TEACHER'S NOTES LESSON 6

After finishing the warm-up, continue with these **key points** as your lecture/discussion. Make sure that as you are speaking, students are taking notes.

Now that the students know how molecules like to form structures such as the **membrane**, they need to learn how molecules like to move in space. For instance, how do molecules like to move in relation to concentration? The warm-up exercise was an example of **diffusion**: the net movement of like molecules down a concentration gradient, i.e. the molecules move from the area where they are the most concentrated to the least concentrated. The steeper the gradient the faster diffusion occurs.

For those who like gross examples talk about someone farting and how the smell is strongest near the one who farted and then the smell passes farther and farther away from the person until all near him/her smell it. So, the smellier the fart, the faster it moves away from the farter. You can also have another demonstration. Have a bowl of water on a desk or table. Ask the students what will happen when you add a drop of dye to the water. After they have given their answers add the drop of water and have the students watch what happens. Were they correct?

Osmosis is another example of how molecules (this time water) like to move in space. Osmosis is the movement of water from an area of high water concentration (low solute concentration) to an area of low water concentration (high solute concentration), i.e. water moves from the area with lots of water to the area with little water, or, from an area with few solutes to lots of solutes. It moves in this way because it wants to form a state of equilibrium, an equal quantity of water in both places.

Introduce **iso**, **hypo**, and **hyper** in relation to isotonic, hypertonic and hypotonic. Another demonstration can be done, or, if you have enough materials, this can be done as an experiment. If done as a demonstration, have three bags (made out of a membrane that water can cross but sucrose cannot or very thin sandwich bags) filled with 2M sucrose solution. The first bag will be put in a beaker filled with distilled water, the second in 10M sucrose solution, and the last in 2M sucrose solution. Before you put the bags into the different solutions have the students predict what will happen. Are they correct? Why did they give the answers they did? Explain what is really happening. Draw images on the board to help clarify how the movement of water is occurring.

Now that the students have learned about the movement of molecules and water in space, i.e. down a concentration gradient, have them think about the movement of molecules from one side of a membrane to another. How does movement of molecules through the membrane occur? In essence it is down a concentration gradient just like the movement of molecules in space. There is one exception and it will be explained in a moment.

Explain that **channel proteins** are like continually **open doors**. The molecule passes from the side where there is a high concentration of molecules to the side with a lower concentration of the same kind of molecule, i.e. down the concentration gradient. The direction can change depending on which side has more molecules.

Some **carrier proteins** are like **revolving doors**. You enter and get moved to the other side as the door revolves. The carrier protein changes shape after the molecule enters and binds, thereby transferring it to the other side. It also moves down its concentration gradient. This type is used for passive transport. Some carrier proteins are like doors that need a special key or password to open. Once you have the key, the door opens and transfers the molecule. In this case, the key is ATP or energy. This type of carrier protein—when a molecule wants to go against a concentration gradient, i.e. from low concentration to high—is called active transport. Active transport always requires the input of energy so there is a price to pay for going in the opposite direction.

Exocytosis and **endocytosis**: Ask how a cell moves very big molecules (ones that don't fit through the pores of channels) from one side of the membrane to the other. Explain that there are two processes:

- endocytosis (movement from the outside of a cell to the inside)
- exocytosis (movement from the inside of the cell to the outside).

In exocytosis a vesicle moves to the surface, fuses and then releases its contents outside of the cell. In endocytosis, substances near the surface of the membrane collect in an indentation that eventually gets bigger and pinches off on the inside of the cell. This can happen three ways: receptor-mediated where a receptor collects the molecules that will enter the cell; bulk-phase where the vesicle will collect all the molecules near the indentation; and phagocytosis where a cell engulfs (or eats) another organism or particle.