The cell membrane regulates what enters and exits the cell. Let’s look at the cell membrane and see how its’ structure allows it to perform this important task. When you think about a membrane, imagine it is like a big plastic bag with some tiny holes. That bag holds all of the cell pieces and fluids inside the cell and keeps any nasty things outside the cell. The holes are there to let some things move in and out of the cell - this is called semi-permeable.

The cell membrane is not one solid piece. Everything in life is made of smaller pieces and a membrane is no different. Three macromolecules combine to make cell membranes. Lipids called phospholipids make up most of the cell membrane. Proteins serve as channels, pumps or markers and make up another large portion of the cell membrane. Carbohydrates are also a part of the membrane so cells can recognize each other.

Scientists describe this organization of the phospholipids and proteins as the fluid mosaic model. It is called fluid, because it moves. It is called a mosaic, because it has many macromolecules that combine to make it - like mosaic tiles.

Phospholipids are specialized lipids that are in a shape like a head with two tails. The heads love water (hydrophilic) and the tails fear water (hydrophobic). Since living things always have to have water inside and outside of the cell, the membrane is built in a manner that “hides” the hydrophobic tails. The tails bump up against each other and the heads are out facing the watery area surrounding the cell - this double layer of phospholipids is called the lipid bi-layer!

What about the proteins in the membrane? Scientists have shown that the proteins float in that bi-layer too. Some of them are found on the inside of the cell and some on the outside. Other proteins cross the bi-layer with one end outside of the cell and one end inside. Those proteins that cross the layer are very important in the active transport and facilitated diffusion of ions and small molecules.

As you learn more about the organelles inside of the cell, you will find that most have a phospholipid membrane surrounding them. This is why many descriptions of eukaryote cells say they have membrane-bound organelles. Some organelles even have 2 membranes - the mitochondria and the chloroplast both have double membranes surrounding them.

Color the picture of the phospholipid bi-layer below and color the entire cell membrane on the following pages: Colors will vary
Analysis Questions:

1. What is the job of the cell membrane?
   The cell membrane regulates what enters and exits the cell.

2. Why is the cell membrane described as semi-permeable?
   The cell membrane is described as semi-permeable because it allows only some things to pass into or out of the cell.

3. What are the 3 macromolecules that make up the cell membrane?
   The cell membrane is made up of lipids (phospholipids & steroids/cholesterol), proteins and carbohydrates.

4. Draw one phospholipid. Label the head, tail, hydrophobic portion and hydrophilic portion.

5. What is the primary role of proteins in the cell membrane?
   Most proteins (integral proteins) act as channels or “pumps” that allow large or charged particles to move across the cell membrane.

6. Why is the cell membrane described as a fluid mosaic model?
   The cell membrane is described as a fluid mosaic model because the molecules that make up the membrane can slide past each other, allowing the membrane to move (“fluid”). The membrane is also made up of many different types of molecules that form a single structure (“mosaic”).

7. Why does the cell membrane have to form a lipid bi-layer? Why not a single layer?
   The phospholipids in the cell membrane form a bi-layer to allow their hydrophobic tails to stay away from water, which is found both inside and outside of the cell. This also allows the hydrophilic heads to be in contact with water molecules.

8. Why function do carbohydrates have in the cell membrane?
   Carbohydrates are markers on the cell that allow cells to recognize each other.

9. What is meant by “membrane-bound” organelles? What type of cells have these?
   Membrane-bound organelles are organelles that are surrounded by a membrane. Only eukaryotic cells have membrane bound organelles. (Ribosomes are not surrounded by a membrane and are found in both eukaryotes and prokaryotes.)

10. If you were on the inside of a cell, would you be able to see the tails of a phospholipid? Why or why not?
    If you were on the inside of a cell you would not be able to see the tails of the phospholipids. The tails would be on the inside of the lipid bi-layer. You would only be able to see the hydrophilic heads of the phospholipids.

*Going Further:* What is a polar molecule? What is a nonpolar molecule?
A polar molecule is a molecule that has an uneven distribution of electrons causing it to have a partial negative charge on one side and a partial positive charge on the other side. Water is a polar molecule, so polar molecules are hydrophilic.
A non-polar molecule has an equal distribution of electrons throughout the molecule and so has no partially charged regions. Non-polar molecules are hydrophobic.