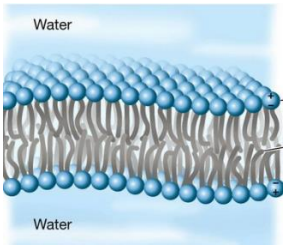
Name: _____ Date: _____

Background: If you compare a cell to a house, the membrane of a cell acts just like the outside walls of the house. It is responsible for maintaining the internal balance, or **homeostasis**, of different substances, such as water and salts in the cell. The membrane is semi-permeable, meaning it lets some things in and out. For example, if the cell needed food, it would allow the food in but keep out a virus that was trying to invade it. In this investigation you will explore a model that displays some of the same features as a cell membrane.

Bubbles make great models of 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 (lollipops with 2 sticks).



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. We will make membranes with soap today and observe their properties.

Pre-lab questions:

1. What is homeostasis?

2. What does semi-permeable mean? Give an example.

3. How is the membrane responsible for maintaining homeostasis?

4. What three characteristics do bubbles have that are similar to the cell membrane?

5. What kind of relationship do phospholipids have with water? Draw a picture of the cell membrane and label it with the help of your teacher.

Materials:

• soap solution
• 4 bendable straws
• 30 inches of string (optional)
• Spool of thread
• 1 clean straw
• Shallow tray (cafeteria trays work well)
https://www.haikudeck.com/cell-membrane-bubble-lab-uncategorized-presentation-CGr1dLyYXe

Set Up:

1. Create a bubble frame by using the following instructions. (see figure 3 for help)
   a. Cut straws in 5 ½ inch lengths.

b. Run a 30 inch string through all four straws.

c. Tightly tie ends of string together to create a frame.

d. Cut off loose ends of string.

3. Create a ring of thread by tying a loop about two fingers wide.

4. Cut off the loose ends.

5. Place bubble frame into shallow tray

6. Add bubble solution to slightly cover bubble frame.

Procedure:

Cell Concept 1 – Membranes are Fluid and Flexible

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

1. Lift bubble frame out of solution so that a thin film spans across 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 a similar fashion.

4. Hold the frame by the edges and rotate the sides in opposite directions. (See Fig. 4) Notice the elasticity of the film.

5. Hold the bubble film parallel to the floor and gently move the frame up and down until the surface begins to bounce up and down.

6. Like the bubble film, membranes can flex without breaking.

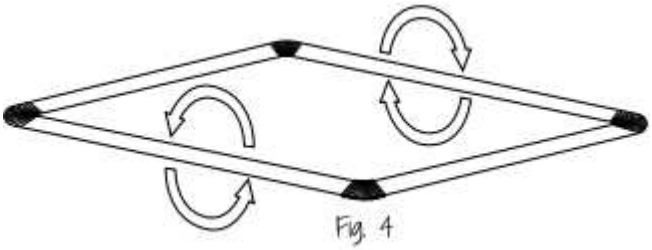


Fig. 4

Cell Concept 2 – Membranes Can Self-Repair

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

1. Lift bubble frame out of solution so that a thin film spans across frame.

2. Cover the surface of your finger or extra straw in bubble solution.

3. Slowly push finger or straw through film. Film should allow finger to pass without breaking.

4. Remove finger from film. Film should repair itself.

5. Try the same procedure with your entire hand.

6. Like the bubble layer, cell membranes can spontaneously repair small tears in the lipid bilayer.

Cell Concept 3 – Eukaryotic Cells Feature Membrane Bound Organelles

The membranes surrounding organelles in Eukaryotic cells feature a phospholipid bilayer like the one found in the outer "plasma" membrane.

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" 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. In a similar fashion, Eukaryotic cells feature membrane bound organelles that create specialized compartments within a single cell. The primary structure of the outer cell membrane as well as the membranes that enclose organelles is a double layer of phospholipids known as a phospholipid bilayer.

Cell Membrane Bubble Lab

Student Analysis

In this lab, soap bubbles were used to model several properties that are characteristic of cellular membranes.

Below is a chart listing each of the "Cell Concepts" investigated in the Cell Membrane Bubble Lab.

Complete the following steps for each cell concept from the lab.

1. Describe the cell concept, as you understand it, in your own words.

2. Describe how the soap bubble was used to model the cell 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.

Teacher notes:

1000ml beaker

- 900ml water
- 100ml dish soap
- 25ml corn syrup or glycerol