# Bubble (Cell Membrane) Lab

**Background:** The membrane that surrounds cells and organelles are made of a layer of phospholipids and proteins. It would take more than 10,000 stacked cell membranes to equal the thickness of a piece of paper. The phospholipid bi-layer is fluid but holds its shape due to its interactions with water. We will use soap bubbles as an analogy for the cell membrane. Soap bubbles are also lipid bi-layers that are held together because of the surface tension of water.

**Activity 1: Flexibility**
This activity will show how the cell membrane acts as a liquid and a solid. You will be able to see the flexibility of the bubble which acts as the cell membrane and how it is able to keep the shape of the cell without breaking. A cell membrane is actually even more flexible since it has a lower surface tension that the bubble.

1. Place the straw device (straw/string rectangle) into the soap mixture on your plate.
2. Lift it out at an angle to create a film that covers the straw device.
3. Slowly twist it back and forth to show the flexibility of the cell membrane.

**Question 1**: Why might this characteristic be important to a cell's survival?

**Activity 2: Self-sealing and Protein Movement**
This activity will show how the lipid bi-layer is able to re-seal itself after being opened. This property allows for the cell to be semi-permeable so that nutrients can be imported into the cell and protein products and waste can be exported out of the cell without destroying the membrane. You will also see the fluidity of the membrane as you move the object, which acts as a protein, around the membrane without disrupting the membrane.

1. Dip your straw device into the bubble solution and slowly lift out at an angle to create a film.
2. Take the glass stirring rod and put gently put it into the film. You should be able to move it around the bubble without popping it. (You may also try your finger for this activity)
3. Remove the glass stirring rod/finger and observe how the membrane "repairs" itself.

**Question 2**: Describe what happened when you inserted the glass stirring rod or your finger into the membrane.

**Question 3**: Describe what happened when you moved the object around the membrane.

**Activity 3: Transport**
This activity also illustrates how proteins are embedded in the lipid bi-layer. As part of the "fluid mosaic" proteins don't remain in one place. These proteins provide passageways for larger molecules to cross the membrane (sort of like a revolving door). We will use a thread ring that represents a channel that allows molecules through the membrane.

1. Take a piece of thread, make a circle with it (about the size of a quarter) and tie it in a knot.
2. Place the straw device into the soap solution and slowly pull it out at an angle to create a film.
3. One partner holds the straw device while the other partner carefully places the circle of thread on the soap membrane.
4. Pop the membrane **inside** the thread circle and move the circle around.
5. Drop several objects through the opening to demonstrate the passage of materials through the membrane.
6. Remove the circle of thread without popping the membrane in the rectangle to represent the membrane "repairing" itself.

**Question 4:** What happened to the rest of the membrane when you popped the inside of the thread circle?

**Question 5**: Why is this property of a membrane (being able to form pores and then reseal) important for the survival of a cell?

**Question 6:** Why might it be important for proteins to be able to move from one part of the cell membrane to another?

**Activity 4: Vesicle Function**

This activity will show that vesicles are membrane-bound sacs used in the cell to store and transport materials. Certain organelles in the cell like the Endoplasmic Reticulum (ER) and the Golgi apparatus often use vesicles to transport materials throughout the cell and out of the cell. The membranes of the vesicles can fuse with the cell membrane. Vesicles will pinch off of the cell and the membrane will stay intact.

1. Use your regular straw to slowly blow into the bubble solution to make one large bubble in the corner of your tray.
2. Keeping the straw in the bubble, slowly blow an additional bubble inside the large bubble
3. Let go of the smaller bubble and pull out the straw.
4. The original membrane shouldn't break and the vesicle that was created should move outside of the large bubble. This shows that even though the vesicles are given off, the membrane can keep its shape.

**Question 7:** How does the movement of vesicles important for the survival of a cell?

**Application Question:**

While on a hunting trip in a remote location in Delaware, a friend of yours was bitten by a copperhead. He nearly died from hemolysis, or breakage of many of his red blood cells. The copperhead's venom was sent to a lab and the lab technician found three different enzymes (proteins responsible for chemical reactions) were present:

- Phospholipase - breaks down phospholipids
- Neuraminidase - removes carbohydrates from cells
- Protease - breaks down proteins

**Question 8:** Which of these enzymes do you think was responsible for his near fatal red blood cell hemolysis? Explain your reasoning.