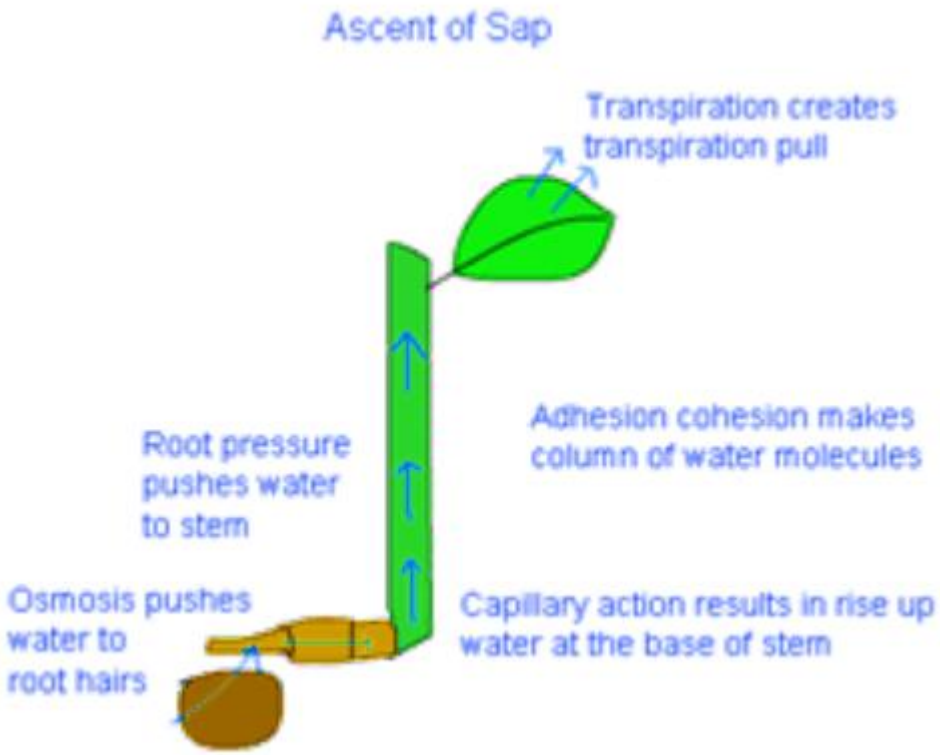
Life Processes

Ascent of Sap & Transportation of Food Material

❖ **Ascent of Sap**



Root Pressure: The walls of cells of root hairs are very thin. Water, from soil, enters the root hairs because of osmosis. Root pressure is responsible for movement of water up to the base of the stem. A large number of root hairs, at the root tip, increases the surface area so that a greater amount of water can be absorbed. But root pressure can help in rise of water only up to a few centimeters. So, root pressure alone cannot explain the rise of water in tall plants.

Capillary Action: A very fine tube is called capillary. Water, or any liquid rises in the capillary because of physical forces and this phenomenon is called capillary action. In stem, water rises up to some height because of capillary action. Combined effect of root pressure and capillary action may be enough for water need of small herbs but not for trees.

Adhesion-cohesion of Water Molecules: Water molecules make a continuous column in the xylem because of forces of adhesion and cohesion among the molecules.

Cohesion: The force of attraction between molecules of same substance is called cohesion.

Adhesion: The force of attraction between molecules of different substances is called adhesion.

Water molecules stick together because of force of cohesion. Water molecules stick to a surface because of force of adhesion. Due to combined effect of adhesion and cohesion, a continuous column of water is formed inside xylem vessels. This is necessary to provide read supply of water to the topmost branches whenever there is a pull effect because of transpiration.

❖ **Transpiration Pull:** Loss of water vapour through stomata and lenticels (in plants) is called transpiration. Transpiration through stomata creates vacuum which creates a suction, called transpiration pull. The transpiration pull sucks the water column from the xylem tubes and thus water is able to rise to great heights in even the tallest plants.

Ascent of water can be summed up in a few sentences. Water from soil enters the root cells due to osmosis. When water enters the root cells, there is built up of pressure inside root. Water rises up to a few centimeters due to root pressure. Beyond that, capillary action inside xylem vessels results in rise of water up to a few centimeters higher. The effect of adhesion-cohesion of water molecules helps in building a continuous column of water inside xylem tubes. Trasnpiration pulls sucks this column of water and thus water rises to the topmost bracnhes of a tree.

❖ **Transport of Food**

Food synthesized mainly in leaves and hormones synthesized at tip of root and shoots aretransported by Phloem.

Phloem uses energy for bidirectional transfer. It comprise of

(I) **Sieve tubes**

(II) **Companion cells**

(III) **Phloem parenchyma**

(IV) **Phloem sclerenchyma**

Translocation of Food is best explained by **Munch hypothesis** Food is produce in leaves **(source)** and used by other parts like root **(sink)** .Sucrose is transferred into **sieve tube** of phloem using ATP. This increases osmotic pressure of tissue causing water to move inside phloem. In the phloem, there is a continuous input of solute from source tissues (high pressure) and a continuous efflux at the sink (Low pressure). This input and output at the two ends will **maintain a pressure differential** that will keep liquid flowing. Thus, the driving force for solute transport is a **pressure gradient between the source and sink regions.**

Difference in Xylem and Phloem:

Xylem	Phloem
Mainly transport water and minerals	Mainly translocate food
Most part is dead.	Most part is living
Flow is unidirectional (Roots to Apex)	Flow is Bidirectional (Leaves to all parts)
No energy required (Physical forceinvolved)	Energy is required