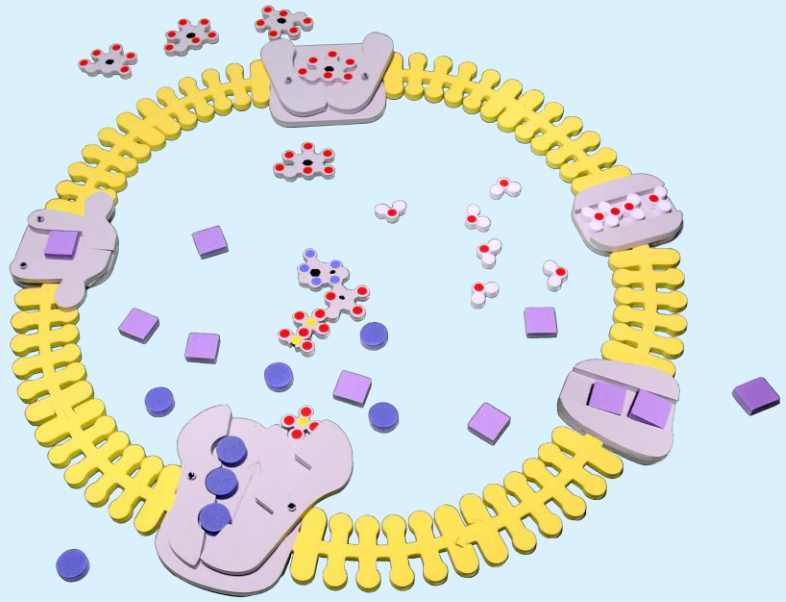
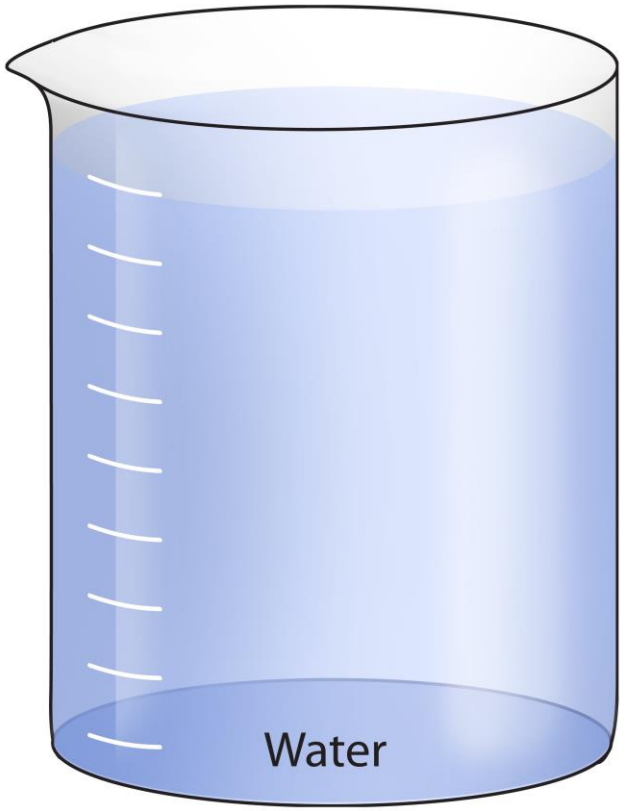
3d molecular designs
Transforming Science Learning

Get a Move On: Modeling Molecular Transport Across Cell Membranes

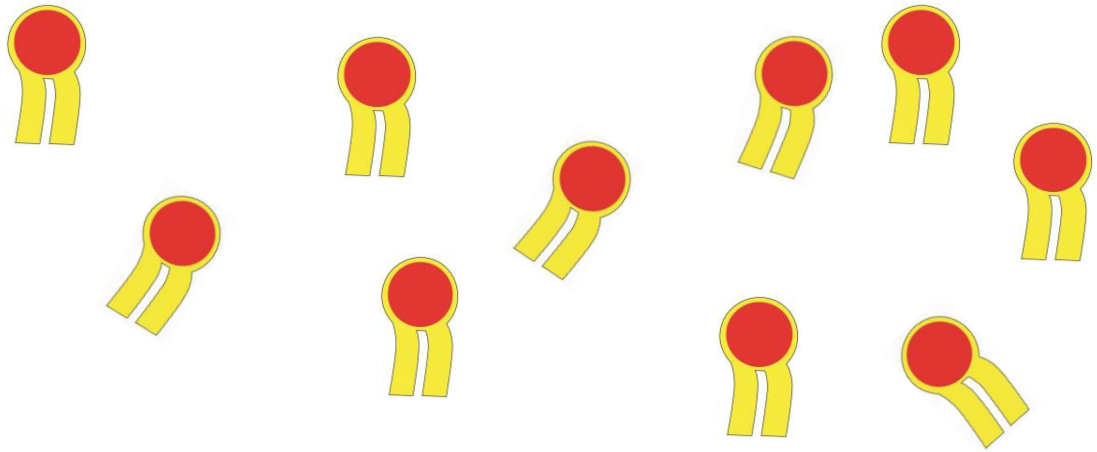
Susan Auld
Seehome High School



BUILDING THE CELL MEMBRANE



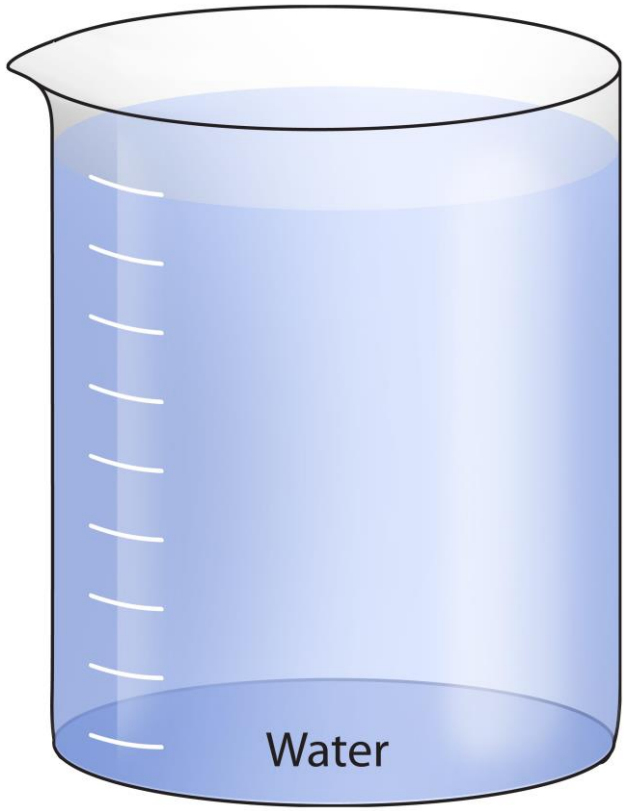
First Thought Experiment:
How would ten phospholipids need to be arranged to form a film at the top of a beaker of water? Think about hydrophobic tails/hydrophilic heads



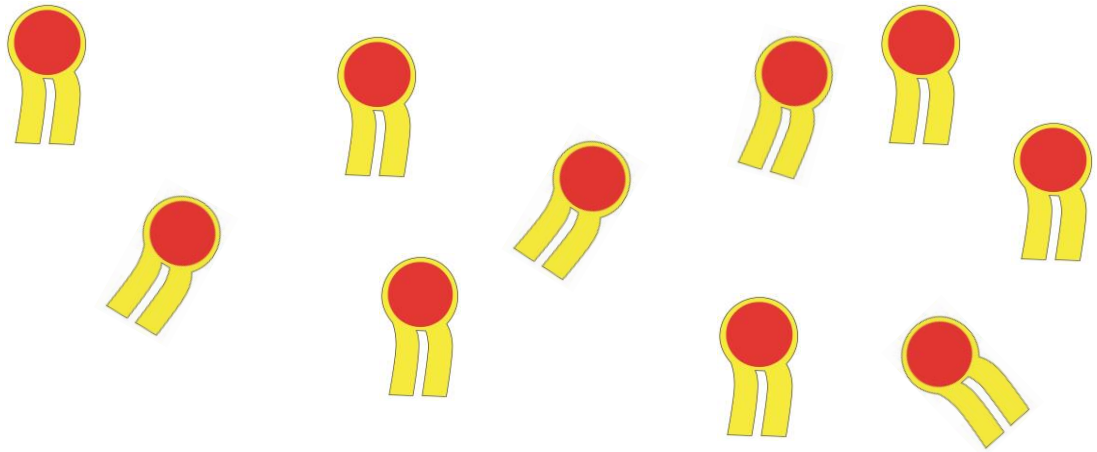
Student Demonstration of a single layer of phospholipids at the surface of a beaker of water.

Discussion questions?

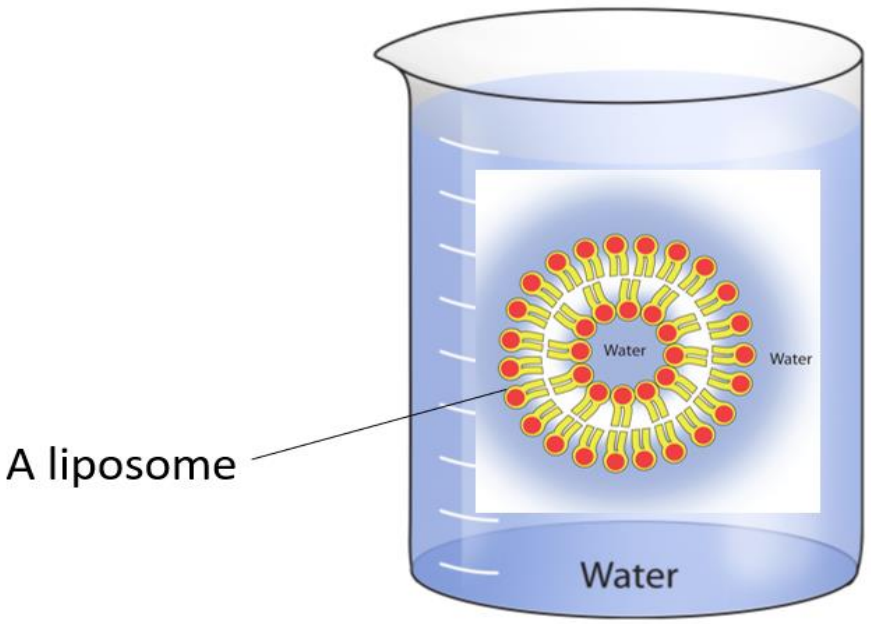
BUILDING THE CELL MEMBRANE



First Thought Experiment:
How would ten phospholipids need to be arranged to form a film at the top of a beaker of water? Think about hydrophobic tails/hydrophilic heads



Student demonstration building a single layer of submerged phospholipids.



Discussion questions:

1. Are the phospholipid heads near water? Are the fatty acid tails shielded from water?

2. Is there more than one way to arrange these phospholipids to make this work? Kids are very creative during this challenge.

3. Do you think that we are missing part of the membrane? Would this solve the problem of getting necessary materials into the cell and getting rid of waste?

How are membranes involved in cell processes such as respiration?

Into Cell (across membrane)

- Food (glucose)
- Oxygen

Out of cell (across membrane)

- Carbon Dioxide
- Water (?)

Respiration (Glucose + oxygen --> water + carbon dioxide + ATP)

Glut1 is an example of a carrier protein that changes shape when it comes in contact with a particular molecule (glucose)

Looking further at what needs to get in and out of cell during respiration

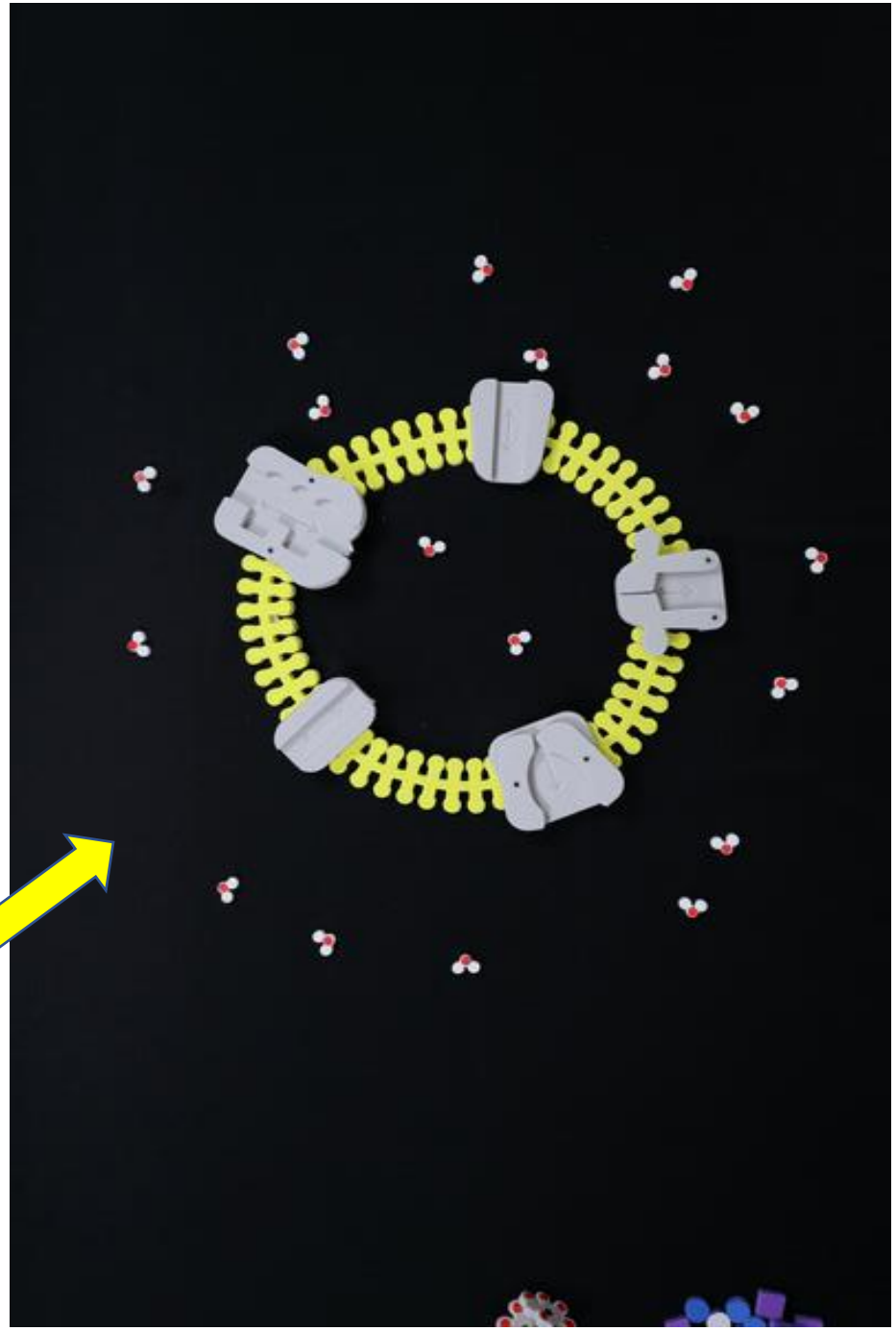
<u>Into the cell</u>

- Food (glucose)
- Oxygen

<u>Out of the cell</u>

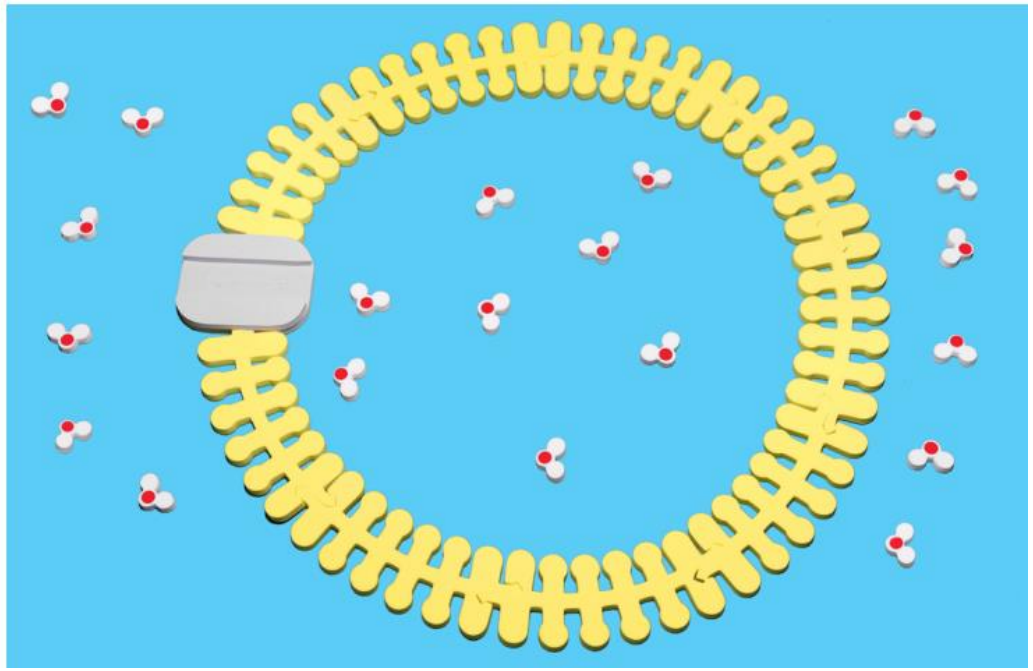
- Carbon Dioxide
- Water

Respiration (Glucose + oxygen --> water + carbon dioxide + ATP)



Misconception: Water just goes through the membrane. Hydrophilic water molecules would have a difficult time going through a membrane that contains hydrophilic tails.

Solution to the problem: Add a unique protein (aquaporin) that is a specific shape and has a hydrophilic interior so that water can cross the membrane.



Set up a system where the water molecules have a higher concentration outside than inside the cell.

If molecules move randomly, show where the water molecules may be after some time.

Looking further at what needs to get in and out of cell during respiration

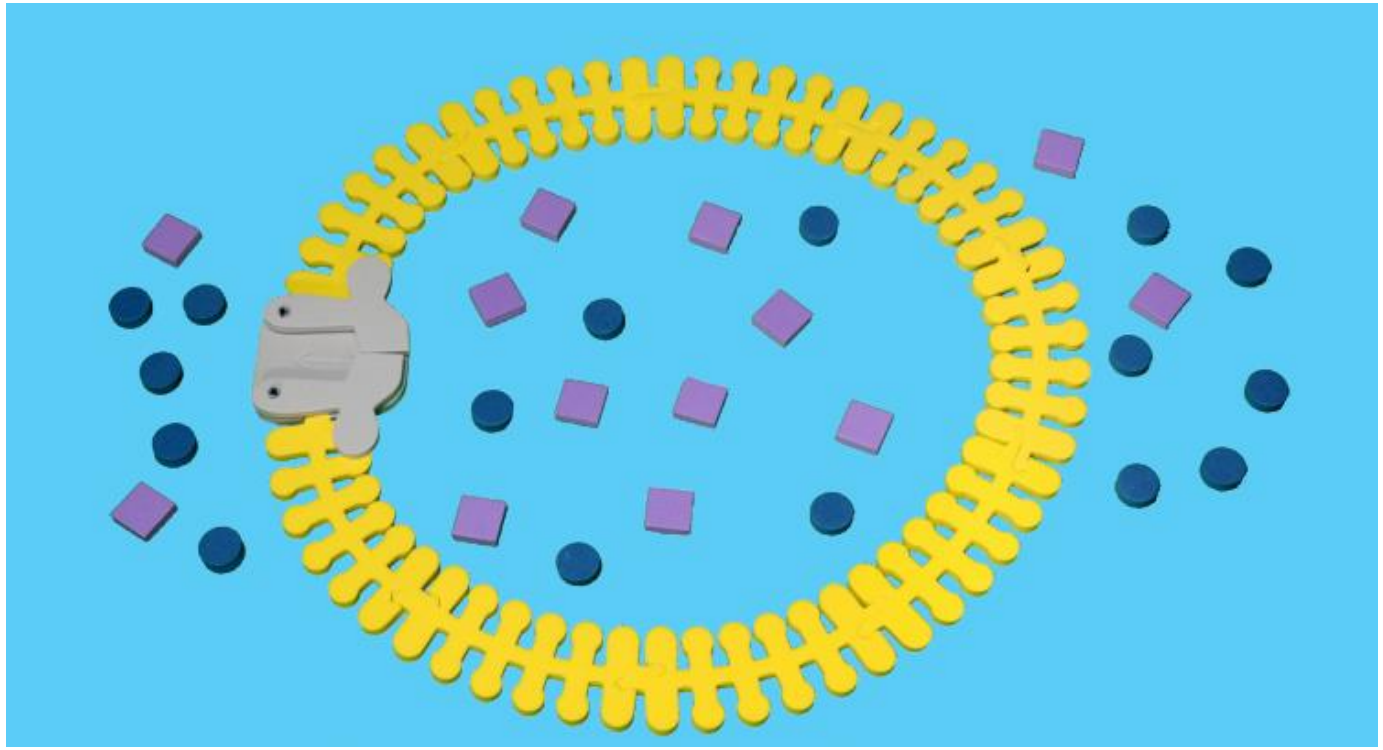
<u>Into the cell</u>

- Food (glucose)
- Oxygen

<u>Out of the cell</u>

- Carbon Dioxide
- Water

Respiration (Glucose + oxygen --> water + carbon dioxide + ATP)



Extensions

Gated Channels: Potassium-gated channels - some channel proteins open in response to a stimulus.

Potassium and Sodium channels are an example of this.

Workshop NGSS Connections

SEPs	CCCs	DCIs
Asking questions	Patterns	PS1.A: Structure andproperties of matter
Developing and using models	Cause and effect	PS1.B: Chemical reactions
Constructing explanations	Scale, proportion, and quantity	LS1.A: Structure and function
	Structure and function	LS1.C: Organization for matter and energy flow in organisms

Summer Course 2023 – Modeling the Molecular World

Join us in Milwaukee for hands-on discovery and professional development
July 29 – Aug 2 OR Aug 5 – 9

Scan to register!

Bring an empty suitcase!
You'll take home all these classroom resources!

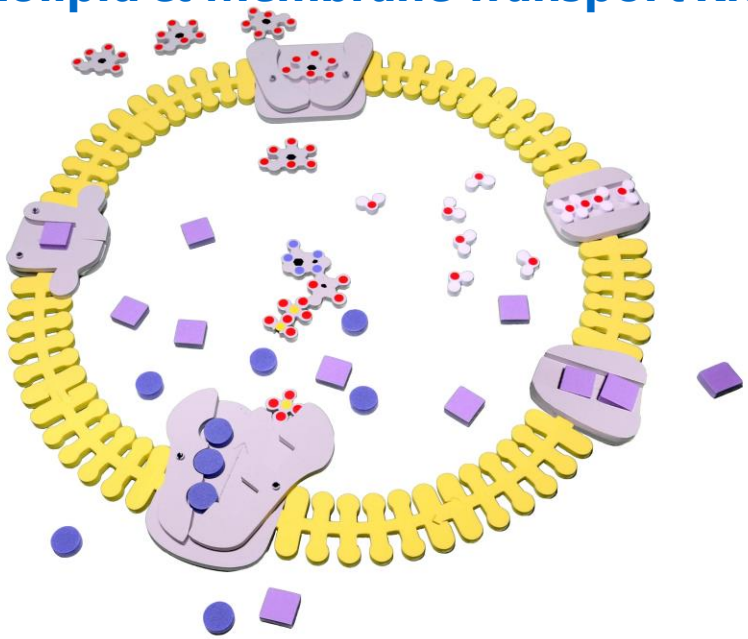
3d molecular designs

Transforming Science Learning

Thank you for attending!

Kits and models used in this session:

Phospholipid & Membrane Transport Kit©



Purchase kits and borrow Kits and Models at **3dmoleculardesigns.com**.

Use discount code **FC23** to receive 20% off most items in our catalog.