Name _____ Class _____ Date _____

Passive and Active Transport

When one area has more of a substance than another, that area has a *high concentration* of the substance. When an area has less of a substance than another, it has a *low concentration* of the substance. A *concentration gradient* is the difference between concentrations. Very often the cell membrane is the boundary between areas of different concentrations. Some materials cross the cell membrane by diffusion.

In diffusion, substances in an area of higher concentration move to an area of lower concentration. This occurs until the amount of the substances on each side of the membrane is equal. This equal distribution of substances is called *equilibrium.*

Diffusion is a form of passive transport. It does not require cells to use energy to move materials. Active transport requires a cell to use energy to move materials. In this process, materials are often moved *against* a concentration gradient—from areas of lower concentration to areas of higher concentration.

Active transport is not completely understood. The following model represents one possible explanation.

In Figure 1 molecules of substance A are shown on either side of a cell membrane. The concentration of A is greater inside the cell than outside.

Examine Figure 2. When substance B enters the cell, it is bound to a protein molecule. The combination of B and the protein cannot pass through the cell membrane. It is too large. Only molecules of substance B that are not bound to the protein can pass back through the cell.

Figure 1

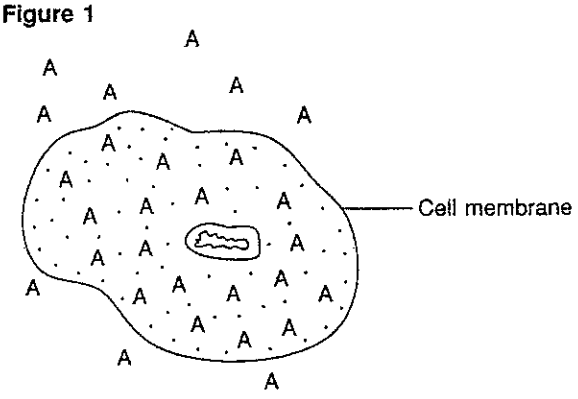
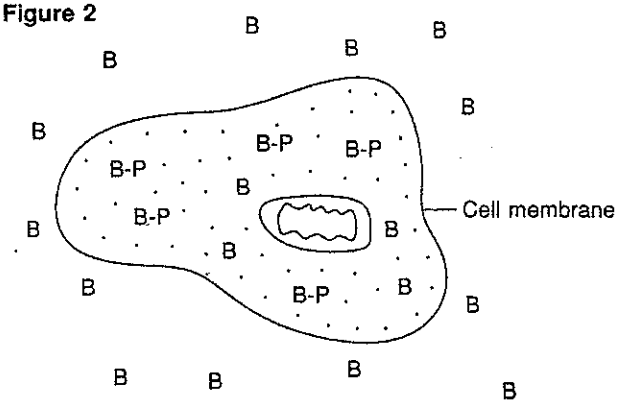


Figure 2



1. If substance A could diffuse across the membrane, what would happen to the concentration of A inside the cell and outside the cell?

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2. Compare the concentrations of unbound B inside and outside the cell.

3. If only substance B could diffuse through the cell membrane, what would happen to the unbound B outside the cell? On a separate piece of paper draw a diagram to help illustrate your answer.

Body cells use active transport to move sodium ions and potassium ions across cell membranes. Living cells pump sodium out of the cytoplasm into the area surrounding the cells. At the same time, they pump potassium from outside the cell into the cytoplasm. This system is known as the sodium-potassium pump. These ions are pumped against a concentration gradient, and the cell uses energy.

4. Add sodium and potassium ions to Figure 3 to show that active transport is at work. (Remember to show a concentration gradient by drawing more of one type of ion on one side of the membrane.)
5. Suppose that the active transport of sodium and potassium stopped. Illustrate what would happen by completing the drawing in Figure 4.

Figure 3

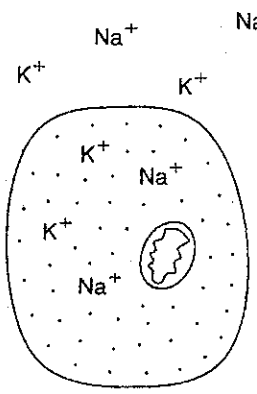
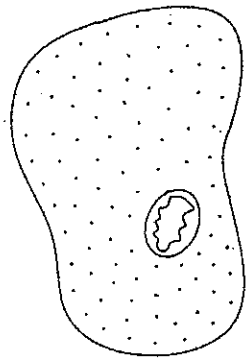


Figure 4



6. Describe what is occurring in Figures 3 and 4.

7. If a cell's capability of producing energy failed, which of the following processes might continue: osmosis, active transport, diffusion?