

Chapter 1: Transport of Food and Minerals in Plants

Plants need water, minerals, and food for growth and survival. These substances are transported through specialized tissues using different processes.

1. Diffusion

- **Definition:** Movement of molecules from an area of higher concentration to an area of lower concentration.
 - **Example:** Exchange of gases (O_2 and CO_2) in leaves during photosynthesis and respiration.
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2. Osmosis

- **Definition:** Movement of water molecules from a region of higher water concentration to a region of lower water concentration through a **semipermeable membrane**.
 - **Example:** Absorption of water by plant roots.
 - **Semipermeable Membrane:** A membrane that allows only specific molecules (like water) to pass through.
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Concept of Endosmosis & Exosmosis

1. **Endosmosis:**
 - Water moves **into the cell** when placed in a **hypotonic solution** (more water outside than inside).
 - This causes the **protoplasm to swell**, leading to **turgidity**.
 - Example: **Plant cell in pure water absorbs water and becomes swollen (turgid).**
 2. **Exosmosis:**
 - Water moves **out of the cell** when placed in a **hypertonic solution** (less water outside than inside).
 - This causes the **protoplasm to shrink**, leading to **plasmolysis**.
 - Example: **Plant cell in salty water loses water and shrinks (plasmolyzed).**
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Effects on Protoplasm Size

Condition	Water Movement	Effect on Protoplasm	Cell Condition
Turgidity	Water enters (Endosmosis)	Protoplasm swells	Cell becomes swollen & firm
Plasmolysis	Water leaves (Exosmosis)	Protoplasm shrinks	Cell becomes shrunken & weak

3. Root Pressure & Active Transport

- **Root Pressure:** The upward force that pushes water into the xylem due to continuous water absorption by roots.
- **Active Transport:** The movement of minerals into root cells against the concentration gradient using energy (ATP).

4. Transpiration

- **Definition:** Loss of water vapor from the aerial parts of a plant, mainly through leaves.
- **Importance:**
 - ✓ Cools the plant
 - ✓ Helps in water and nutrient transport
 - ✓ Maintains water balance
- **Factors Affecting Transpiration:**
 - Temperature (higher temperature = more transpiration)
 - Humidity (higher humidity = less transpiration)
 - Wind (more wind = more transpiration)
 - Light intensity (more light = more transpiration)

5. Structure and Function of Xylem and Phloem

Tissue	Function	Structure
Xylem	Transports water & minerals from roots to leaves	Long, hollow tubes made of dead cells
Phloem	Transports food (sugar) from leaves to all parts of the plant	Made of living cells with sieve tubes

6. Importance of Minerals in Plants

Plants need minerals for healthy growth. They are classified into:

- **Macronutrients (needed in large amounts):** Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), Sulfur (S).
- **Micronutrients (needed in small amounts):** Iron (Fe), Zinc (Zn), Copper (Cu), Manganese (Mn), Boron (B), Molybdenum (Mo).

Deficiency Diseases in Plants

1. **Nitrogen Deficiency:** Stunted growth, yellow leaves.
2. **Phosphorus Deficiency:** Poor root growth, purple leaves.
3. **Potassium Deficiency:** Weak stems, brown leaf edges.

Conclusion

The transport of food and minerals in plants is essential for their survival. Water and minerals move through **xylem**, while food moves through **phloem**. Processes like **diffusion, osmosis, transpiration, and active transport** play a vital role in plant nutrition. Proper mineral supply ensures healthy plant growth! 🌱💧