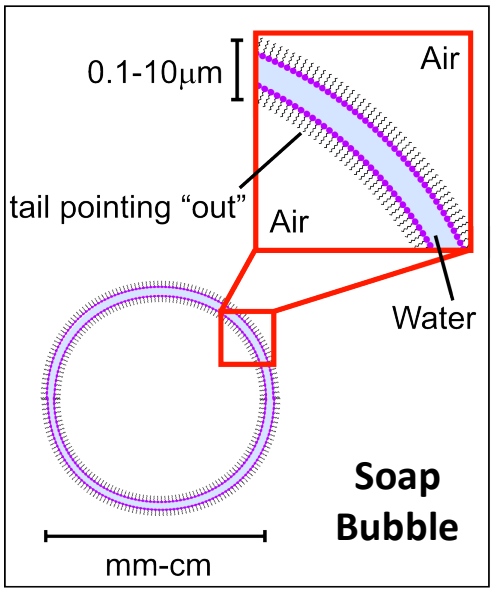
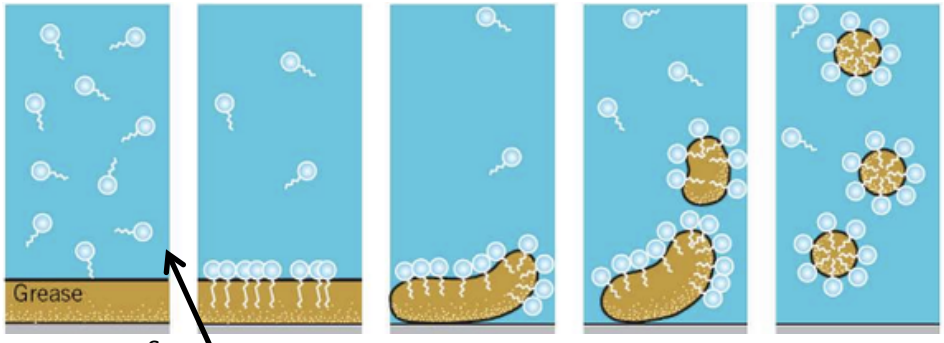
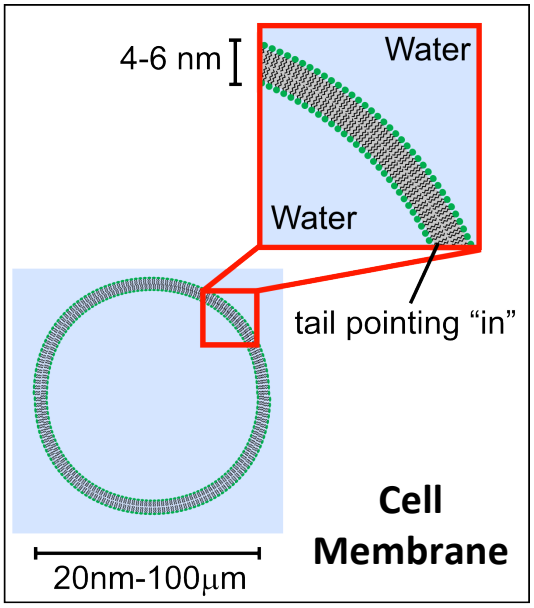
3.2: Cell Membrane Characteristics Bubble Activity

Bubbles make a great stand in for cell membranes. They're fluid, flexible, and can self-repair. Bubbles and cell membranes are alike because their parts are so similar. If you could zoom down on a cell membrane, you'd see that much of the membrane is a double layer of little molecules called phospholipids. Phospholipids have a love-hate relationship with water. One end, the "head," is attracted to water, and the other end, the "tail," is repelled by water. Place phospholipids in water and they quickly form a double layer with the heads facing out on both sides.

A soap molecule has the same split personality. The "head" of a soap molecule is charged (ionic) and attracts to water molecules, which have regions of positive and negative charge (polar). The hydrocarbon tail of the soap molecule is not charged and is repelled by water's polarity. This explains why we use soap to clean. The hydrocarbon tail of soap mixes with and dissolves in other hydrocarbons, like oils and fats, while the head region grabs a hold of passing water molecules and follows them down the drain. The surface of a bubble has three layers. The middle layer is a thin lm of water. On both sides of this lm is a layer of soap molecules with hydrophilic heads oriented toward the water lm and hydrophobic tails pointing away.

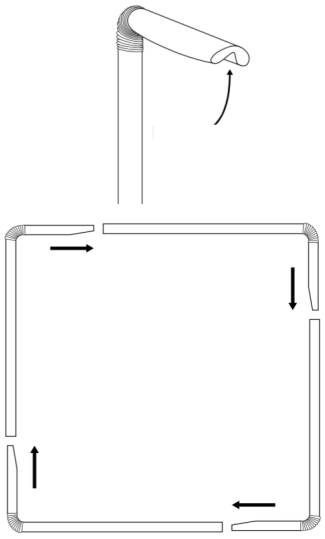






Setup:

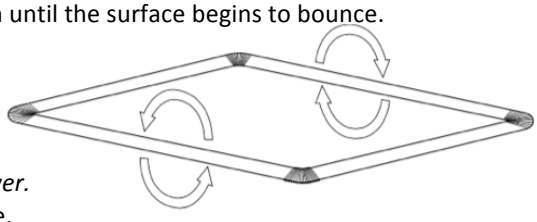
- **Materials:**
  - Soap Solution (pre-made): 900mL water, 100mL dish soap, 25mL glycerin
  - 8 bendy straws
  - String
  - Thread
  - Clean straws
  - Shallow lab tray
- **Setup Bubble Frames:**
  - Take four bendy straws and bend at the elbows
  - Flatten the shorter ends of the straws and fold flattened surface in the middle
  - Connect straws together by inserting short ends into long ends to create a square
  - Do this twice to make two bubble frames



Concept #1: Membranes are Fluid and Flexible

Cell membranes are not static, they bend and flex in order to adapt to changing conditions.

1. Lift the bubble frame out of solution so that a thin film spans across the frame.
2. Tilt the frame back and forth and observe the surface of the film.
3. Notice the swirl of color as the light reflects off the film. Molecules in the cell membrane move about in the same way.
4. Hold the frame by the edges and rotate the sides in opposite directions (see figure below). Notice the film's elasticity.
5. Hold the bubble film parallel to the floor and gently move the frame up and down until the surface begins to bounce.
6. **Like the bubble film, membranes can flex without breaking.**



Concept #2: Membranes Can Self-Repair

Attraction between phospholipids allows cell membranes to repair small breaks in the bilayer.

1. Lift the bubble frame out of the solution so that a thin film spans across the frame.
2. Try to put your clean dry finger or a clean dry extra straw through the bubble film. What happens?
3. Next, cover the surface of your finger or an extra straw in bubble solution.
4. Slowly your push finger or the straw through the film. The film should now allow your finger or the straw to pass through without breaking.
5. Remove your finger or the straw from the film. The film should repair itself.
6. Try the same procedure with your entire hand!
7. **Like the bubble layer, cell membranes can spontaneously repair small tears in the lipid bilayer.**

Concept #3: Eukaryotic Cells Have Membrane-Bound Organelles & Structures

Membranes surrounding organelles in eukaryotic cells feature a phospholipid bilayer like the one found in the outer membrane.

1. Lift the bubble frame out of solution so that a thin film spans across the frame.
2. Place the tip of a clean straw into the bubble solution. Gently blow on the other end of the straw to create a bubble.
3. Slowly lift the tip of the straw out of the liquid while continuing to fill the bubble with air.
4. Allow the bubble to grow to a size of about 6" wide.
5. Return the tip of the straw back into the bubble solution and try to create a smaller bubble inside the larger bubble.
6. Notice how the smaller bubble creates a compartment of air that is contained within but separated from the air of the larger bubble.
7. **Similarly, eukaryotic cells have membrane-bound organelles that create specialized compartments within a cell.**

Concept #4: Membrane Proteins Perform Special Functions

Specialized proteins float in the membrane, giving the membrane unique properties. Some proteins form a passageway for large or electrically charged molecules to pass through the membrane.

1. Lift the bubble frame out of solution so that a thin film spans across frame.
2. Hold the frame parallel to the tray. Gently lay the loop of thread on to the film surface.
3. Use a pencil or pen to break the bubble film that is inside the loop of thread.
4. The loop of thread should rapidly expand into the shape of a circle.
5. Insert a pencil or finger into middle of thread loop.
6. Rock frame back and forth to see thread loop drift across film.
7. **Membrane proteins can also drift across the lipid bilayer.**

Concept #5: Many Cells Reproduce Through Cellular Division

Single-celled organisms and many types of cells in multi-cellular organisms reproduce by splitting into two cells.

1. Place the tip of a clean straw into the bubble solution in the tray.
2. Gently blow on the other end of the straw to create a bubble.
3. Life the straw out of the liquid and continue to blow into the bubble.
4. Increase the size of the bubble until it is about 6" wide.
5. Hold a piece of thread that is twice as long as the bubble and slide it underneath the bubble.
6. Lift the thread up through the bubble and the bubble should split it into two.
7. **In cellular division (splitting), cells divide when a thing ring of proteins located at the cell's midpoint contracts, effectively dividing the cell into two new daughter cells.**

Lab Group Names: _____ Period: _____

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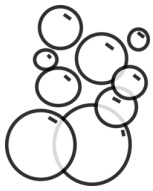

3.2: Cell Membrane Characteristics Activity

For each of the concept activities:

1. Describe the membrane concept, as you understand it, in your own words.
2. Describe how the soap bubble was used to model the cell concept.

Concept #1:	Concept #2:
1.	1.
2.	2.
Concept #3:	**Concept #4:**
1.	1.
2.	2.
Concept #5:	
1.	
2.	