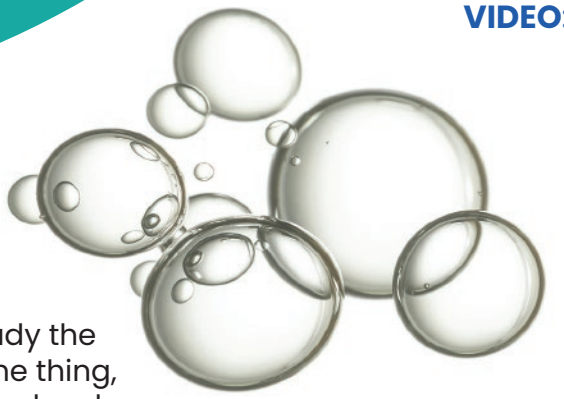
SCIENCE AT HOME

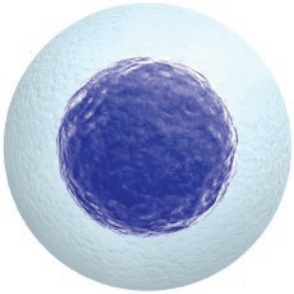
BUBBLE MEMBRANES

GRADE: **12U**

SBI4U

SUBJECT: BIOLOGY
STRAND: BIOCHEMISTRY
TOPIC: MEMBRANES
EXPECTATIONS: B2.1, B2.2, B2.3, B2.5, B3.1, B3.2, B3.6
VIDEO: youtu.be/hTW-Wo8Oq1w





INTRODUCTION:

Soap bubbles are a great way to study the properties of cell membranes. For one thing, they're chemically alike. Both soap molecules and phospholipid molecules — which make up cell membranes — are **amphipathic**, meaning they have **hydrophilic** (water-loving) heads and **hydrophobic** (water-hating) tails. Phospholipids have one head and two tails, and soap has one head and one tail.

The two kinds of molecules also organize similarly. When they form membranes, they orient themselves so that their hydrophilic heads are all pointing towards water and their hydrophobic tails are all pointing away from it. So the two kinds of membranes, although different, behave chemically in similar ways.

ACTIVITY: Explore bubble membranes

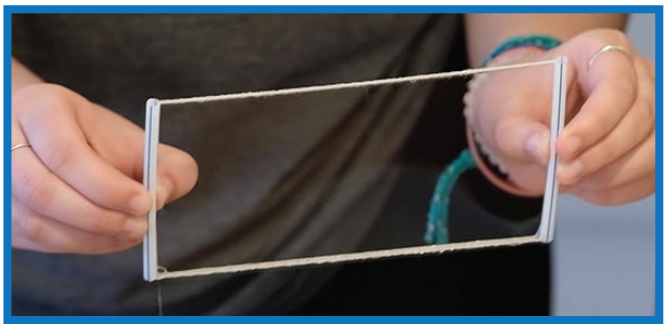
TIME: 45 minutes

WHAT YOU NEED:

- 10 mL dish soap
- 140 mL water
- 10 mL (2 tsp) white sugar
- measuring cup
- a teaspoon
- 3-4 plastic straws
- cotton string (the length of your arm)
- a piece of thread about 10 cm long
- objects to pass through the membrane (a pencil, for example — or anything else you don't mind getting wet)
- scissors
- a shallow dish

WHAT YOU DO:

- Mix the dish soap, water and white sugar in the measuring cup. Set it aside.
- Cut one straw in half and pass the string through each part. Tie the string, cut the hanging ends and tuck the knot inside the straw. You should now have a rectangular bubble membrane apparatus.



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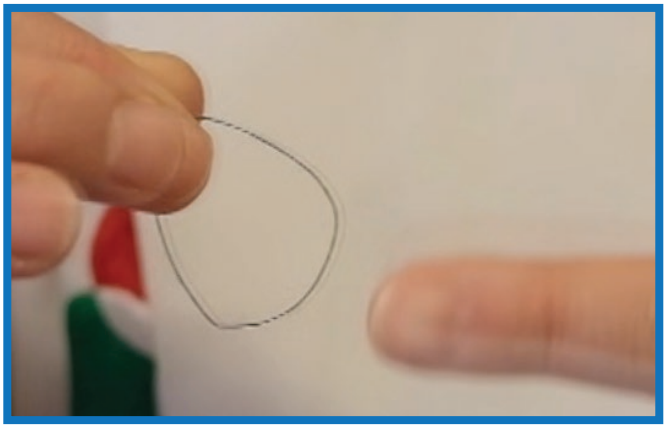
WHAT YOU DO (continued):

- Pour some of your bubble mixture into the shallow dish. Submerge your apparatus into the soapy solution and pull it out gently. With luck, you have created a bubble membrane.
- Try passing objects through the membrane. Which objects go through no problem? Which ones pop the bubble?
- Now tie a knot in your piece of thread to create a closed loop.



Your thread loop should measure about 3 cm in diameter

- Explore how you can use that loop of thread to create a pore within the bubble membrane. Now try passing things through the pore. What objects are now able to get through? Any idea why? What happens to the membrane when you remove the pore?
- With what's left of the soapy solution, create a bubble right in the dish. Use a straw to make bubbles within that bubble.

Pop the membrane inside your loop with a pencil tip to create a pore (hole).

WHY THIS MATTERS:

Bubbles help us visualize what's going on with cell membranes.

TAKING IT FURTHER: Killing the coronavirus

These days, we are asked to wash our hands with soap for 20 seconds. Why? What does that do to this virus, and why does it take 20 seconds?

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UNPACKING WHAT HAPPENED:

Explore bubble membranes

Only substances that are chemically similar to the bubble membrane can pass through it. So if the pencil has the soapy solution on it, it can pass through. But if it's dry, it pops the membrane. Unless, that is, you have a pore, like the one you created with your thread. Then you can pass the dry pencil — or any object that can fit — through the membrane.

The same is true for cell membranes. Molecules that are small and chemically similar to the membrane, like oxygen gas, can simply pass through. But larger molecules that are chemically dissimilar, like glucose, need a pore. Our own cell membranes have such pores, made from protein, that allow these molecules to get through.

Creating bubbles within a bubble helps us visualize cells. Just as inside a bubble membrane there can be several smaller bubbles, all with their own membranes, inside a cell membrane, there are organelles, each with membranes of their own.

Killing the coronavirus

The coronavirus has a coat that is hydrophobic. If you wash your hands with water alone, the virus will remain intact on your skin. If you use soapy water, though, the hydrophilic ends of the soap will be attracted to the water, leaving the hydrophobic ends of the soap to attach to the hydrophobic viral coat — pulling it off the skin and breaking it apart. It takes 20 seconds because viruses are tiny and they get stuck in the folds of your skin. So you have to make sure the soapy water gets to them and has time to establish the fatal attraction.

MORE ONLINE:

https://www.nature.com/scitable/topicpage/cell-membranes-14052567/

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