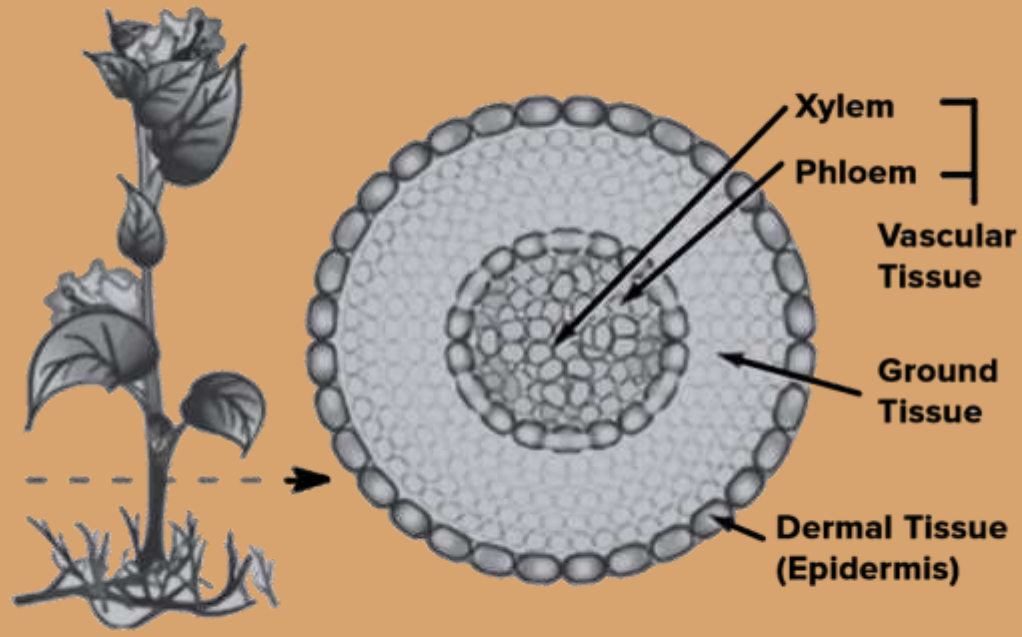
Biology L.O.9

Qena Student Club

Plant tissues

- Plant tissues are composed of cells that are similar and perform a specific function.
- Together, tissue types combine to form organs. Each organ itself is also specific for a particular function.



Types of plant tissues

I. **Meristematic** has III types which are:

I. Apical II. Lateral iii. Intercalary

ii. **Permanent** has ii types which are

i. Simple (Ground-dermal-vascular) or (Parenchyma-collenchyma- sclerenchyma)

ii. Complex (Xylem-phloem)

Meristematic

- **Plants undergo a process called Indeterminate growth (doesn't stop growing)**
- **Plants are capable of indetermine growth due to <u>meristems</u> That divide when conditions permit, leading to new cells that can elongate**

Apical Meristems

- Located at tips of roots and shoots and in axillary buds of shoots Provide additional cells that enable growth in length (Primary growth)
- Primary growth: Allows roots to extend throughout the soil and shoots to increase exposure to light

I. In herbaceous (Non-woody plants): produces all or almost all of the plant's body

II. In woody plants: also grows in circumference in the parts of stems and roots that no longer grow in length This growth in thickness is called secondary growth.

Lateral Meristems

- Called vascular cambium and cork cambium these extended along the lengths of roots and stems

I. Vascular cambium: Adds later of vascular tissue called **Secondary xylem** (wood) and **Secondary phloem**.

II. Cork cambium: Replaces the epidermis with thicker, tougher periderm.

Lateral Meristems

- The cells within meristems divides relatively frequently, generating additional cells.
- Some new cells remain in the meristem and produce more cells, while others differentiate and are incorporated into tissues and organs of the growing plant
- **Initials (Stem cells)** : cells that remain as sources of new cells
- **Derivatives** : the new cells displaced from meristem, divide until the cells they produce become specialized in mature tissues

Intercalary meristem

- Located at base of leaves or the internodes
- helps to grow twigs into branches
- Tissue filled with cytoplasm

Simple Permanent tissue

Parenchyma

- Responsible for photosynthesis (cells include large number of chloroplasts)
- Found in roots and leaves
- Food storage
- Covers wounds by growing
- Provides support
- Unspecialized cells with thin cell walls
- Cells are loosely packed which forms large spaces between cells **(intercellular spaces)**

Simple Permanent tissue

Collenchyma

- Cells are living, elongated and irregularly thickened at corners
- Intercellular spaces are present
- Present below epidermis in leaf stalks
- Provides mechanical support
- Flexibility
- Presence of Pectin

Simple Permanent tissue

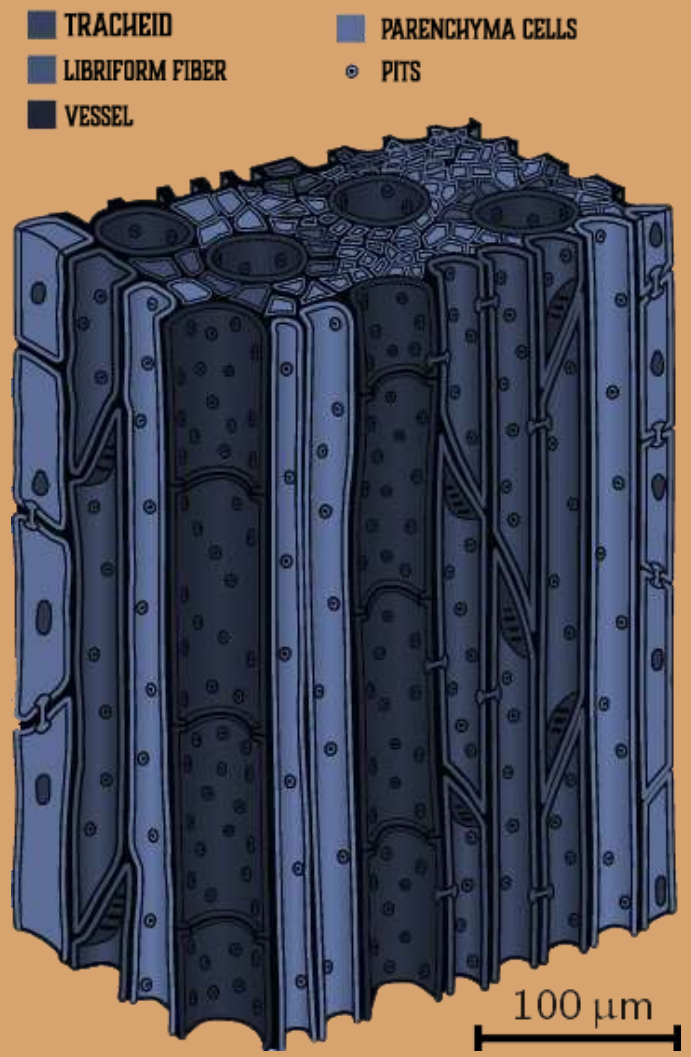
Sclerenchyma

- Cells are dead, hence the plant is **hard and stiff**
- The cells are long, narrow and thickened walls due to presence of **lignin**
- Intercellular spaces are absent in some conditions
- Provides strength
- resent in **stems, veins of leaves, covering of seeds and vascular bundles.**

Complex Permanent tissue

- **Xylem: Responsible for the conduction of minerals and water from roots to leaves**
- **Provides physical support to the plant. Consists of xylem parenchyma, vessels and tracheid cells**
- **Xylem Parenchyma: Xylem parenchyma cells, located in wood, can be positioned either lengthwise or radially. Even though these cells typically have thin and commonly lignified secondary cell walls, they perform important functions vital for the health of wood and trees.**

Xylem


TRACHEID
LIBRIFORM FIBER
VESSEL
PARENCHYMA CELLS
PITS
100 µm

Complex Permanent tissue

- **Xylem vessels: The main type of conductive cells in angiosperms is called a vessel element. These elements are usually wider in diameter than tracheids and are arranged axially, stacked one above the other, forming elongated tubes called vessels. Xylem sap is moved through interconduit pits, allowing the lateral flow of solutes between adjacent conductive elements and axial transport in tracheary elements. Pits also serve to connect conduits with nearby xylem parenchyma cells, which are non-tracheary elements.**

Complex Permanent tissue

- **Xylem Tracheids: Tracheids are small conductive elements in plants that support wood structure in conifers, lacking supporting cells, and facilitate the transport of xylem sap. They are connected through bordered pits and openings in the secondary cell wall, and both gymnosperms (conifers) and angiosperms have wood containing a significant number of tracheids.**

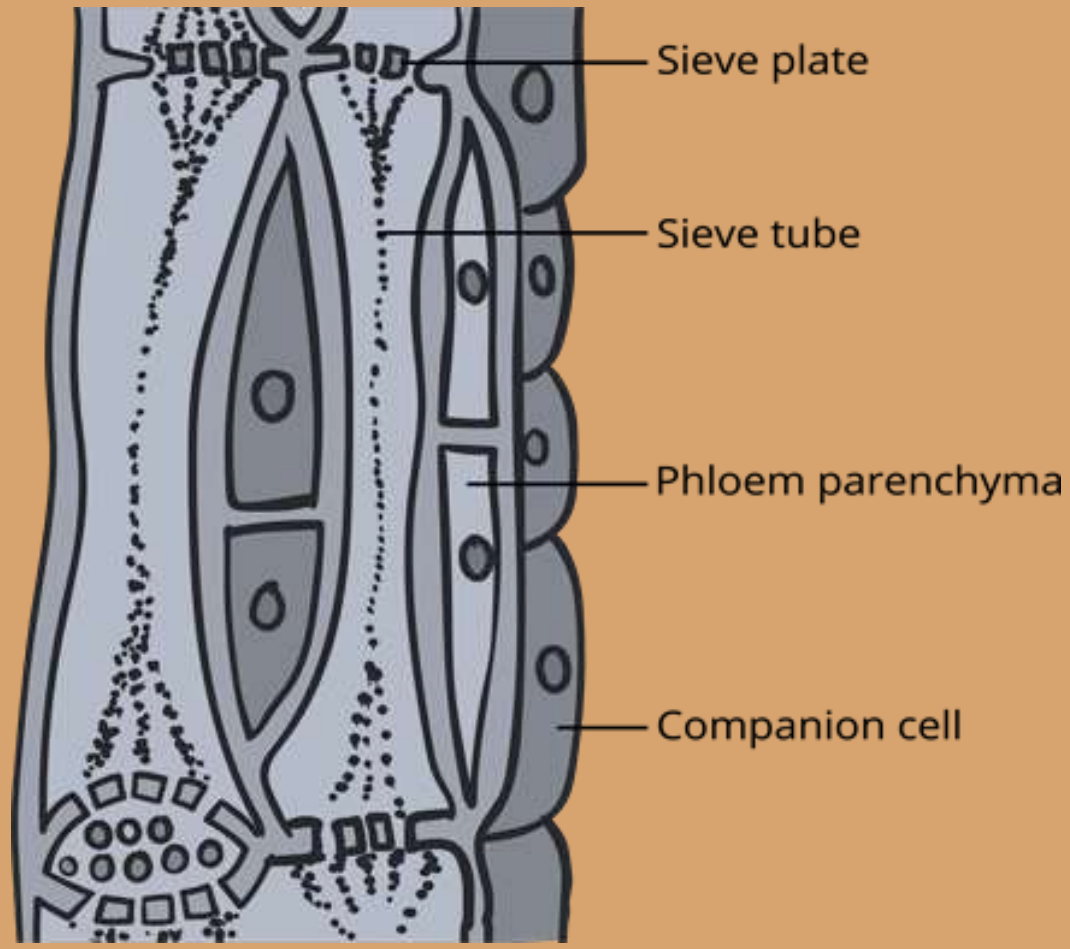
Complex Permanent tissue

- **Xylem Fiber: Xylem fibers are dead cell with a central lumen and lignified walls and provides mechanical support in water transportation**

Complex Permanent tissue

- **Phloem: Responsible for the transport of food from leaves to other parts of the plant. It consists of a sieve tube, Phloem parenchyma, and phloem fibers, also responsible for transporting the proteins and mRNA through the plant**

Phloem



Complex Permanent tissue

- **Phloem Parenchyma: The parenchyma, a group of cells in plant tissues, functions as the "filler." These cells have thin and flexible cellulose walls. The parenchyma within the phloem is responsible for storing starch, lipids, proteins, tannins, and resins in certain plants.**

Complex Permanent tissue

- **Sieve tubes: Sieve elements are a highly specialized plant cell type characterized by the absence of a nucleus and other organelles at maturity, including cytosol, ribosomes, and the Golgi apparatus. This lack of organelles maximizes space for material translocation. These elongated, narrow cells form the sieve tube structure of the phloem.**

Complex Permanent tissue

- In angiosperms, sieve elements exist as 'sieve members,' while gymnosperms have the more primitive 'sieve cells.' Both types originate from a common "mother cell." Sieve plates, which are modified plasmodesmata, are located at the junctions between sieve member cells. These plates have large, thin pores that facilitate the movement of materials between cells. Additionally, sieve plates act as a protective barrier to prevent sap loss when the phloem is damaged by insects or herbivores.

Complex Permanent tissue

- Gymnosperms exhibit a more primitive form of sieve elements compared to angiosperms. Instead of sieve plates, they have numerous pores at the tapering end of the cell walls, allowing material to pass through freely.

Complex Permanent tissue

- **Phloem Sclerenchyma: Sclerenchyma Tous cells are found in phloem fibres. The phloem, which gives the plant stiffness and strength, is mainly supported by the sclerenchyma. Both fibers and sclereids, two types of sclerenchyma, have a strong secondary cell wall and are often dead when they reach maturity.**
- **The bast fibers are thin, elongated cells with thick cellulose, hemicellulose, and lignin walls and a limited lumen (inner cavity) that support the tension strength while allowing the phloem to be flexible.**

Complex Permanent tissue

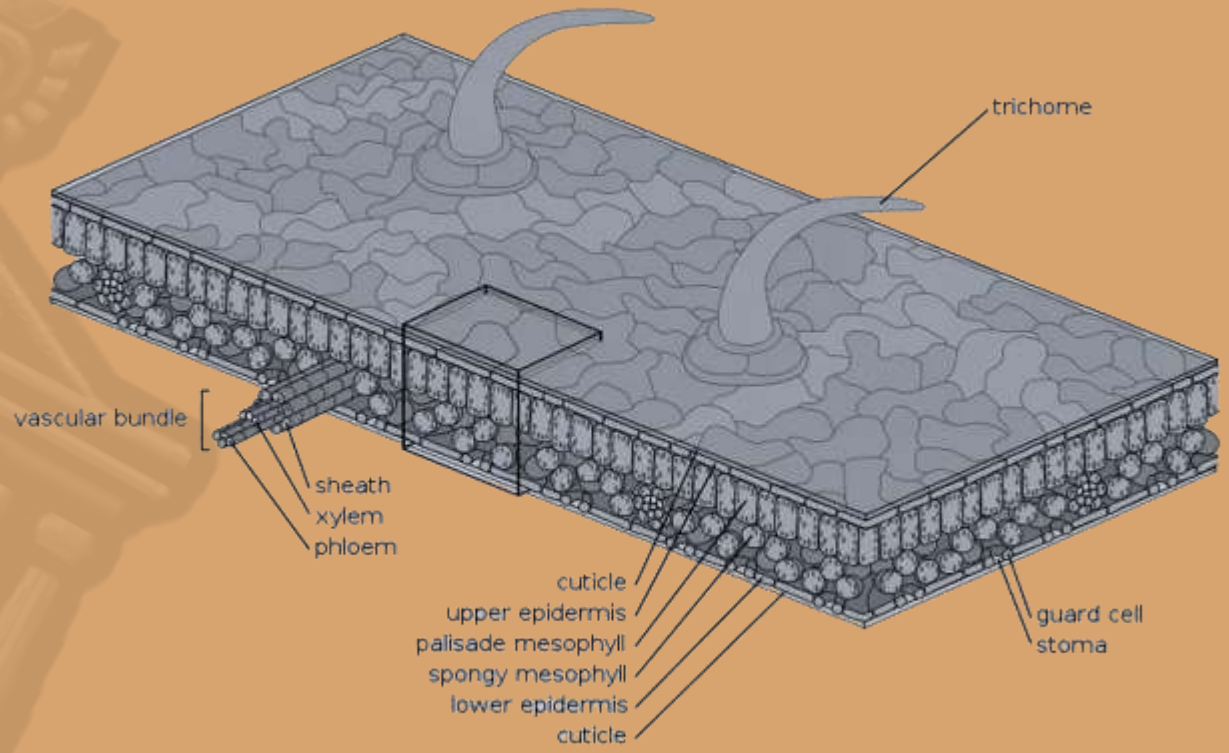
- **Dermal Tissue: The outer layer of tissue that surrounds the primary body of vascular plants**

I. **Post modern: In the embryo which will become dermal tissue**

II. **Epidermis: Dermal tissue in young plants**

III. **Periderm: Dermal tissue in older plants**

Dermal tissue



Complex Permanent tissue

- **The dermal tissue contains 3 layers:**

I. **Cuticle: Controls water which goes in or out the plant**

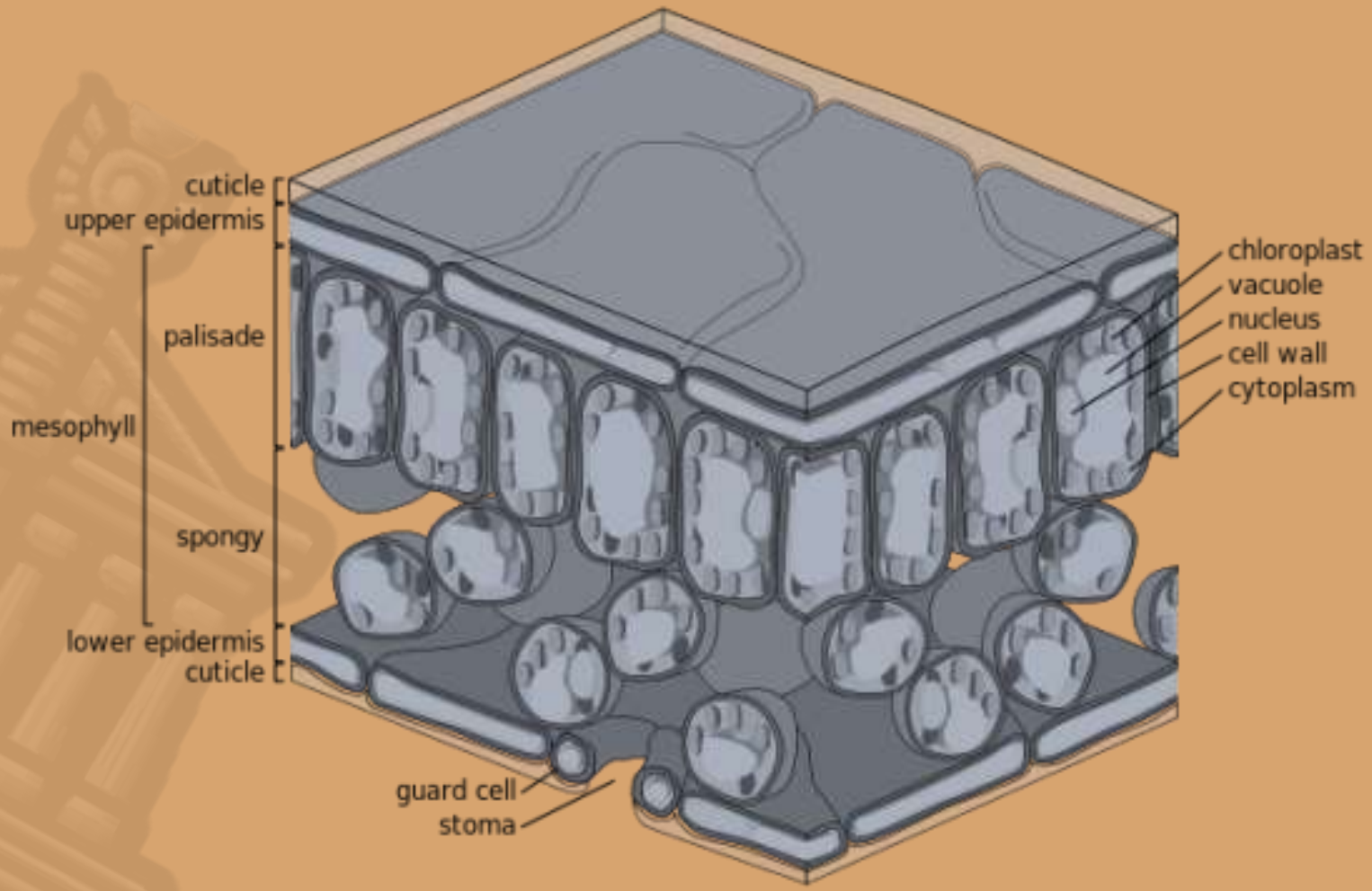
II. **Cuticle and cellulose**

III. **Cellulose**

Complex Permanent tissue

- **Ground Tissue: Responsible for photosynthesis and metabolic process, It’s between Vascular and dermal tissues.**
- **Pith: Internal vascular tube tissue**
- **Cortex: External vascular tube tissue**

Ground tissue



Capillary Theory

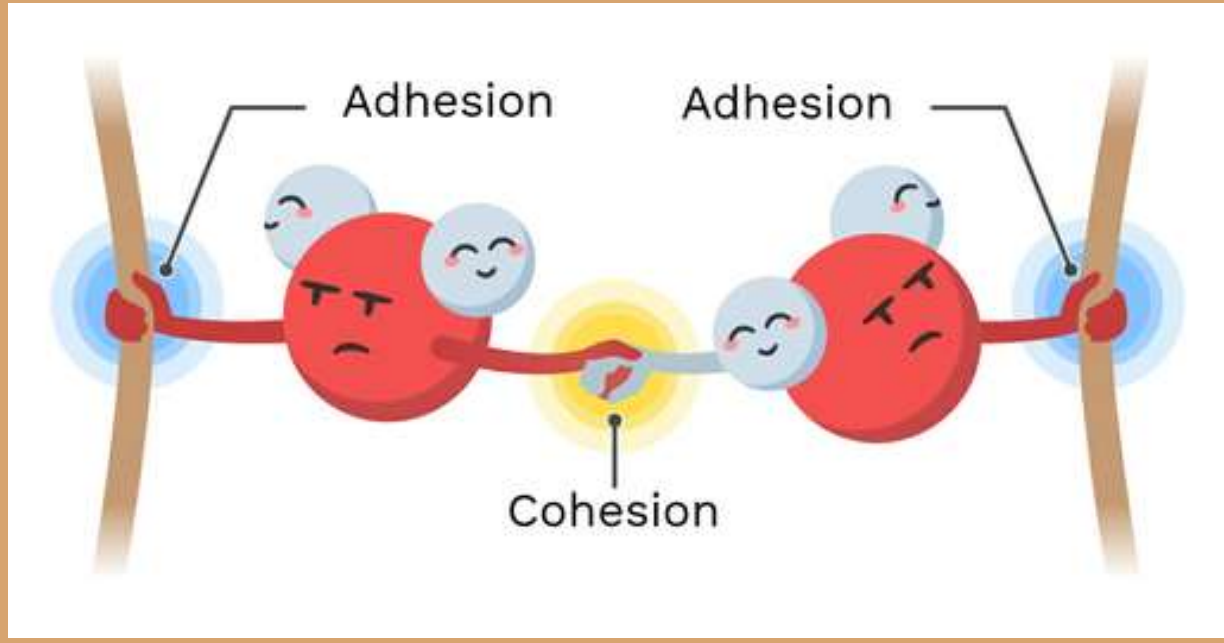
- Water rises by the capillary phenomenon in the capillary tubes , such as the xylem vessels whose diameter ranges from 0.2mm to 0.5mm.
- It is tendency for water molecules to rise through adhesion and cohesion against gravity into small spaces such as those between soil particles, or the xylem vessels of plants
- Capillarity phenomenon is considered a weak secondary force for the ascent of sap as the finest capillary tube does not allow the rise of water more than a height of 150cm.

A Cohesion-Adhesion-Transpiration pull

The scientists : H.H Dixon and J.Joly in 1895
Proved that "water is pulled by the leaf, due to the consumption of water in the metabolite processes, transpiration and evaporation in leaves

These forces are the main forces that work pulling water in the stem for a very high distances which reach about 100 m.

Transpiration is the evaporation of water from plants occurring
At the leaves while their stomata are open for the passage of CO2 and O2 during photosynthesis
The transpiration pull that is originated from the transpiration in leaf will not only pull up water from the vascular cylinder of root,but it
Will also help in the lateral pull of water from the root hairs



The water in the sap upon by the following:

The force	Evidence of its presence	The conditions needed for water to have a high pulling force in xylem vessels
Cohesion force between the water molecules in the xylem	Presence of continuous column of water in the xylem	Tubes must be free of any gasses or air bubbles that could break the cohesion attraction and cause water column to fall
Adhesion between water molecules and xylem walls	Water is held always on the xylem wall from inside against gravity	-walls of the xylem must be colloids to have attractive force for the water
Transpiration pull originated from continuous transpiration in the leaves	The presence of continuous attraction of the water column upward toward the leave	-tubes must be capillary

When some seedlings are transplanted from a nursery to an open soil, they fail to grow, if the remain
Exposed to the sun for long time, because of the entry of gases or formation or air bubbles inside the
Conducting tubes (xylem vessels and tracheid)=process called cavitation causing the break of cohesion
Of water column molecules inside these tubes, preventing the arrival of sap and finally the seedlings wilt and die