The Nature of Science

Under what conditions do cells gain or lose water?

A cell membrane permits some materials to pass through while keeping other materials out. Such a membrane is called a selectively permeable membrane. Under normal conditions, water constantly passes in and out of this membrane. This diffusion of water through a selectively permeable membrane is called osmosis. Like other substances, water diffuses from a region of higher concentration to a region of lower concentration. When the transfer of water molecules in and out of a cell reaches the same rate, a state of equilibrium is reached.

If the concentration of water molecules is greater outside a cell, then the solution is hypotonic to the cell. Water will move into the cell by osmosis. The pressure against the inside of the cell membrane will steadily increase. If the pressure becomes great enough, the cell membrane will burst.

A solution is isotonic to the inside of the cell when there is the same concentration of water molecules on the inside and outside of the cell membrane. To maintain equilibrium, water molecules move into and out of the cell at the same rate.

Suppose a living cell is placed in a solution that has a higher salt concentration than the cell has. Such a solution is hypertonic to the cell, because there are more salt ions and fewer water molecules per unit volume outside the cell than inside. Water will move from the region of higher water concentration (inside the cell) to the region of lower water concentration (outside the cell). The selectively permeable membrane does not allow salt ions to pass into the cell. The cell shrinks as the cell loses water.

In this Virtual Lab you will place a red blood cell, an Elodea cell, and a Paramecium in hypotonic, isotonic, and hypertonic solutions. You will examine how and why these cells gain or lose water in the different solutions.

Objectives:

* ·Describe the process of osmosis.
* ·Observe the movement of water through cell membranes during the process of osmosis.
* ·Compare and contrast three osmotic states: hypotonic, isotonic, and hypertonic.

Procedure: FIRST – prepare a data table like the one shown below….

1. Select one of the three cells pictured at the top of the screen and drag it into one of the beakers.

2. Observe the process of osmosis. Determine whether water, represented by animated blue arrows, moves into, stays in equilibrium, or moves out of the cell. Observe what happens to the shape and size of the cell.

3. Record your observations in the Table.

4. Move the cell to a different beaker or choose a different cell. Observe the process of osmosis again and record your observations in the Table.

5. Repeat this activity with all three cells and all three solutions. Write your comparisons and your observations.

6. Answer questions.

Data Table:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Type of Solution | Red Blood Cell Water movement in/out | Red Blood Cell Appearance | Elodea Water movement in/out | Elodea Appearance of Cell | Paramecium Water movement in/out | Paramecium Appearance of Cell |
| Hypotonic Solution |  |  |  |  |  |  |
| Isotonic Solution |  |  |  |  |  |  |
| Hypertonic Solution |  |  |  |  |  |  |