

**CHAPTER - 4 Absorption by Roots -
Processes involved**

This lesson is for Class 9 for the subject of Biology Topic Tonicity and its significance which is covered in Chapter 4 Absorption by roots - processes involved starting on Page No 37 of your text book titled Concise Biology - Selina Publications and is being submitted to you on 14.10.2024.

Dear students let us learn about -

TONICITY is the relative concentration of the solution that determines the direction (inward or outward) and extent of diffusion. Based on tonicity solution can be of 3 types -

ii) **ISOTONIC** solution means with same concentration - en. In isotonic solution the relative concentration of water molecules and solute on either side of the cell membrane is the same. In such a solution there is no net movement of water molecules across the cell membrane i.e. no osmosis can take place because the concentration is same on either side of cell membrane. For eg. if a cell is kept in isotonic solution (i.e. in a solution whose concentration is exactly same as that of cell sap/cytoplasm then no osmosis will occur across the cell membrane and the cell size & shape remains unchanged. See Fig 4.8 A Page 43 of text book.

ii) **HYPOTONIC** solution has lower concentration. In hypotonic condition, the solution outside the cell has a lower solute concentration as compared to the solution (fluid) inside the cells. So the water molecules

move into the cell from outside. For eg. distilled water is hypotonic to animal cell. The animal cell placed in distilled water enlarges and sometimes bursts due to endosmosis. Plant cell has cell wall surrounding the cell membrane which resists bulging and protects the delicate cellular parts inside and further prevents the bursting of plant cell while making it enlarged, stretched out and fully distended. See Fig 4.8 C on Page 43 of your text books.

HYPERTONIC solution has higher concentration.

In hypertonic solution, the solution outside the cell has higher solute concentration as compared to fluids inside the cell so the water molecules from the interior of the cell move out due to exosmosis.

For eg - Sea water is hypertonic to animal cell. Animal cell when placed in sea water shrinks in size and loses its shape.

Plant cell when placed in hypertonic solution undergoes plasmolysis. In plant cell the cell wall does not change its shape due to its rigidity. However the cell membrane along with the cytoplasm/cell sap shrinks.

In the process the cell membrane detaches from the cell wall. [Details of plasmolysis we will discuss further in the chapter.]

See Fig 4.8 B on Page 43 of your text books.

PASSIVE TRANSPORT is simple diffusion i.e. free movement of molecules from region of their higher concentration to the region of their lower concentration [when areas are in direct contact]

ACTIVE TRANSPORT is the movement of substances (salt/ion) from region of their lower to higher concentration through a living cell membrane using metabolic energy from the cell. Thus active transport differs from passive transport in 2 ways -

a) Active transport requires energy input from the cell. Passive transport does not require any energy.

b) In active transport substances move from their lower to higher concentrations while in passive transport substances move from their higher to lower concentrations.

SIGNIFICANCE OF ACTIVE TRANSPORT -

Certain nutrients like - nitrate, sulphate, potassium, Zinc etc cannot pass through the cell membrane of the root cells easily. This is because their concentration is higher inside the cytoplasm of the root cells than the water outside the root cells. So to obtain these ions/nutrients these ions are forcibly carried inward from the region of their lower concentration to the region of their higher concentration [i.e. inside the cells] by using energy supplied by root cells in the form of ATPs.

Students before going further let us take a short break and recapitulate what we have learnt so far through this small test.

Answer the following questions during the break -

Q.1 Fill in the blanks -

a) Endosmosis occurs when a cell is placed in _____ solution.

Qb. _____ solution has same concentration of water molecules and solute on either side of cell membrane

c) _____ Transport requires the input of energy in the form of ATPs.

You may now pause the lesson for 3 min break. Break is over children.

Listen to the correct answers

a) Hypotonic solution

b) Isotonic solution

c) Active Transport

Now let us resume the topic with the discussion of - **TURGIDITY and FLACCIDITY**

→ When a cell is kept in water it absorbs water through endosmosis and finally reaches such a state that it cannot accommodate any more water. In such a state the cell is fully stretched and distended, it is called turgid and condition is called turgidity.

→ When a cell is turgid, its walls is stretched under pressure from inside, and in turn, it presses the cell contents towards the centre of the cell.

The pressure of cell contents on the cell wall is called turgor pressure.

The pressure exerted by the cell wall on the cell content is called wall pressure.

If at times the turgor pressure exceeds wall pressure, the cell wall ruptures and cell contents burst out.

In turgid state cell is in balanced state where turgor pressure counter balance the wall pressure and no more water is entering or leaving the cell.

PLASMOLYSIS and FLACCIDITY

When a living plant cell is kept in some hypertonic condition [like 5% salt solution], the plant cell loses water by exosmosis and turgor pressure is lost. It will lose its distended appearance.

The cytoplasm shrinks and plasma membrane [which in normal plant cell remains in close contact with the cell wall] withdraws from the cell wall.

The shrinkage of protoplasm of the cell and leading to withdrawal of cell membrane from cell wall, when a plant cell is kept in hypertonic solution is called plasmolysis. The cell in this state is said to be limp or flaccid and condition is called flaccidity.

When a plasmolysed (flaccid) plant cell is kept in water (hypotonic solution) before it is dead, its protoplasm again swells up pressing tight against the cell wall. The recovery or reversal of plasmolysis is called deplasmolysis.

Let us define these terms again -

TURGIDITY is the state of the cell in which cell wall is rigid and fully stretched/distended due to absorption of water by endosmosis when the cell is kept in hypotonic solution [Absorbed water increases the volume of vacuoles]

PLASMOLYSIS is contraction/shrinkage of protoplasm of the cell, leading to withdrawal of cell wall from cell membrane, when a plant cell undergoes exosmosis when kept in hypertonic solution.

FLACCIDITY is the shrunken state of the cell when kept in hypertonic solution leading to exosmosis occurring from the cell.

Dear students, with this I am ending today's discussion. Kindly go through the detailed explanation given in the notes and with reference to this detailed discussion you are required to answer the following home assignment questions in your notebooks -

HOME ASSIGNMENT -

Q1 Learn and write Table 4.1 giving Differences between Diffusion, Osmosis and Active Transport [given on Page 44 of your textbook]

Q2. Draw well labelled diagrams to show the fate of an animal cell and a plant cell when kept in -
a) Isotonic solution
b) Hypotonic solution
c) Hypertonic solution

Q3. Answer the following Review question given at the back exercises of the chapter

Q E structured / Application Type
Q No 1