7: MEMBRANES (part 3)

The plasma membrane of a cell is a busy place. Not only does it have many channels and pumps, it also is able to send and receive many kinds of molecular messages. The arrangement of these items in and around the plasma membrane is called the "fluid mosaic model." The word "fluid" tells us that it is not hard or solid, but flowing and changeable. All the phospholipids are able to move around, so the embedded proteins are also able to move. (Imagine a bathtub full of ping pong balls, with other objects floating among the balls.) The word "mosaic" refers to the art form where small colored tiles are used to make a picture. Artists' pictures of membranes often remind of a colorful mosaic image.

We've already learned about some of the things you will find in a plasma membrane: channels and pumps. Aquaporins are also there, but we're going to be non-specific in our drawing and just put in a generic channel and pump (they could be anything). Proteins like channels that go all the way through the membrane are called ***transmembrane proteins***. "Trans" means "across." These proteins go across the membrane. (Don't worry about what the word "protein" means exactly—we'll get to that in the next lesson.) There are also proteins that go only half way in, and proteins that stick to the inside or outside and don't go in at all. Proteins that go in, either halfway or all the way across are called ***integral proteins***. (So all transmembrane proteins are integral proteins, but not all integrals are transmembrane.) Proteins that don't go inside at all are called ***peripheral***. "Peri" means "around or outside."
Our integral protein here looks like it has a hook attached to it. There are proteins that do function like little hooks.

One of the most interesting transmembrane proteins is ***Flippase***. Finally, a name that is easy and makes sense! Flippases can flip phospholipids from the top to the bottom, or vice versa. (The one that flips bottom to top is often called "Floppase.") Why would this be necessary? Several reasons, but the easiest to understand is that during the process of endocytosis a new circle of membrane is being formed. Imagine a vesicle as a running track. The inside lane is shorter than the outside lane. If you put balls along the lanes, you would need more balls for the outside lane because it is longer. In the same way, there will need to be more phospholipids on the outside layer of the vesicle than the inside because the outer layer is larger. As soon as endocytosis starts, Flippase begins flipping phospholipids over, to prepare for this new geometry. Brilliant!

There are many ***receptors*** on the outside of plasma membranes. Receptors receive messages in the form of special molecules. Each receptors has a unique shape so only one kind of message molecule will fit. If a message comes along and snaps into place, then chemical changes will take place inside the cell.

Some proteins have sugar chains attached to them. Because they have sugars as part of their structure, they are called ***glycoproteins***. "Glyco" is Greek for "sugar." Cells use glucose molecules for more than just energy. Short strings of sugars are used as tags or labels. These chains are called ***oligosaccharides***. "Oligo" is Greek for "few," and "sacchar" is Latin for "sugar." (The English word "sugar" came from the Latin "sacchar.") Oligosaccharides are used inside the cell, also, often as "mailing labels" directing where things such as vesicles should be taken. The arrangement of the sugar molecules contains information.

Every cell the body has an "ID tag" called ***MHC1***. We will meet this molecule again when we study the immune system. In those lessons you'll learn all about MHC1. For now, you just need to know it exists and that its job is to label that cell as belonging to the body. When roving immune cells come to inspect, they will look for that tag.

Transmembrane proteins have a middle section that is hydrophobic. This is how they stay in the membrane. In our drawing, the protein's hydrophobic region looks like a spring.

Some floating proteins must work together to do a job. If they drifted apart in the fluid mosaic, they would not be able to work together, so they need to be kept near each other. This is accomplished by a ***lipid raft***. The raft is an area with extra cholesterol and other fatty molecules. The lipids stick everything in that area together, so the proteins can't float away. The raft can drift around, but the proteins will all stay put inside the raft. Lipid rafts are especially important in nerve cells and in immune system cells.