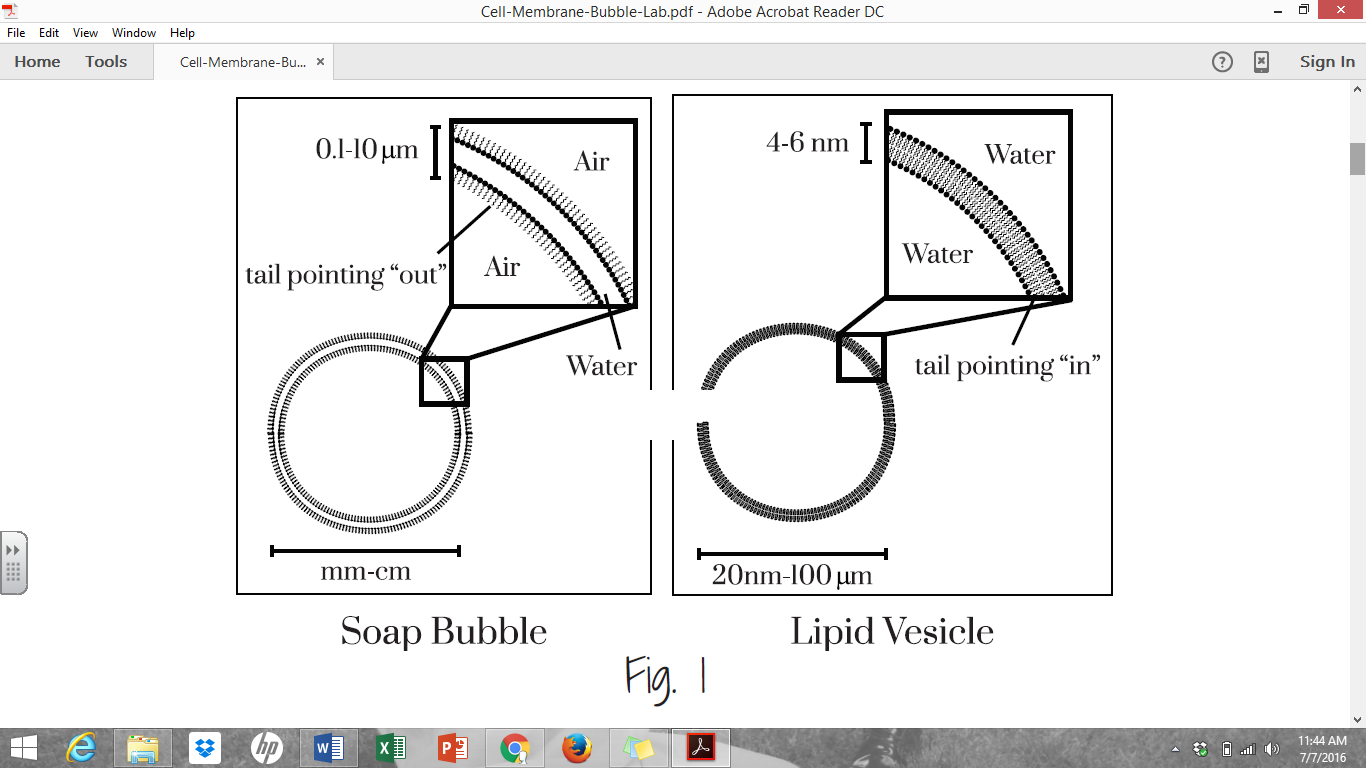
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**Cell Membrane Bubble Lab**

Introduction: Bubbles make great simulated cell membranes. They’re fluid, flexible, and can self-repair. They’re similar to membranes in another important way, as well. If you could zoom down on a cell membrane, you’d see the 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 for a double layer with the ends facing out on both sides.

A soap molecules has the same split personality. The “head” of the 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 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 film of water. On both sides of this film is a layer of soap molecules with hydrophilic heads oriented towards the water film and hydrophobic tails pointing away.



Pre-Lab Q’s:

1. How are cell membranes and bubbles similar? Provide at least 4 reasons (hint: check the introduction)!
2. What is figure 1 displaying? Be specific.

Set-Up Protocol:

1. Create the bubble solution by mixing water, soap and corn syrup in a 1000mL beaker.
2. Create a bubble frame by one of the following methods.

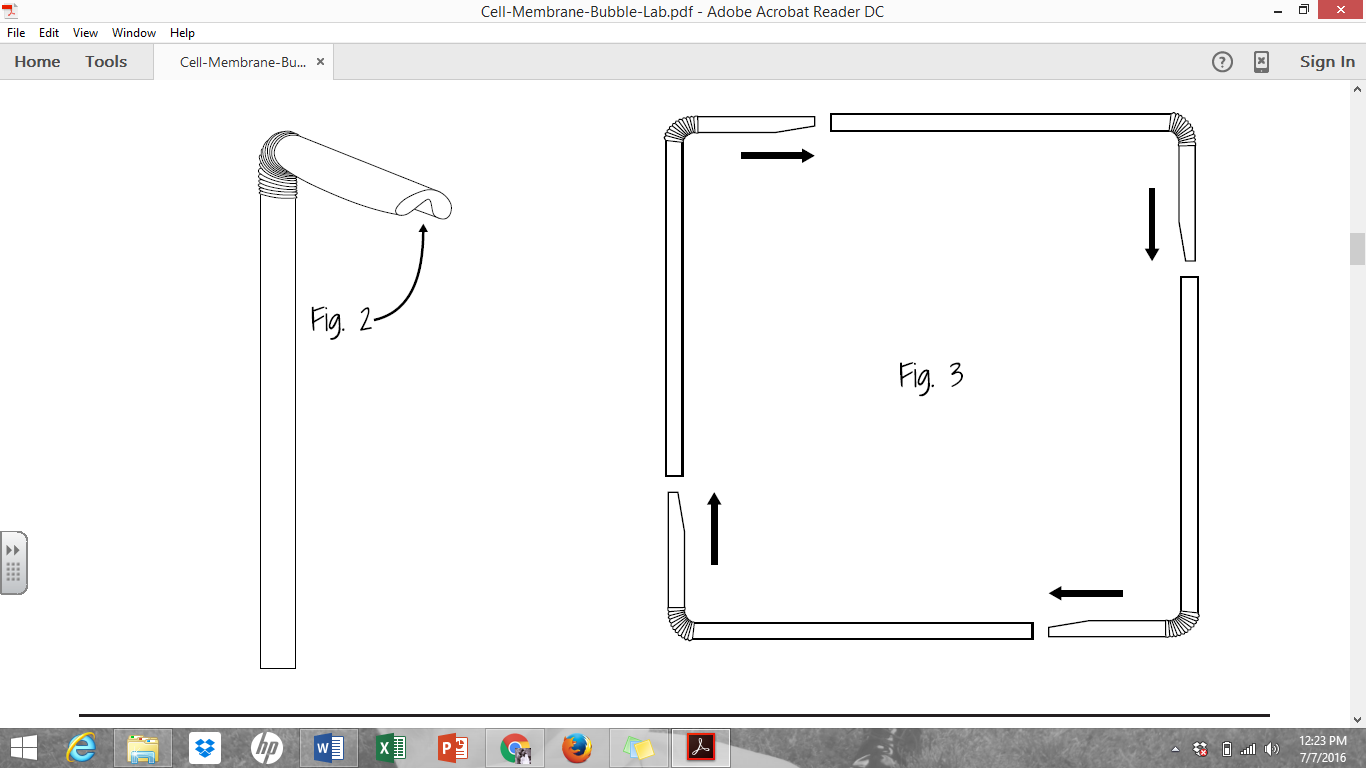
Method 1

* Bend 4 straws at the elbows.
* Flatten the shorter ends of straws and fold flatted surface in the middle (see fig 2).
* Connect straws together by inserting short ends into long ends to create a square (see fig 3).

Method 2

* Cut straws in 5.5” lengths.
* Run a 30” string through all four straws.
* Tightly tie ends of string together to create a frame.
* Cut off loose ends of string.

1. Create a ring of thread by tying a loop about two fingers wide.
2. Cut off the loose ends.
3. Place bubble frame into shallow tray.
4. Add bubble solution to slightly cover bubble frame.



Procedure

1. Cell Concept 1 - Membranes are Fluid and Flexible
   1. Lift bubble frame out of solution so that a thin film spans across the frame.
   2. Tilt the frame back and forth while you observe the surface. What do you notice?

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* 1. Hold the frame by the edges and rotate the sides in opposite directions. What happens?

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* 1. Hold the bubble film parallel to the floor and move the frame up and down (gently) until the surface begins to bounce up and down as well. Did the film break?

1. Cell Concept 2 – Membranes Can Self-Repair

*Attractions between phospholipids allow cell membranes to repair small breaks in the bilayer*

* 1. Lift the bubble frame out of solution so that a thin film spans across the frame.
  2. Cover the surface of your finger or extra straw in bubble solution.
  3. Slowly push finger or straw through the film. Did it pass through without breaking the film? \_\_\_\_\_\_\_\_\_
  4. Remove the finger/straw. Did the film repair itself? \_\_\_\_\_\_\_\_\_\_
  5. Try the same procedure with your entire hand.

1. Cell Concept 3 – Eukaryotic Cells Feature Membrane Bound Organelles
   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. 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” across.
   5. Return the tip of the straw back into the bubble solution and try to create a smaller bubble inside the larger bubble.
2. Cell Concept 4 – Membrane Proteins Perform Special Functions

*Some specialized proteins embed within the lipid bilayer, allowing large or electrically charged molecules to pass through the membrane. We will simulate one such protein now – called a channel protein.*

* 1. Lift the bubble frame out of solution so that a thin films spans the frame.
  2. Hold the frame parallel to the tray.
  3. Gently lay a loop of thread onto the film surface.
  4. Use a pencil or pen to break the bubble film that is inside the loop of thread.
  5. Once the loop of thread expands to the shape of a circle, insert a pencil or finger through the loop.
  6. Rock the frame back and forth so the thread drifts across the film.
  7. What does this tell you about membrane proteins? Do they always stay in the same place? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student Analysis

In this lab, soap bubbles were used to model several properties that are characteristic of cell membranes. Below is a chart listing each of the “cell concepts” investigated in this lab. For each concept, 1) describe the concept, as you understand it, in your own words and 2) describe how the soap bubble was used to model this concept.

|  |
| --- |
| Cell Concept 1 – Membranes are Fluid and Flexible |
| 1) |
| 2) |
| Cell Concept 2 – Membranes Can Self-Repair |
| 1) |
| 2) |
| Cell Concept 3 – Membrane Bound Organelles |
| 1) |
| 2) |
| Cell Concept 4 – Membrane Proteins |
| 1) |
| 2) |