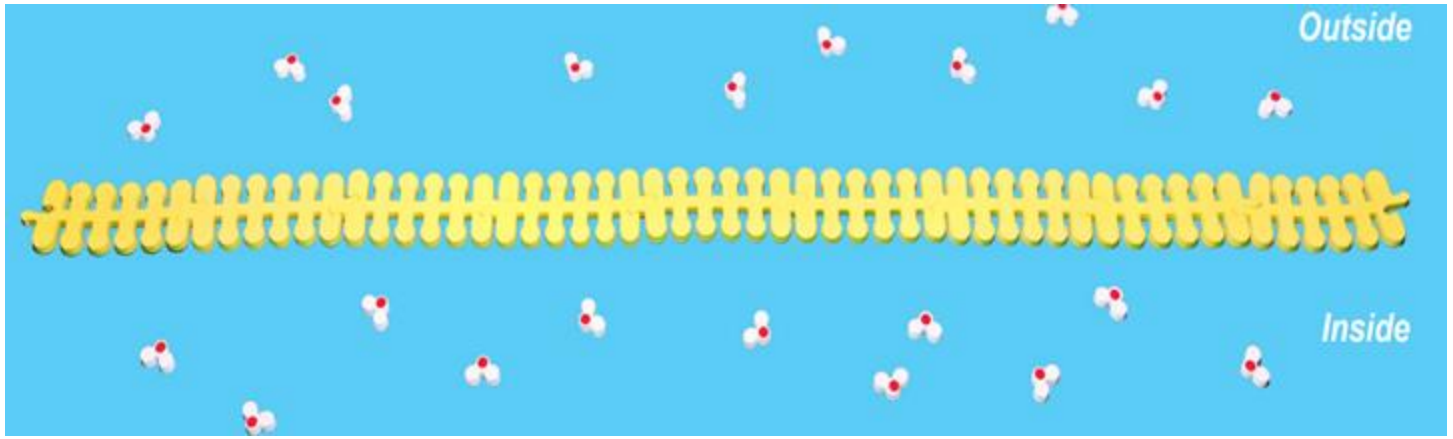
hhmi | BioInteractive Ambassador

Now, about you…

Workshop Learning Goals

You will

- Wonder how students can connect cellular processes to molecular structure.
- Explore how the phospholipid bi-layer structure influences movement of materials into, and out of, cells.
- Explain how modeling can extend your student understanding.



A

https://www.ebay.com/p/photos/fence-palisade-door-gate-closed-158827677/

B

C

D

https://www.thetravel.com/strict-rules-tsa-employees-follow/

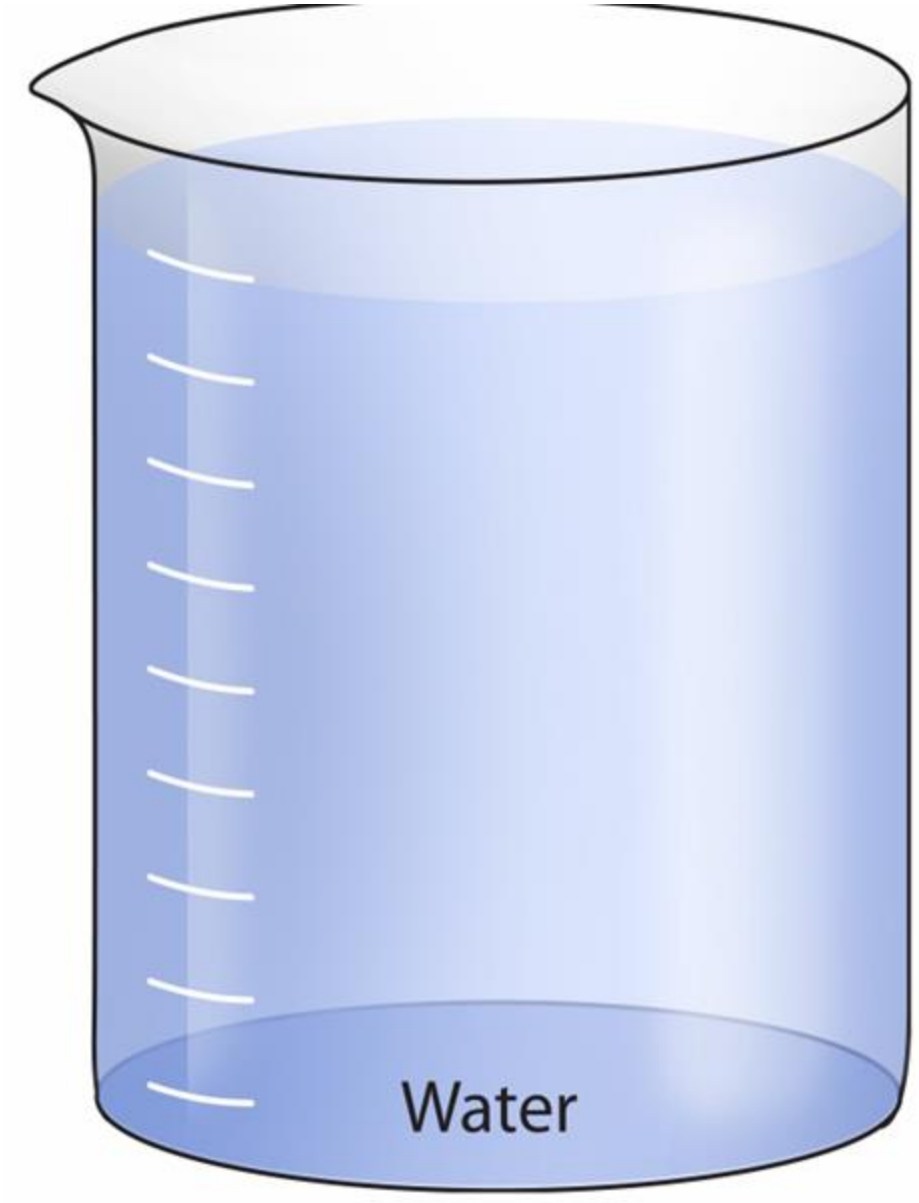
Your Turn

Please work with a partner to gather up

water molecules

and

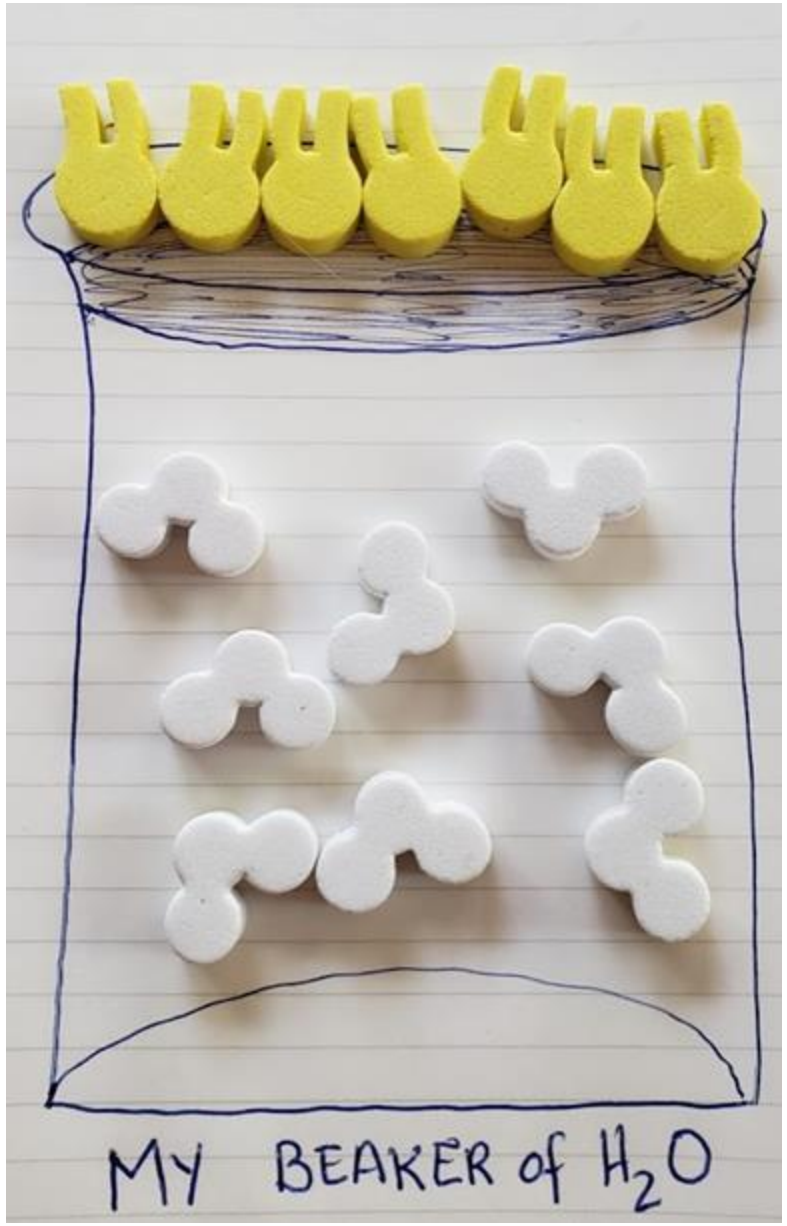
phospholipid molecules

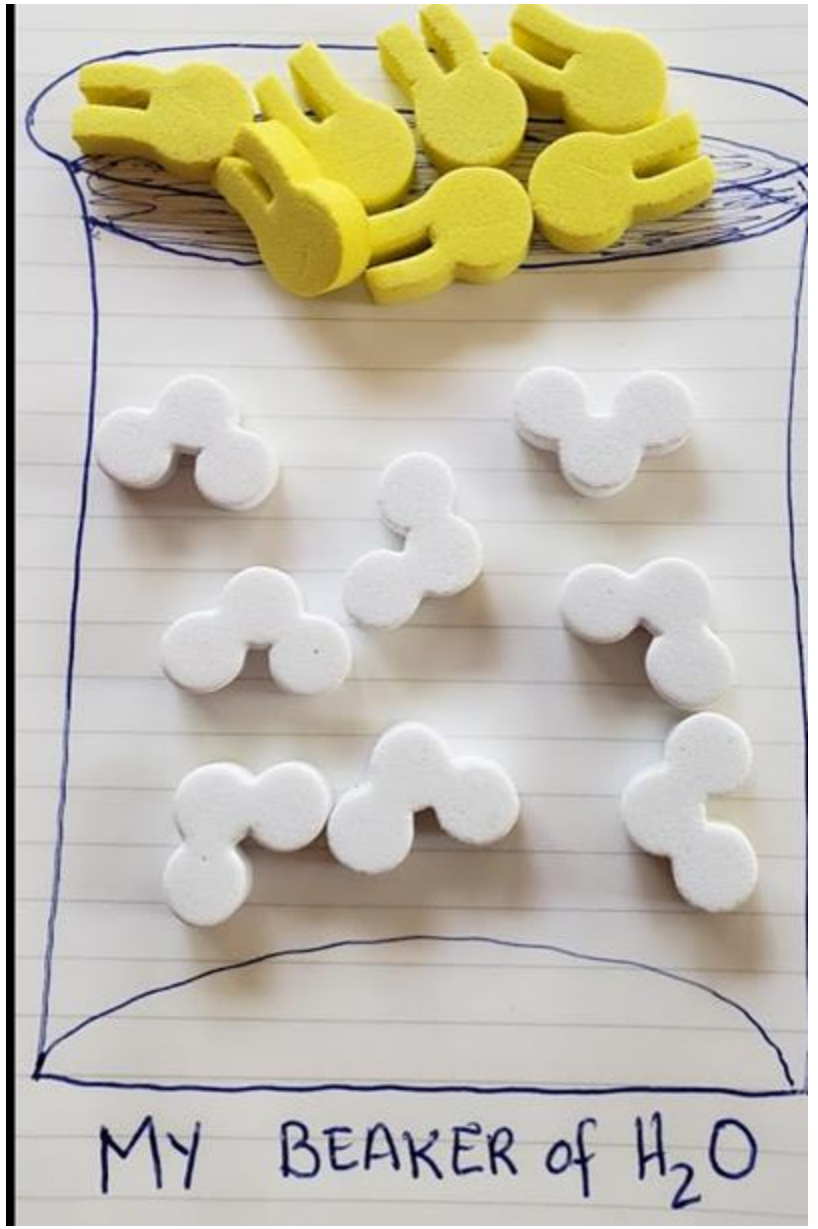


Your turn…

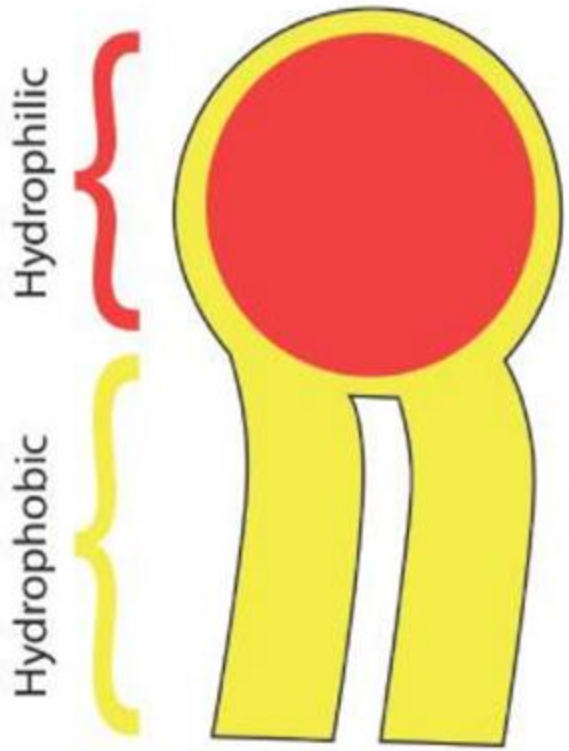
Based upon what you know about phospholipids, arrange ten molecules on the surface of the water in the beaker.

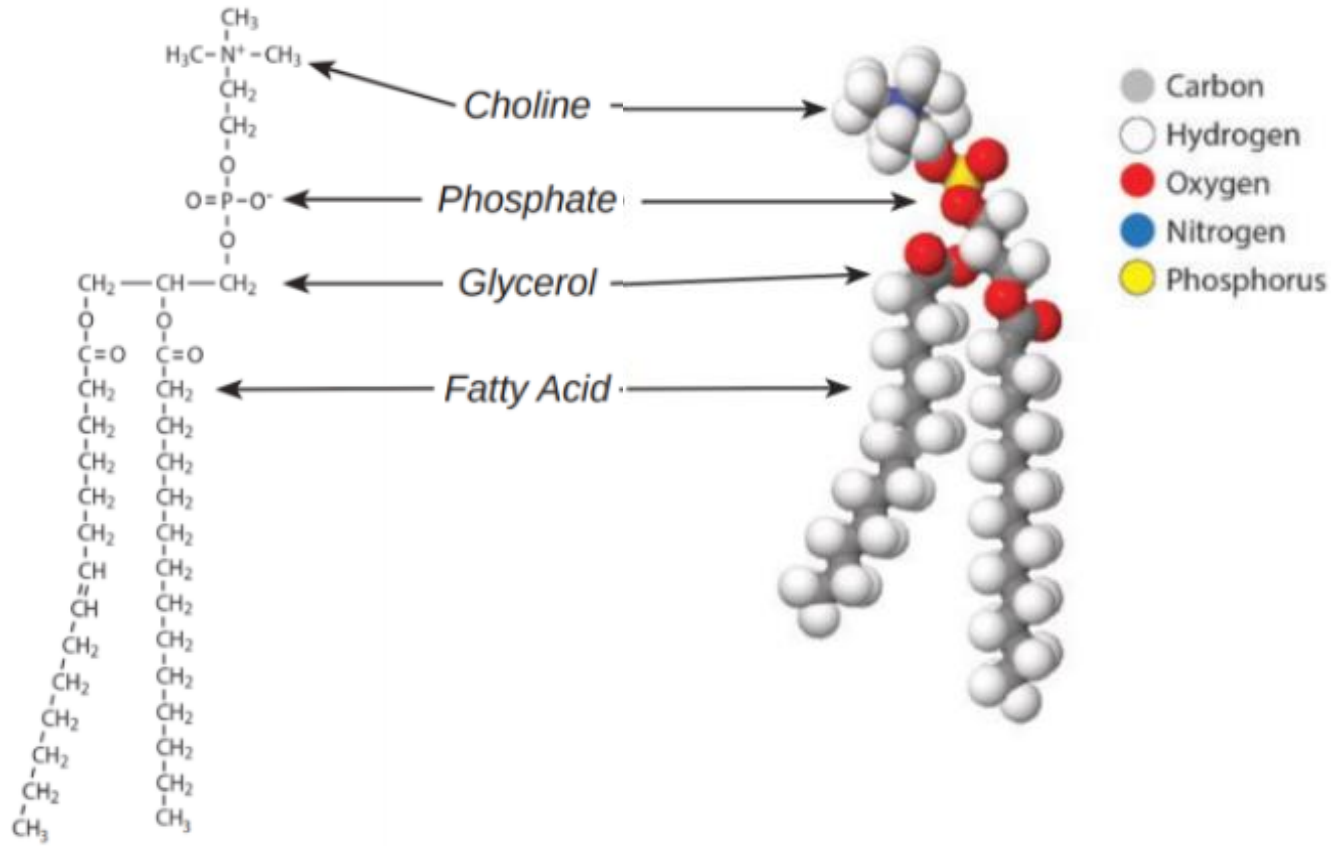
A

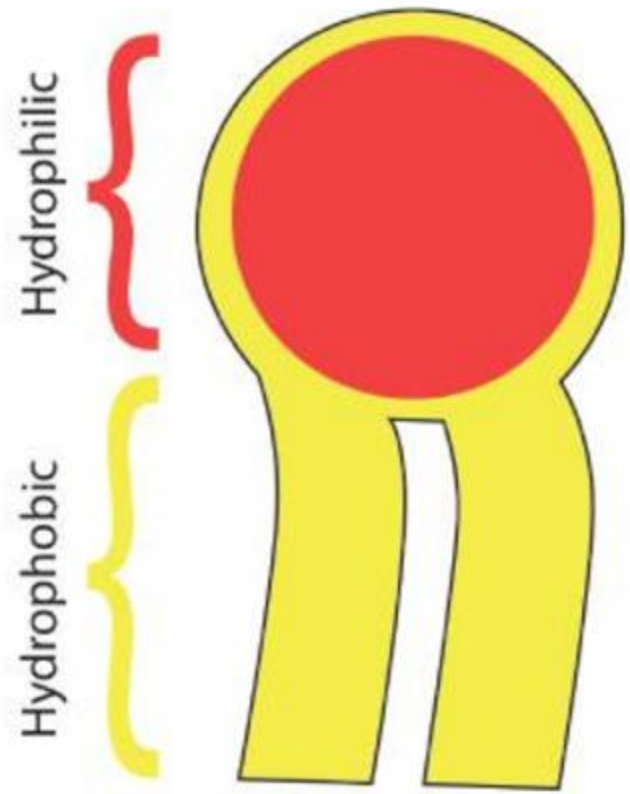




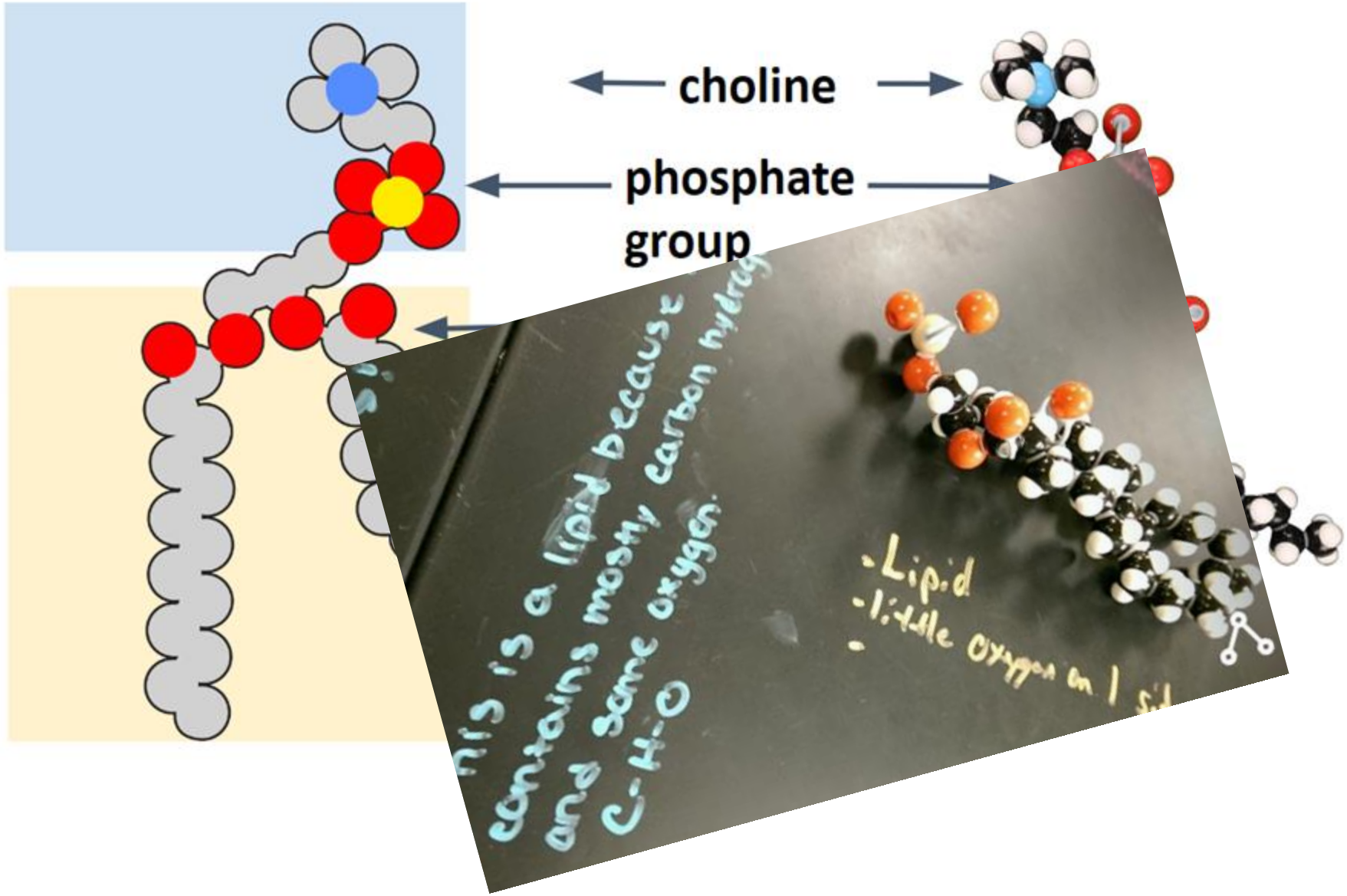
B

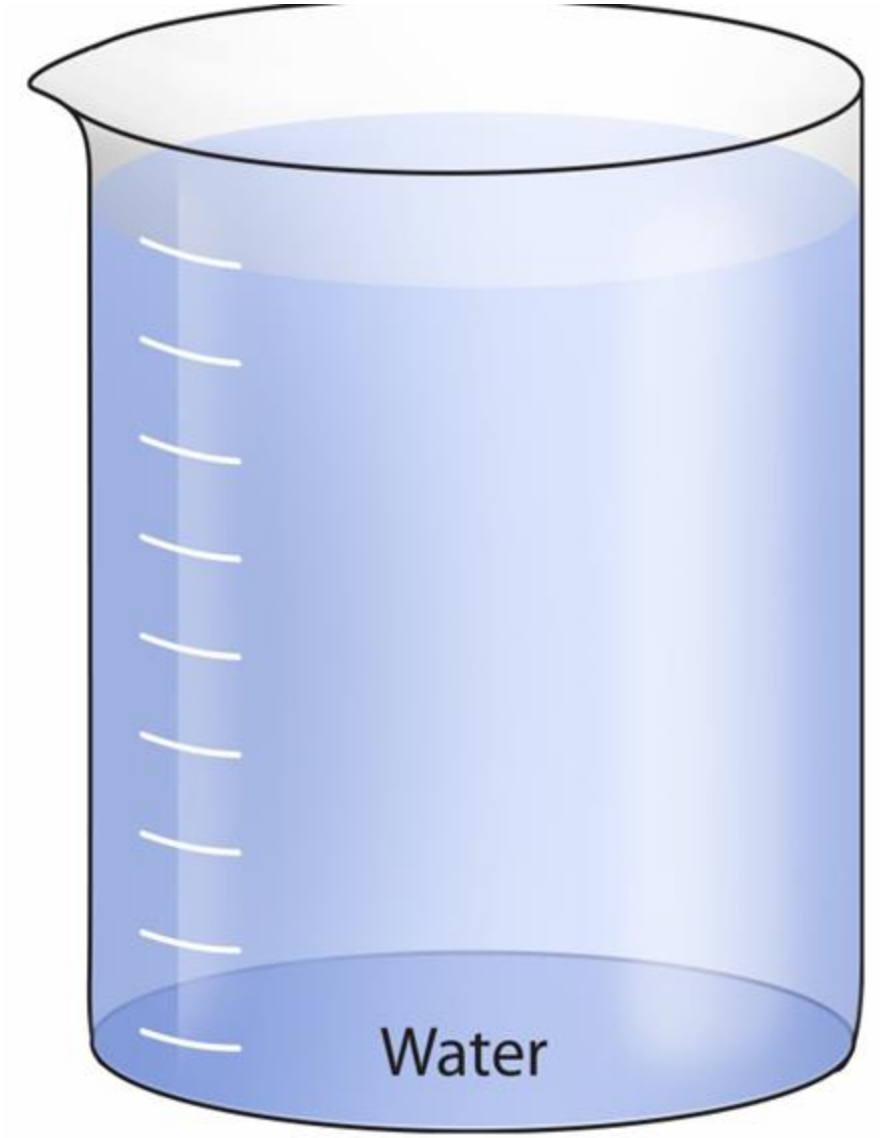

Hydrophilic
Hydrophobic


Choline
Phosphate
Glycerol
Fatty Acid
Carbon
Hydrogen
Oxygen
Nitrogen
Phosphorus



Notice	Wonder
Red = hydrophilic yellow tail = hydro phobic	What does that mean? Is it about water?
Two chains/legs that are CH_2	Is a fatty acid one or two chains?
Different colors for atoms	Does color-coding mean something?
Mostly single bonds in fatty acid but 1 double	What does that double bond do? Why is it there? Is it always?


choline
phosphate group
This is a lipid because
contains mostly carbon
and some oxygen.
C-H-O
-Lipid



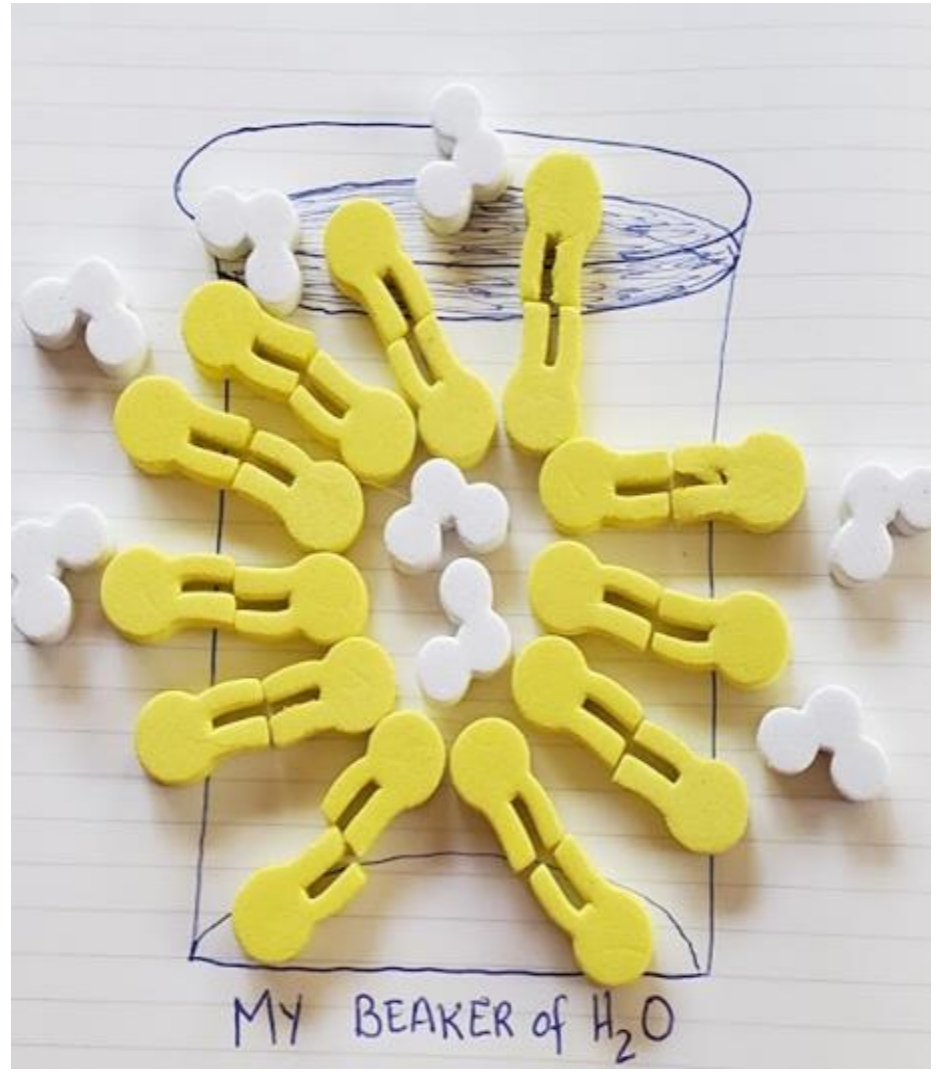
But most cells are surrounded by water. And cells have water inside!

Your Turn Again!

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

(so there is an inside and an outside)

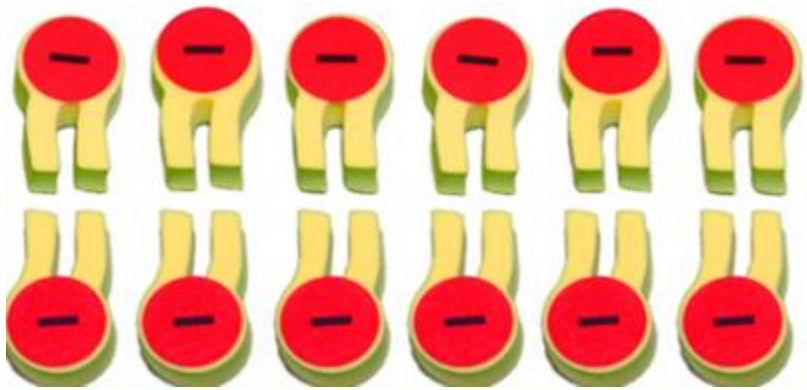
A

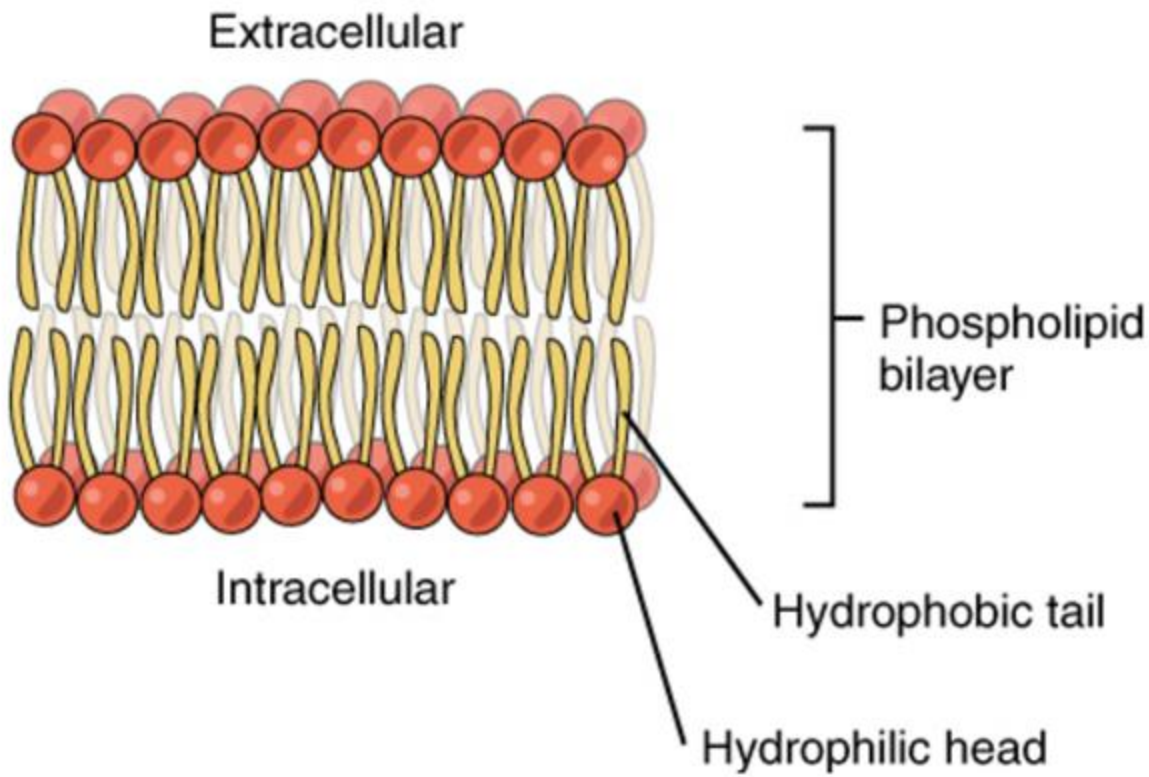


B

Invitation for a conversation!

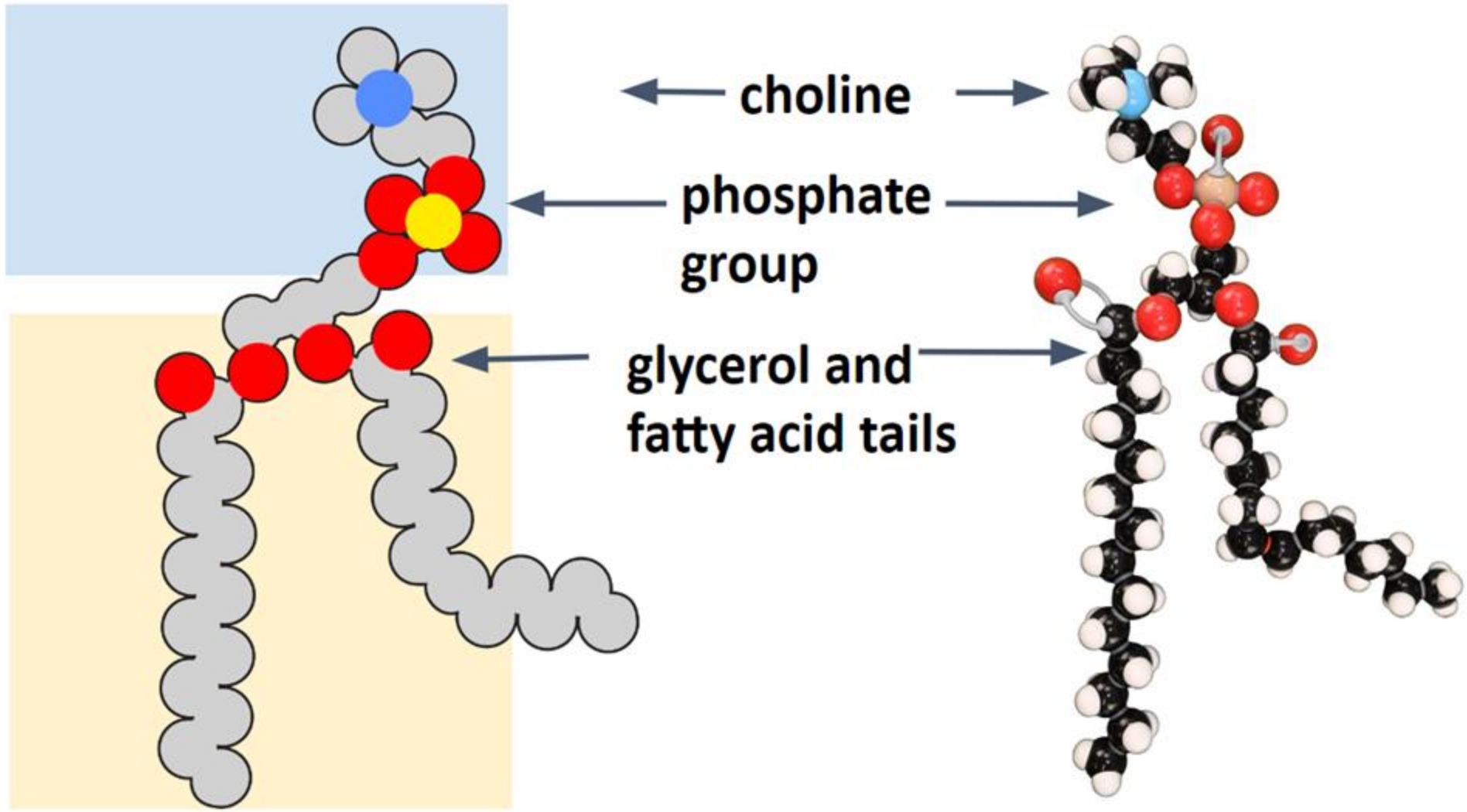
For this student, I might want them to tell me more!

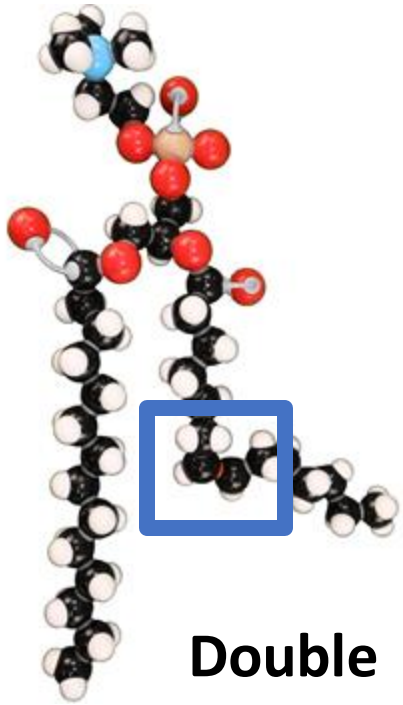




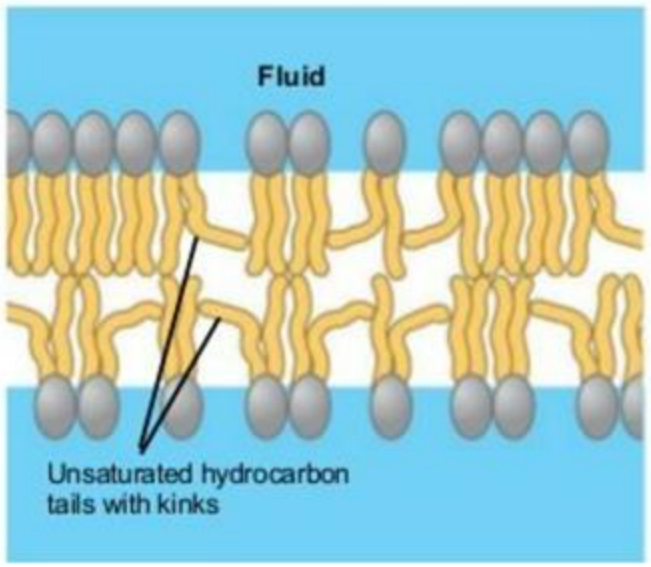
This whole structure, this marvelous collection that holds life together is not covalently bonded!

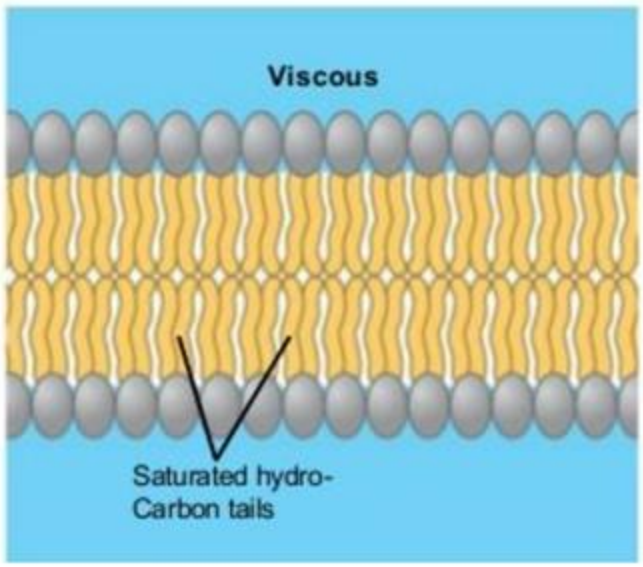
Stay squishy my friends.

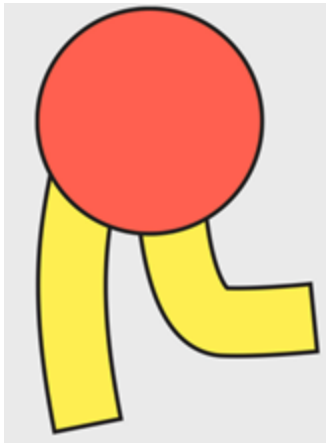

choline
phosphate group
glycerol and fatty acid tails

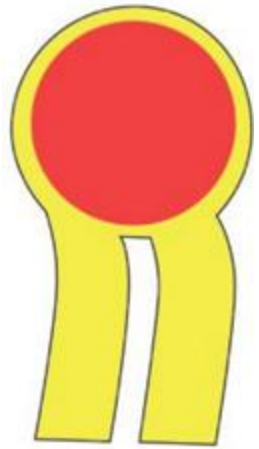


Double bond with carbon atoms

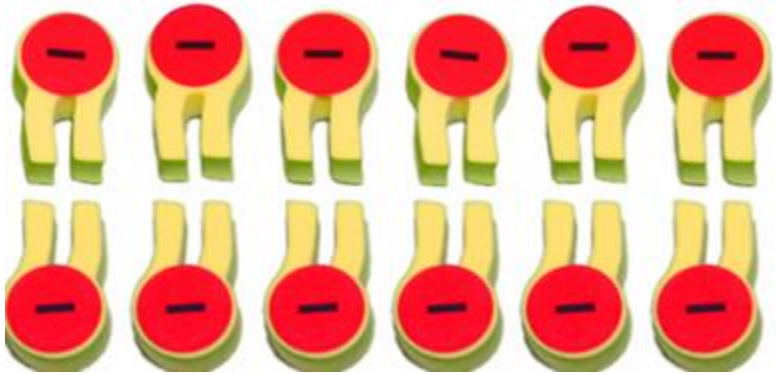






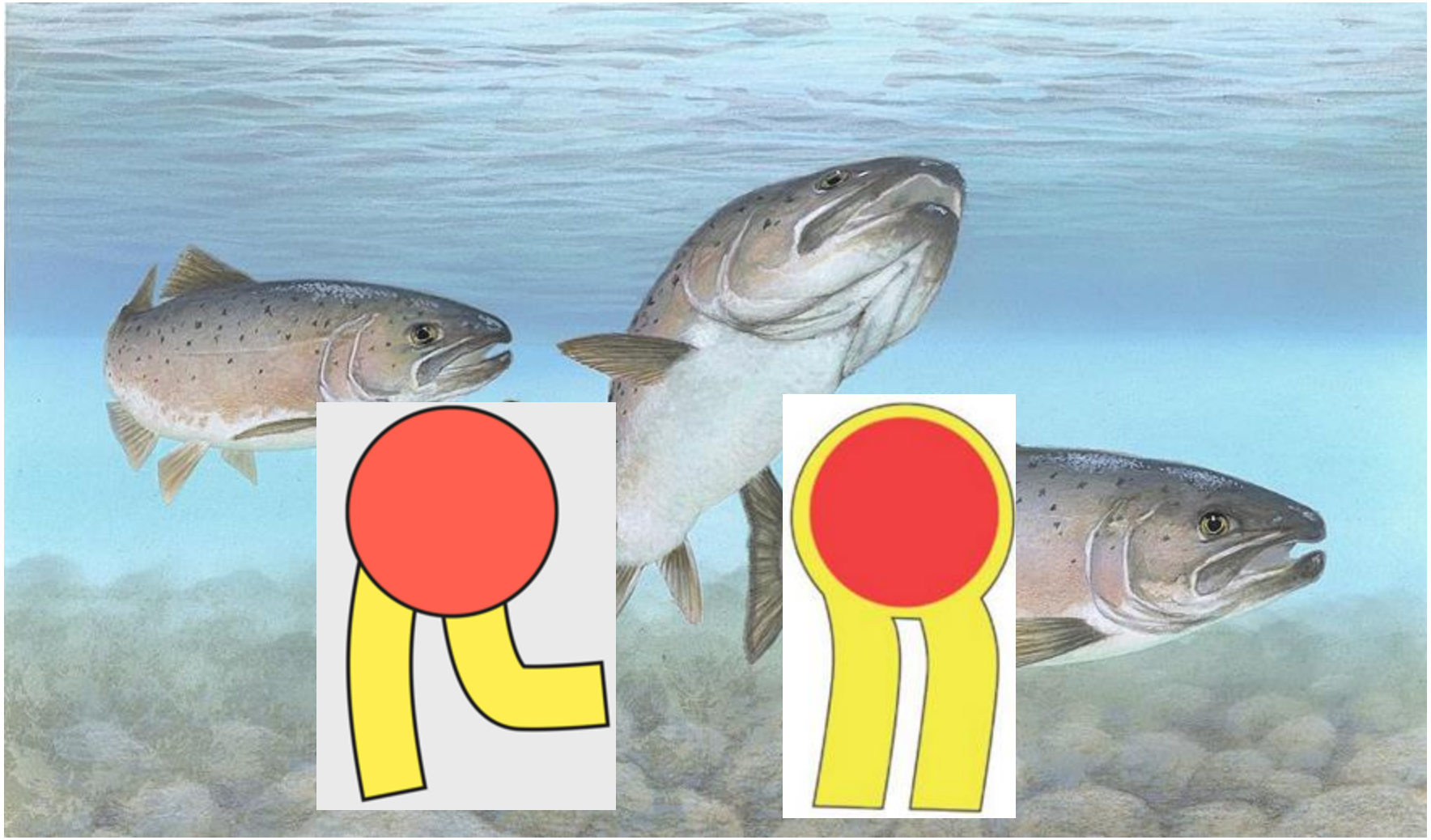


Do the phospholipids ever change in a cell membrane?



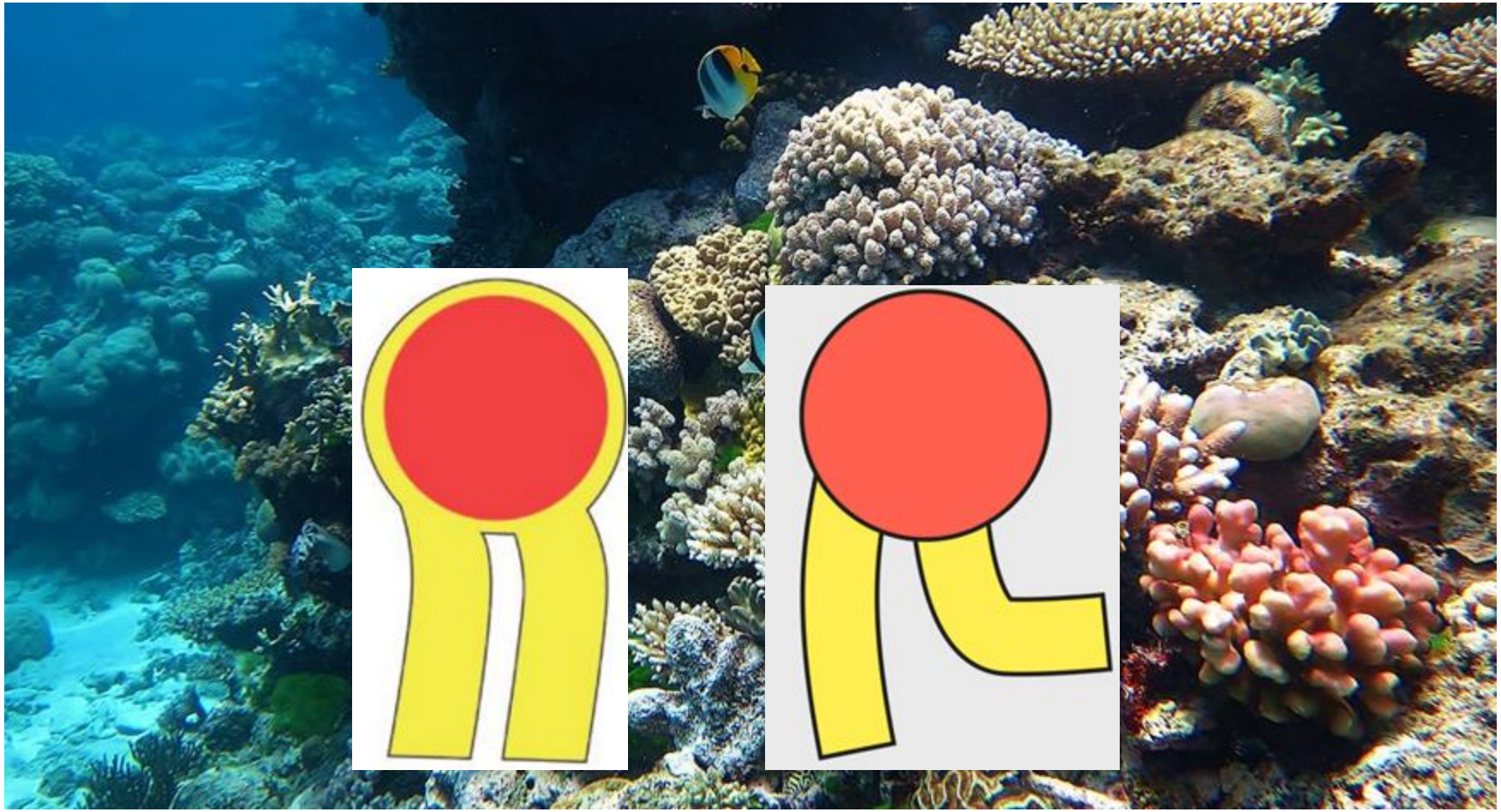
Please arrange 12 phospholipids as a bilayer on your workspace.

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

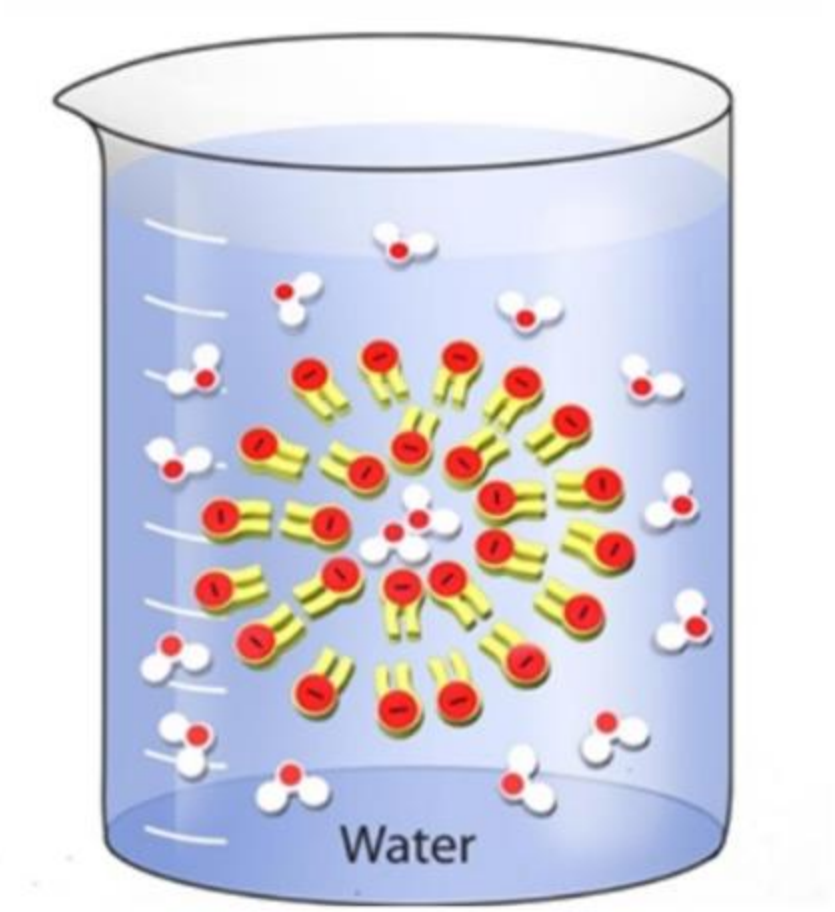


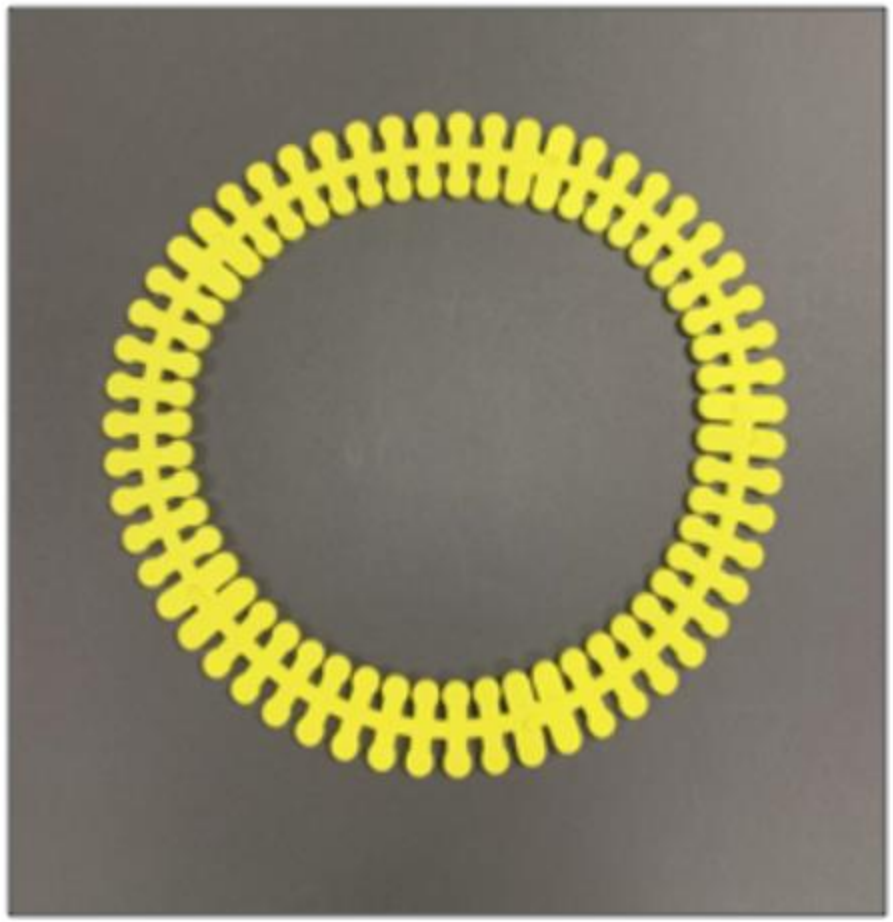
Timothy Knepp, U.S. Fish and Wildlife Service, Public domain, via Wikimedia Commons

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

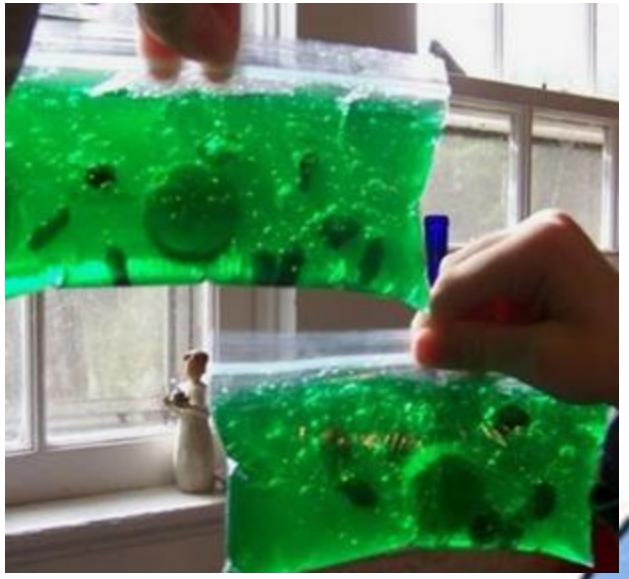


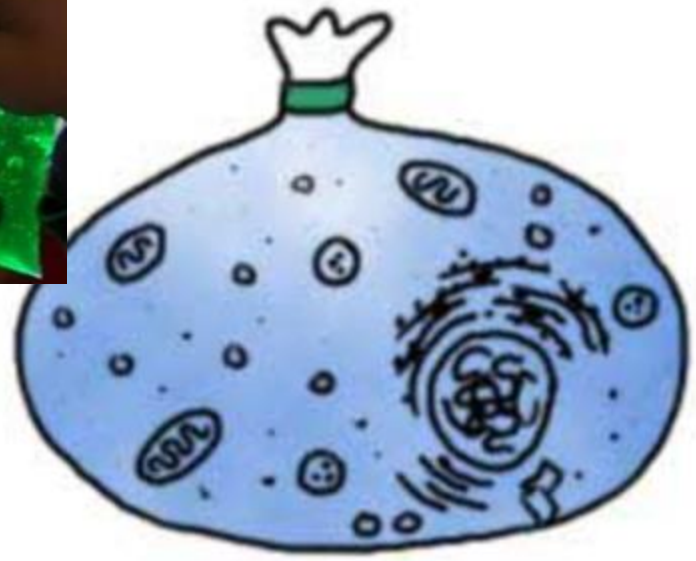
How do things get in our out? Let’s start with water

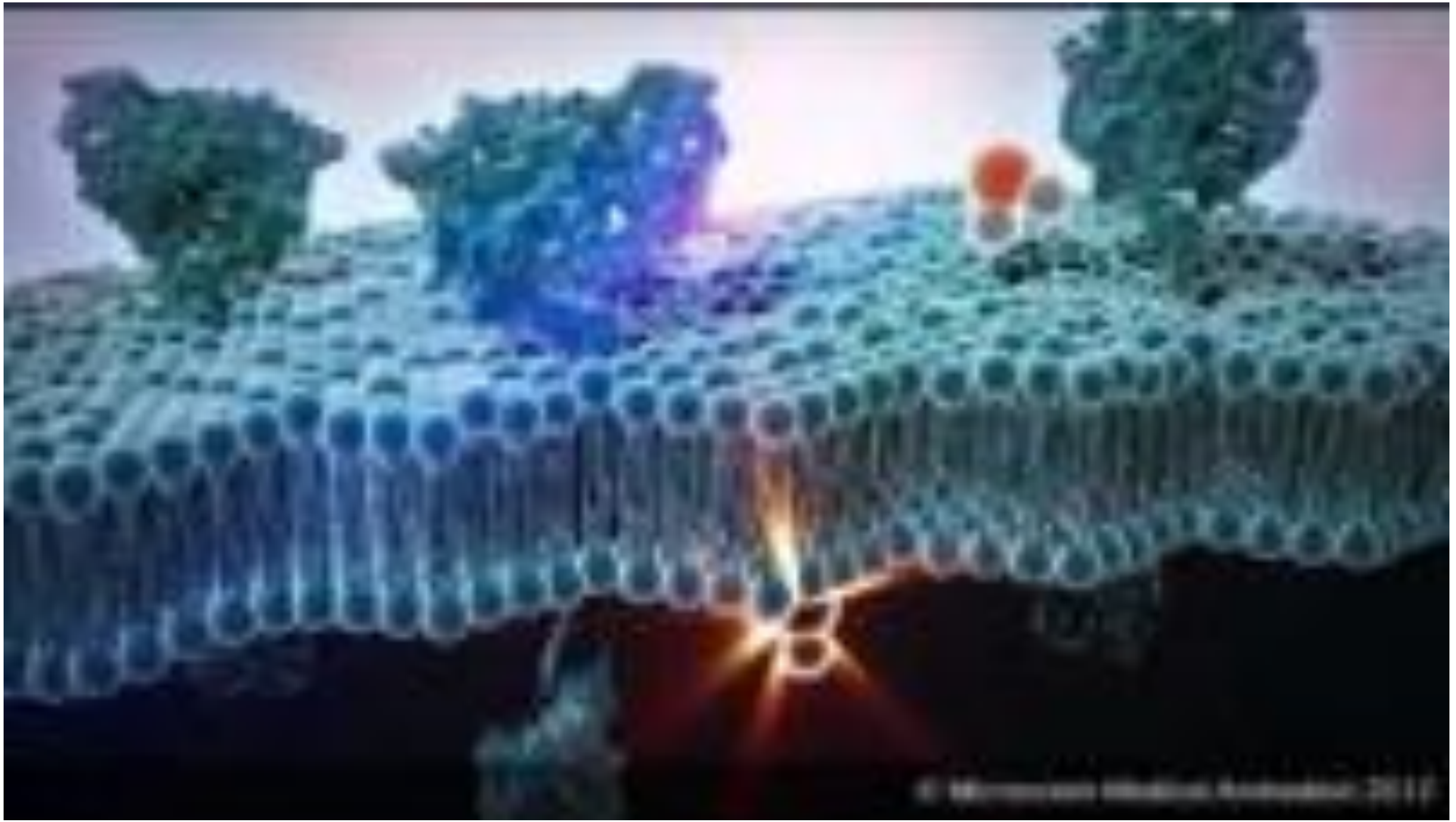




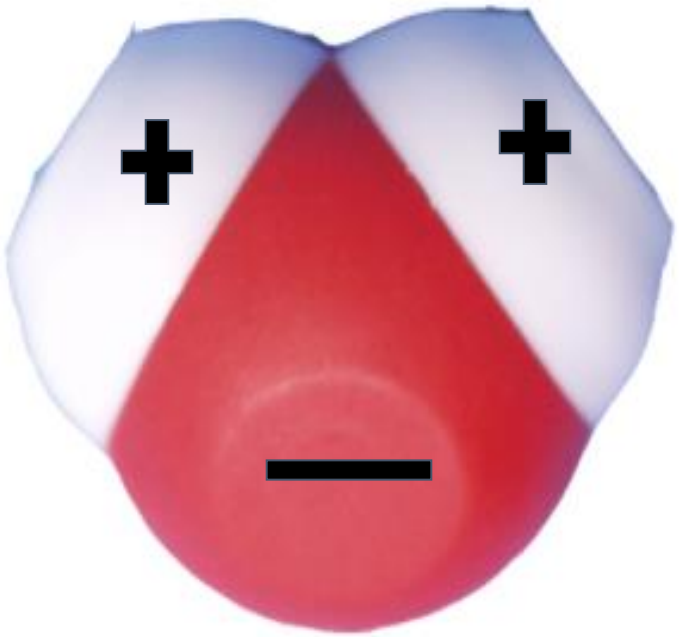
Consider the models our students have seen about cells and cell membranes.



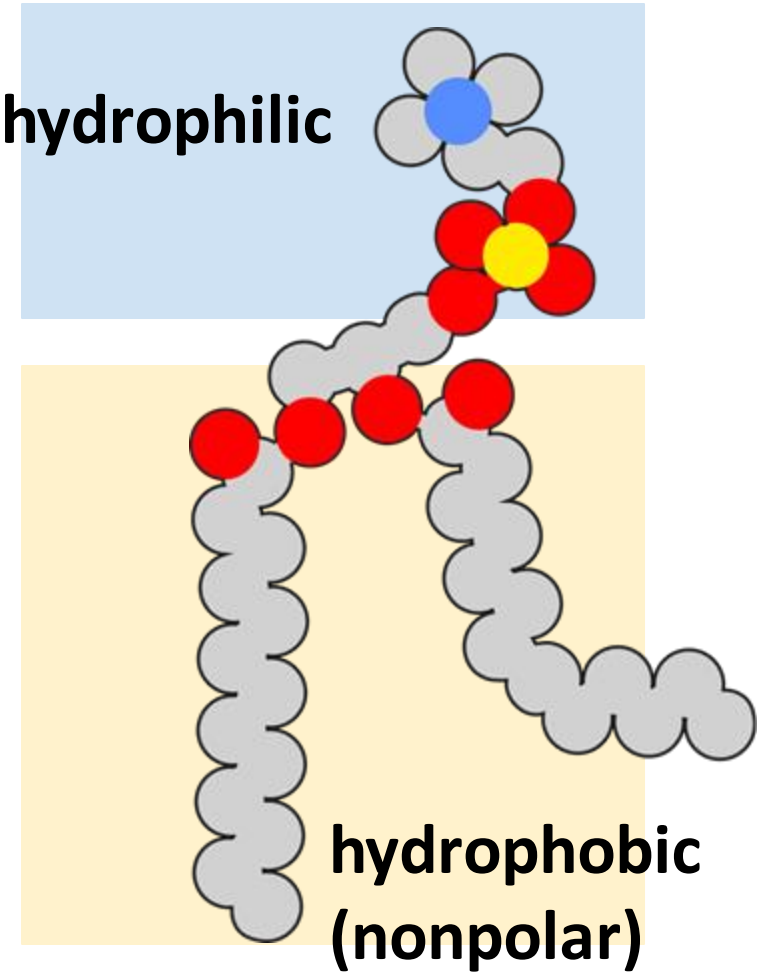




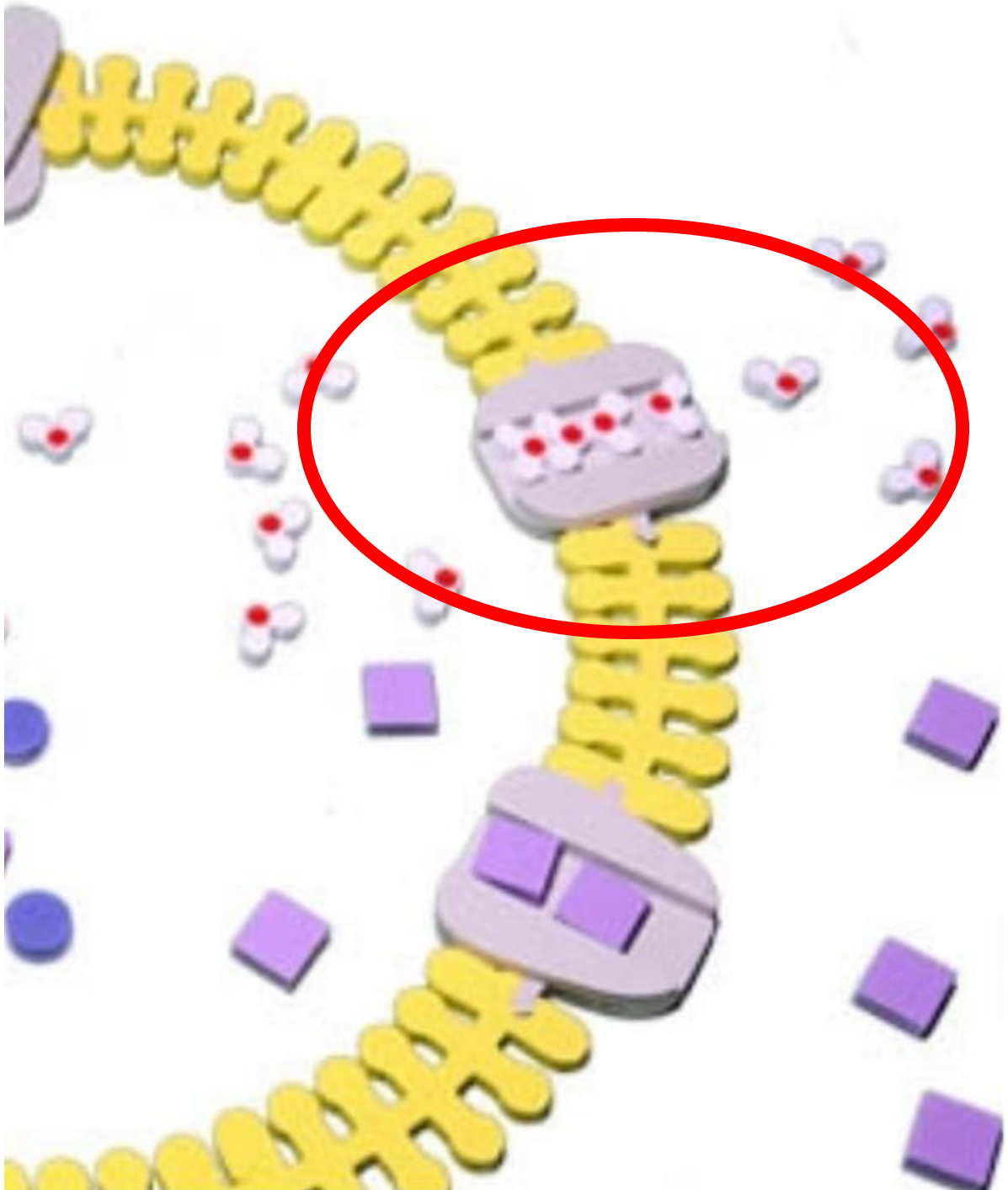
Knowing what you now know about polar molecules and the hydrophobic (nonpolar) nature of the inside of the cell membrane.



Polar

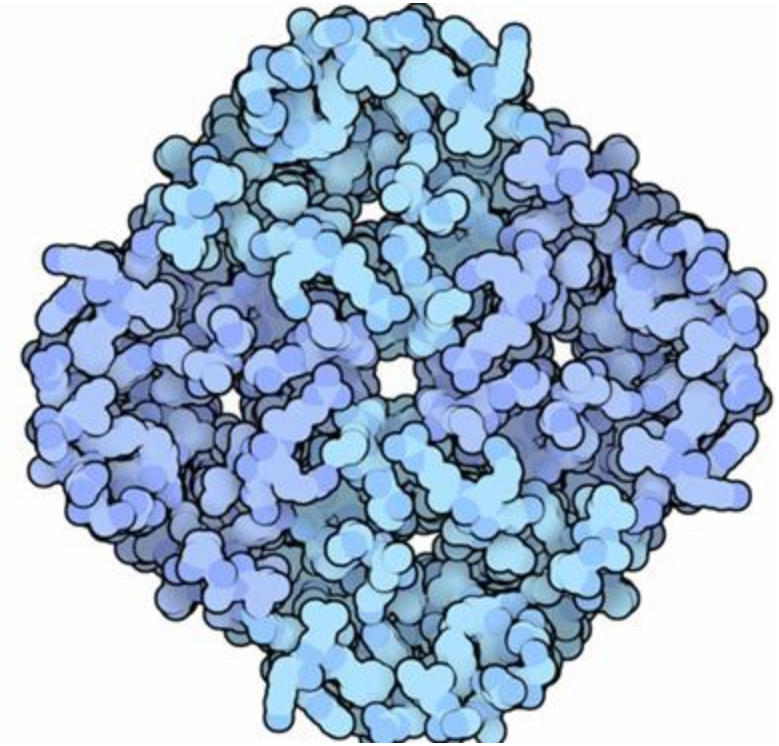


Semipermeable, mosaic lipid bi-layer

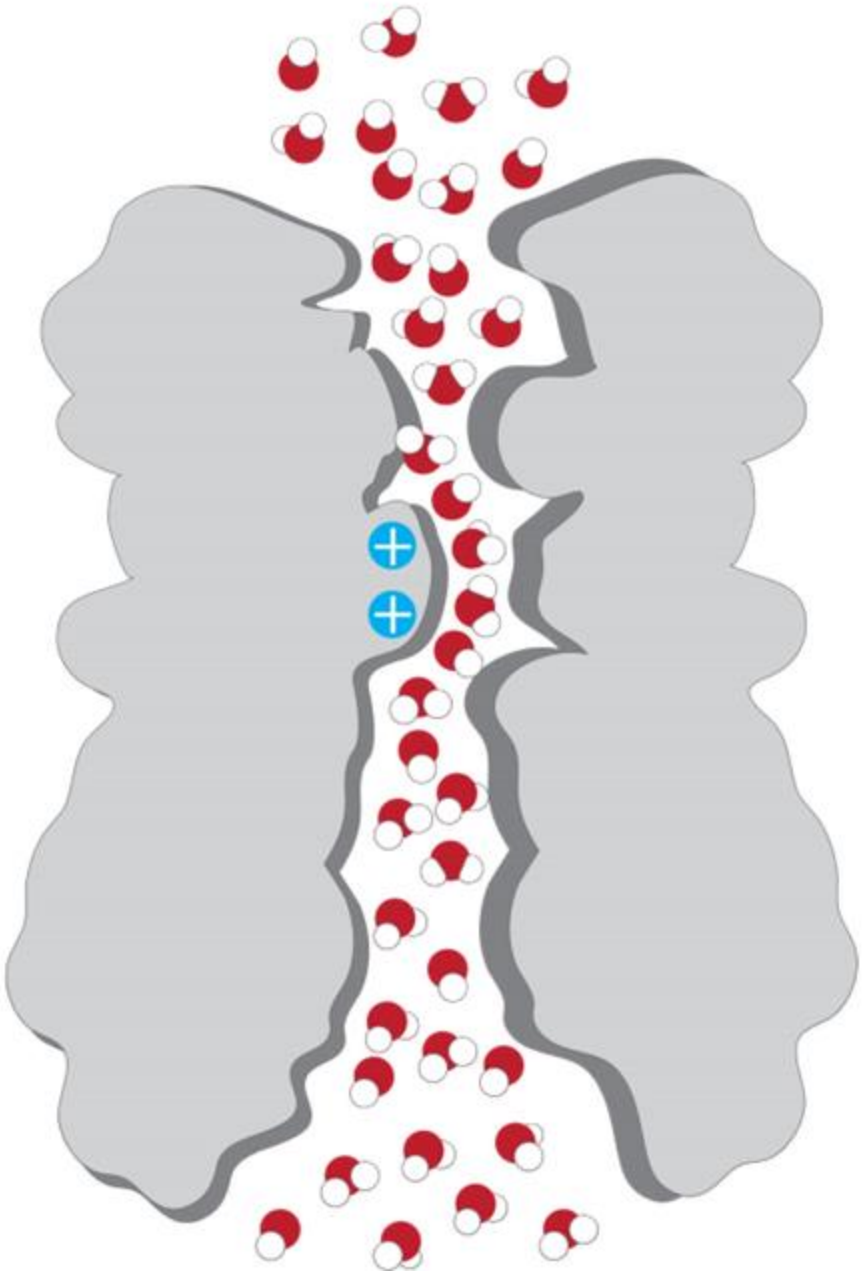


We know that there are transport proteins, some are passive, some are active.

Protein transport channel: Aquaporin



RCSB PDB
PROTEIN DATA BANK

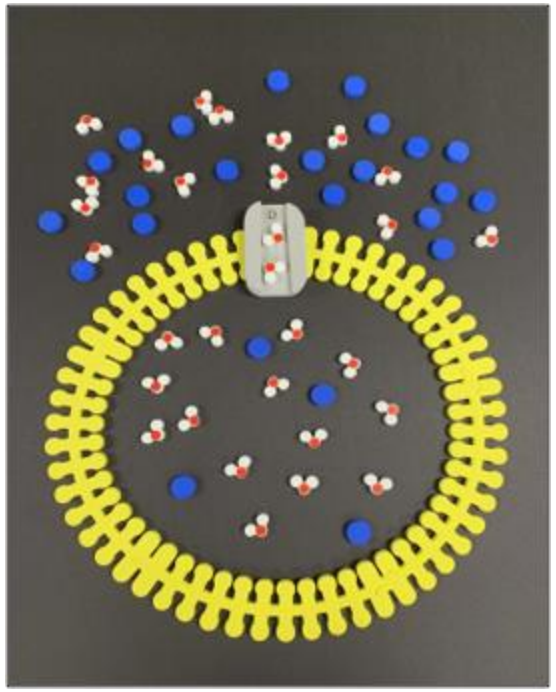


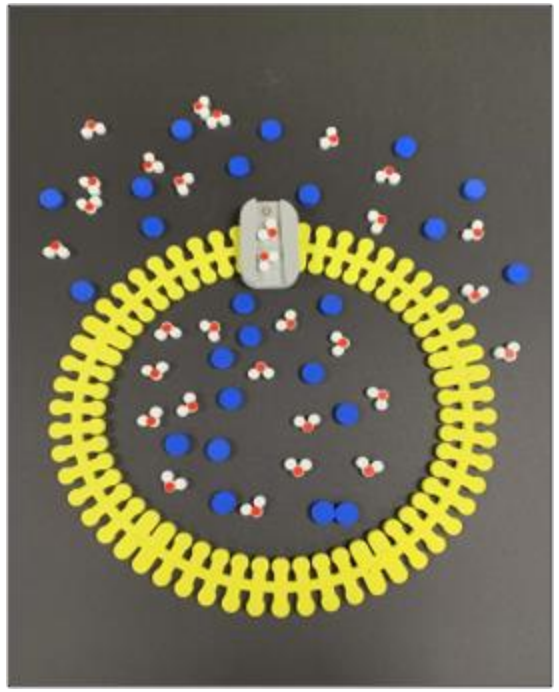
Look closely: What do you notice happens to the water molecule as it passes through the aquaporin.

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

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

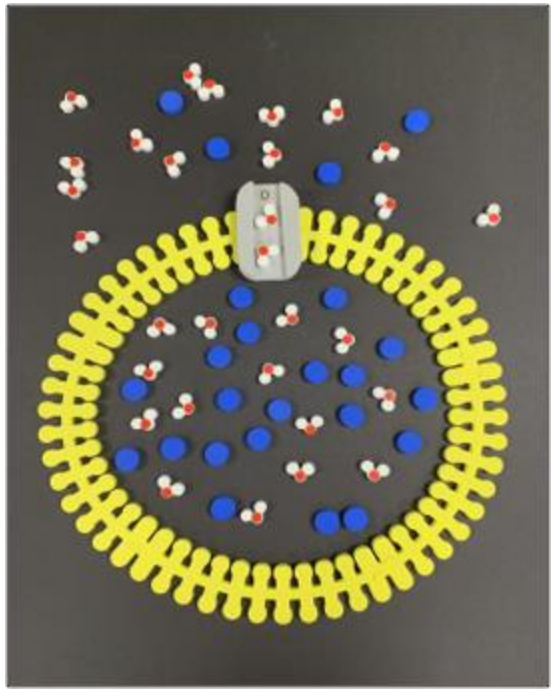
hypertonic concentration of the solute is greater outside the cell than inside



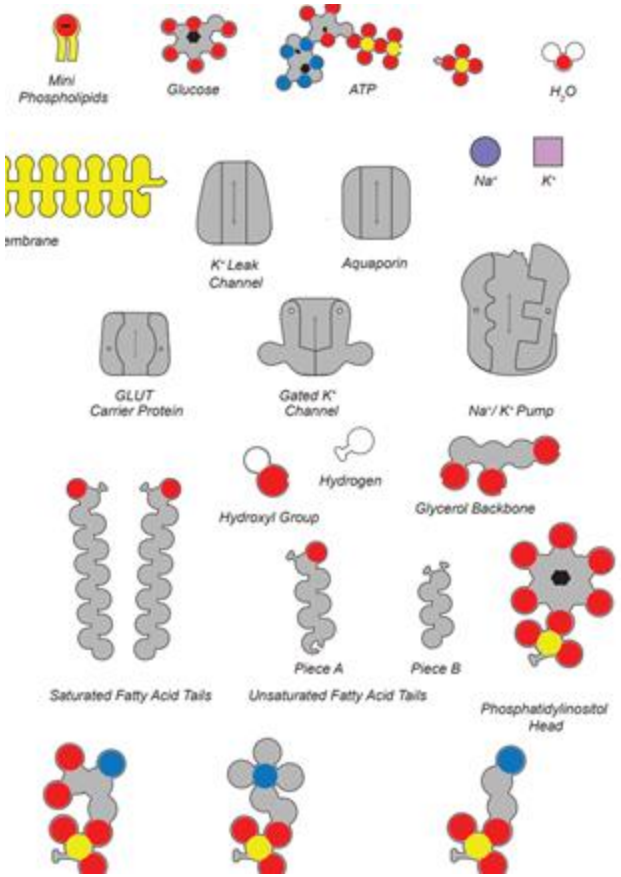


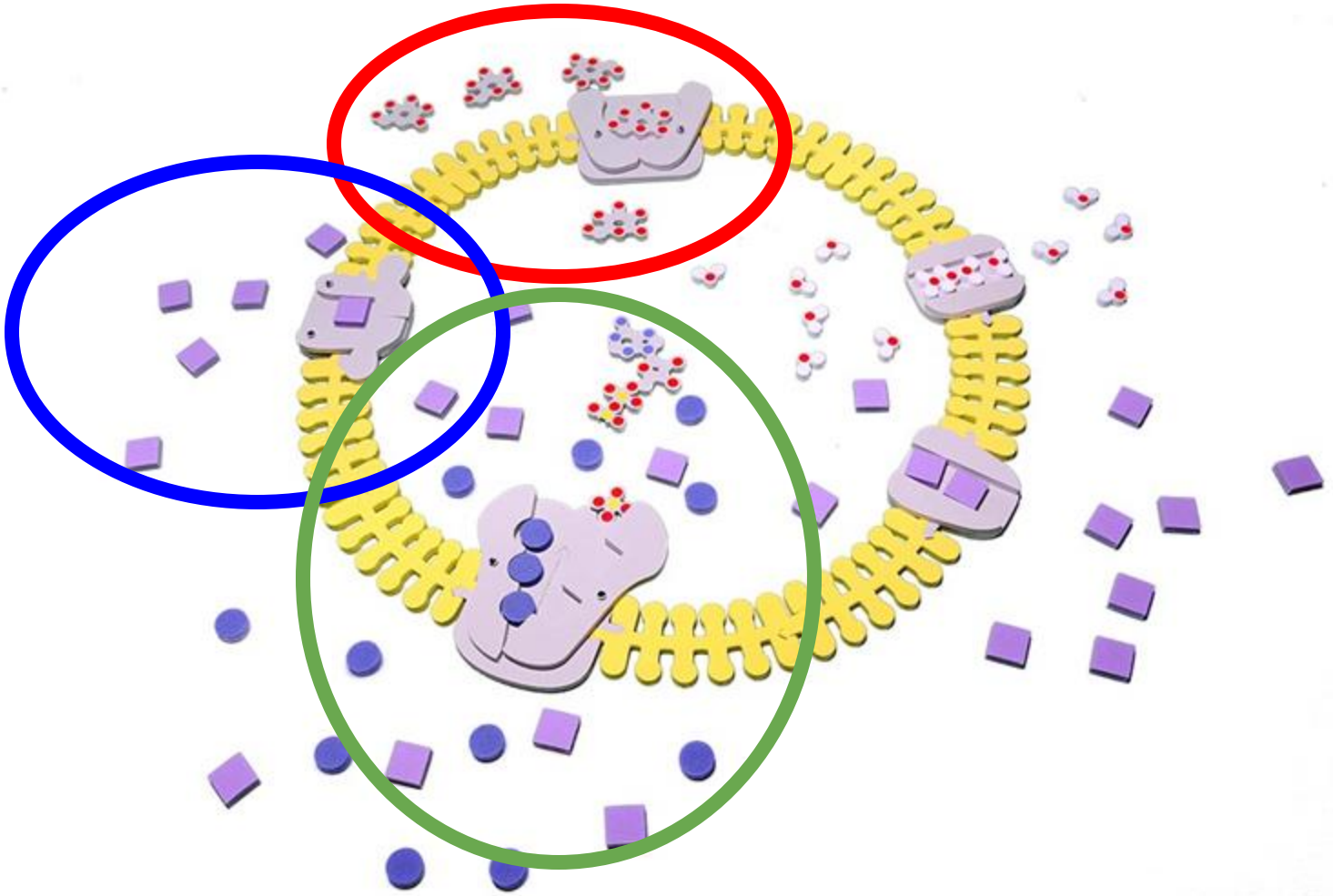
isotonic concentration of the solute is equal inside and outside the cell
(water still moves, it just moves at an equal rate)

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.



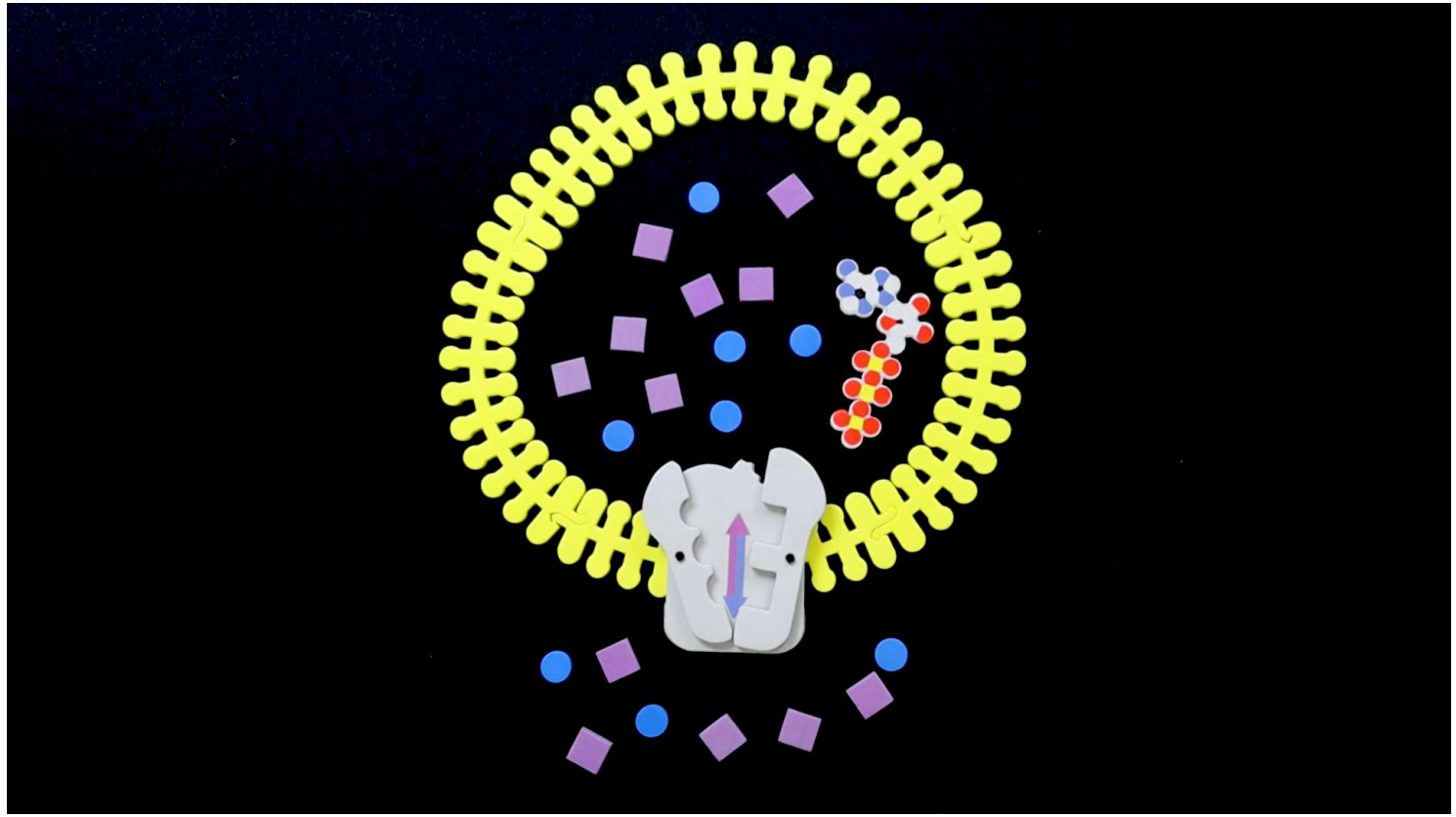


Let's take a look at the sodium-potassium pump

Blue circles = sodium

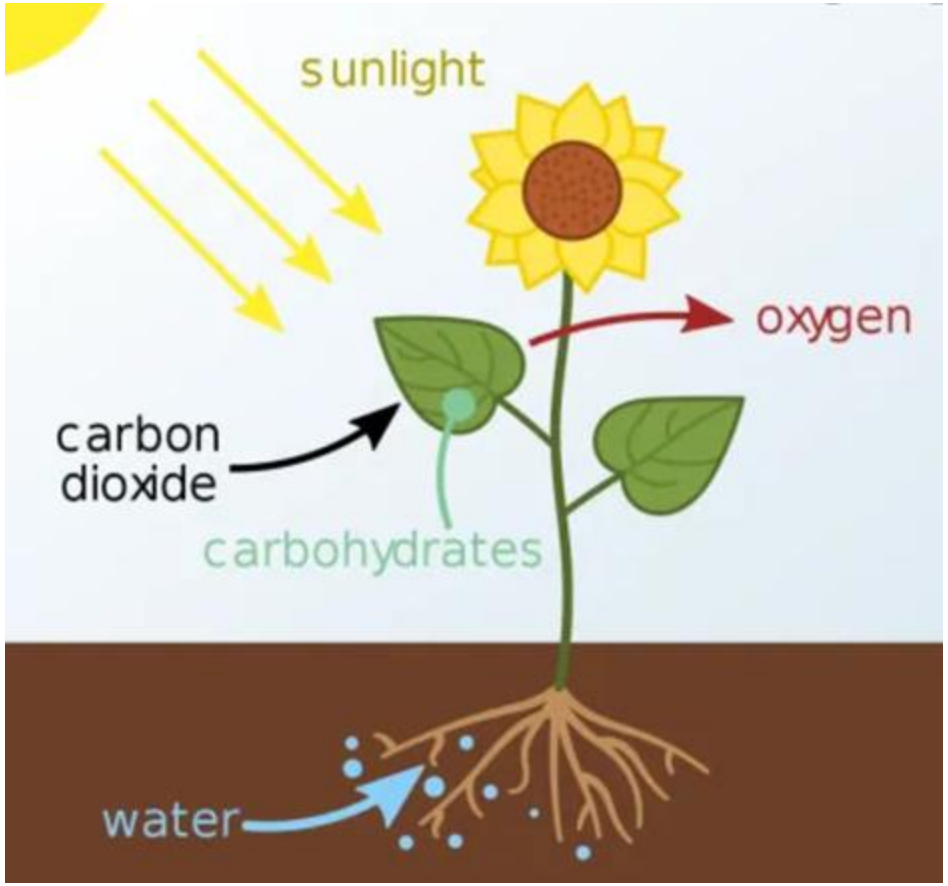
Purple squares = potassium

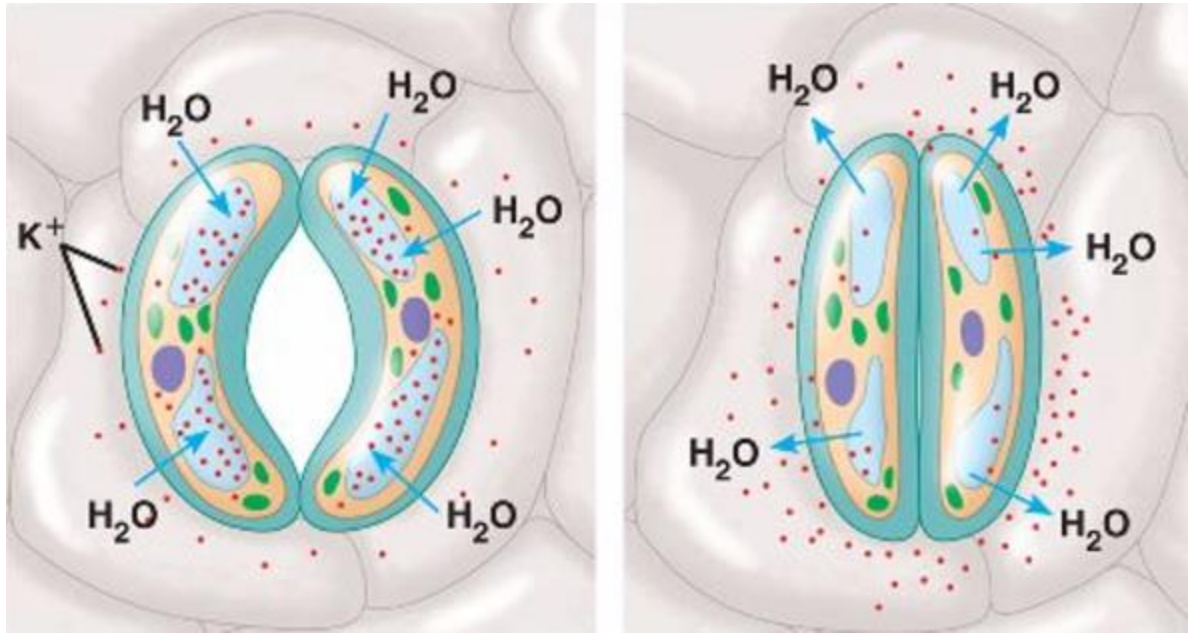
Notice the ATP molecule



What stories could your students investigate with these models?

Active and passive transport in leaf guard cells to open and close stomata.





Models help students gather **evidence** for their own explanation

Omega-conotoxin from cone snails blocks the transport of Ca2+ through the voltage-gated

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**

We put teachers first!

Your opinions are important to us.

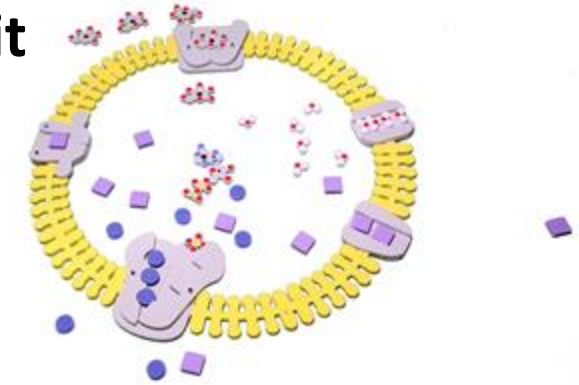
Enter to win a **$500 gift card** by completing this short survey.

This will also allow us to email you the resources associated with this session.

THANK YOU FOR ATTENDING!

Kits and models used in this session:

Phospholipid Membrane Transport Kit



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