Department of biology

2025-2026

((Plant Physiology))

Stage (3)

((Lecture -3- ))

# Diffusion

By

Asst. Lec. Zainab Nadhum Aziz

## Diffusion

If small bottle filled with some gas or vapors is opened at a certain place in the room, very soon its molecules become evenly distributed throughout the available space in that room. Similarly, if a solute is placed in its solvent, it is dissolved and its particles move so that may be evenly distributed throughout the container. **This movement of particles or molecules from a region of higher concentration to a region of lower concentration is called as diffusion.** ***The rate of diffusion of gases is faster than liquid or solutes (solid).** The diffusing particles have a certain pressure called as the diffusion pressure which is directly proportional to the number or concentration of the diffusing particles. Therefore, the diffusion takes place always from a region of higher diffusion pressure to region of lower diffusion pressure.

**The rate of diffusion increases if:**

1- The diffusion pressure gradient is steeper.
2- The temperature is increased.
3- The density of the diffusing particles is lesser.
4- The medium through which diffusion occurs is less concentrated.

***Simple diffusion plays a very important role in the life of the plants:**

1- It is an essential step in the exchange of gases during respiration and photosynthesis.

2- During passive salt uptake, the ions are absorbed by simple process of diffusion.

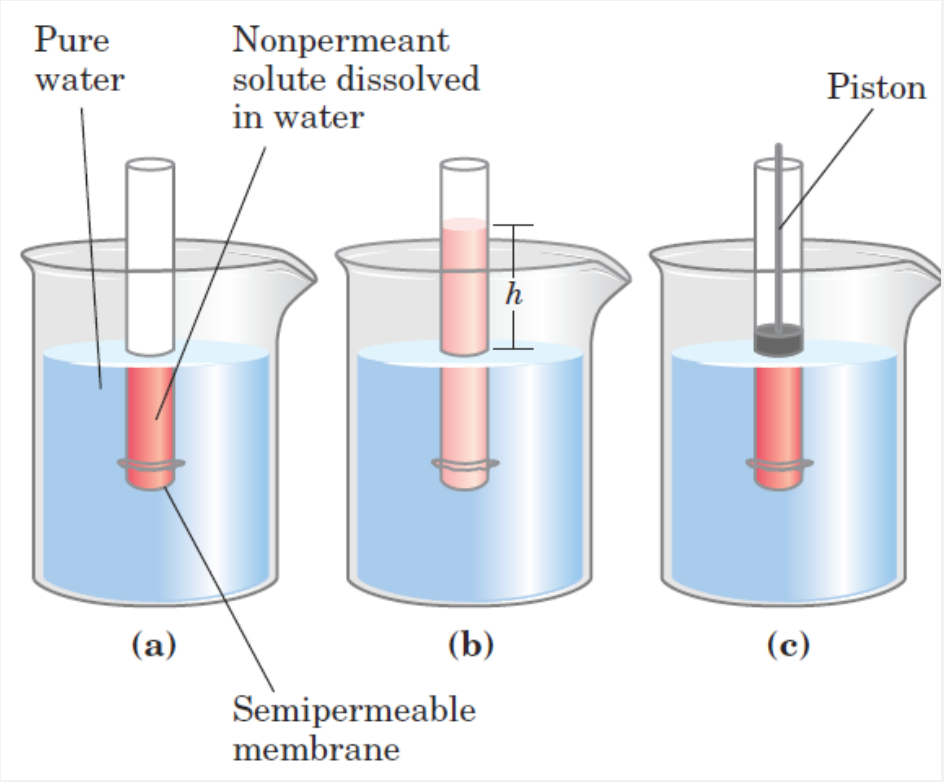
3- Last step in stomatal transpiration is the diffusion of water vapors from the intercellular spaces into the outer atmosphere through open stomata.

# Osmosis

If a solution and its pure solvent are separated by a semipermeable membrane (which allows only solvent and not the solute to pass through it) the solvent molecules diffuse into the solution. This diffusion of solvent molecules into the solution through a semipermeable membrane is called as osmosis.

In case, there are two solutions of different concentrations separated by the semipermeable membrane; the diffusion of solvent will take place from the less concentrated solution into the more concentrated solution till both the solutions attain equal concentration.

**The phenomenon of osmosis can be demonstrated by the following simple experiment:**



## Osmotic pressure

As a result of the separation of solution from its solvent or the two solutions by the semipermeable membrane, a pressure is developed in solution due to the presence of dissolved solutes in it; this is called as osmotic pressure (O.P).

*Osmotic pressure is measured in terms of atmospheres.

*Osmotic pressure is directly proportional to the concentration of dissolved solutes in the solution. More concentration, solution has higher osmotic pressure.

*Osmotic pressure does not increase by the addition of insoluble solute in the solution.

During osmosis the movement of solvent molecules takes place from the solution whose osmotic pressure is lower (less concentrated or hypotonic) into the solution whose osmotic pressure is higher (more concentrated or hypertonic).

Osmotic diffusion of solvent molecules will not take place if the two solutions separated by the semipermeable membrane are of equal concentrations having equal osmotic pressure (they are isotonic).

Plant cells as Osmotic systems: Living cells in plants form osmotic systems due to the presence of semi-permeable plasma membrane and the cell sap having a certain osmotic pressure.

Plasma membrane actually is not truly semi-permeable as it allows certain solutes to pass through it and hence, it is known as selectively permeable or differentially permeable membrane. The tonoplast or the vacuolar membrane also possesses the same nature.

If a living plant cell is placed in water or hypotonic solution, water enters into the cell sap by osmosis. As a result of entry of the water into the cell sap, a pressure is developed which presses the protoplasm against the cell wall and the cell becomes turgid. This pressure is called as turgor pressure (T.P). Consequence of the turgor pressure is the wall pressure which is exerted by the elastic cell wall against the expanding protoplasm this pressure is **called as wall pressure (W.P).**

**T.P = W.P**

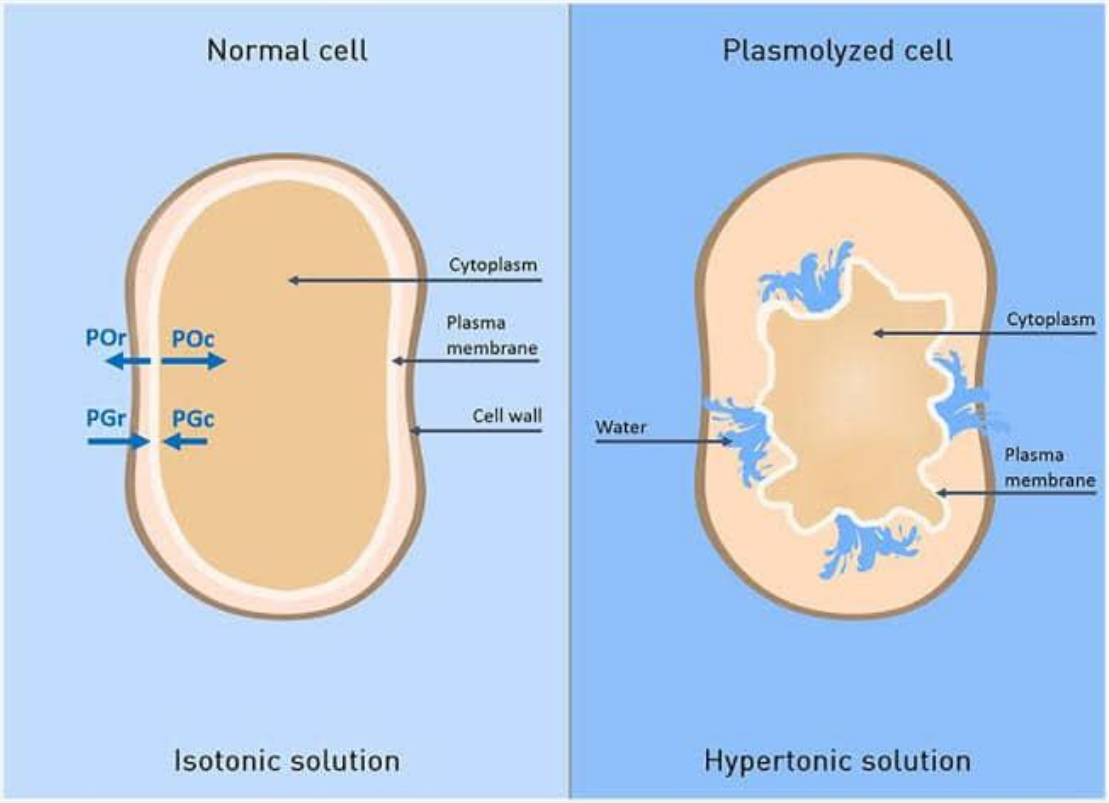
If the plant cell is placed in hypertonic solution the water comes out of the cell sap into the outer solution and the cell **becomes flaccid**.

**Significance of Osmosis in Plants**:

1- Large quantities of water are absorbed by roots from the soil by osmosis.
2- Cell to cell movement of water and other substances dissolved in it involves this process.
3- Opening and closing of stomata depend upon the turgor pressure of the guard cells.
4- Due to osmosis the turgidity of the cells and hence the shape or form of their organs is maintained.
5- The resistance of plants to drought and frost increase in osmotic pressure of their cells.
6- Turgidity of the cells of the young seedlings allows them to come out of the soil.

# Plasmolysis

In normal condition the protoplasm is tightly against the cell wall. If this plant cell is placed in a hypertonic solution, water comes out from the cell sap into the outer solution due to ex-osmosis and the protoplasm begins to contract from the cell wall. This is called as incipient plasmolysis. If the outer solution is very concentrated in comparison to the cell sap, the process of ex-osmosis and shrinkage of protoplasm and ultimately the protoplasm separates from the cell wall assumes a spherical form. This phenomenon is called as plasmolysis and the cell said to be plasmolysed.



**Advantages of plasmolysis**:

1-It indicates the semi-permeable nature of the plasma membrane.

2- This phenomenon is utilized in salting of meat and fishes and addition of concentrated sugar solution to jams and to check the growth of fungi and bacteria which become plasmolysed.

3- It is also used in determining the O.P. of the cell sap.