TRANSPORTATION IN PLANTS

Presented by-
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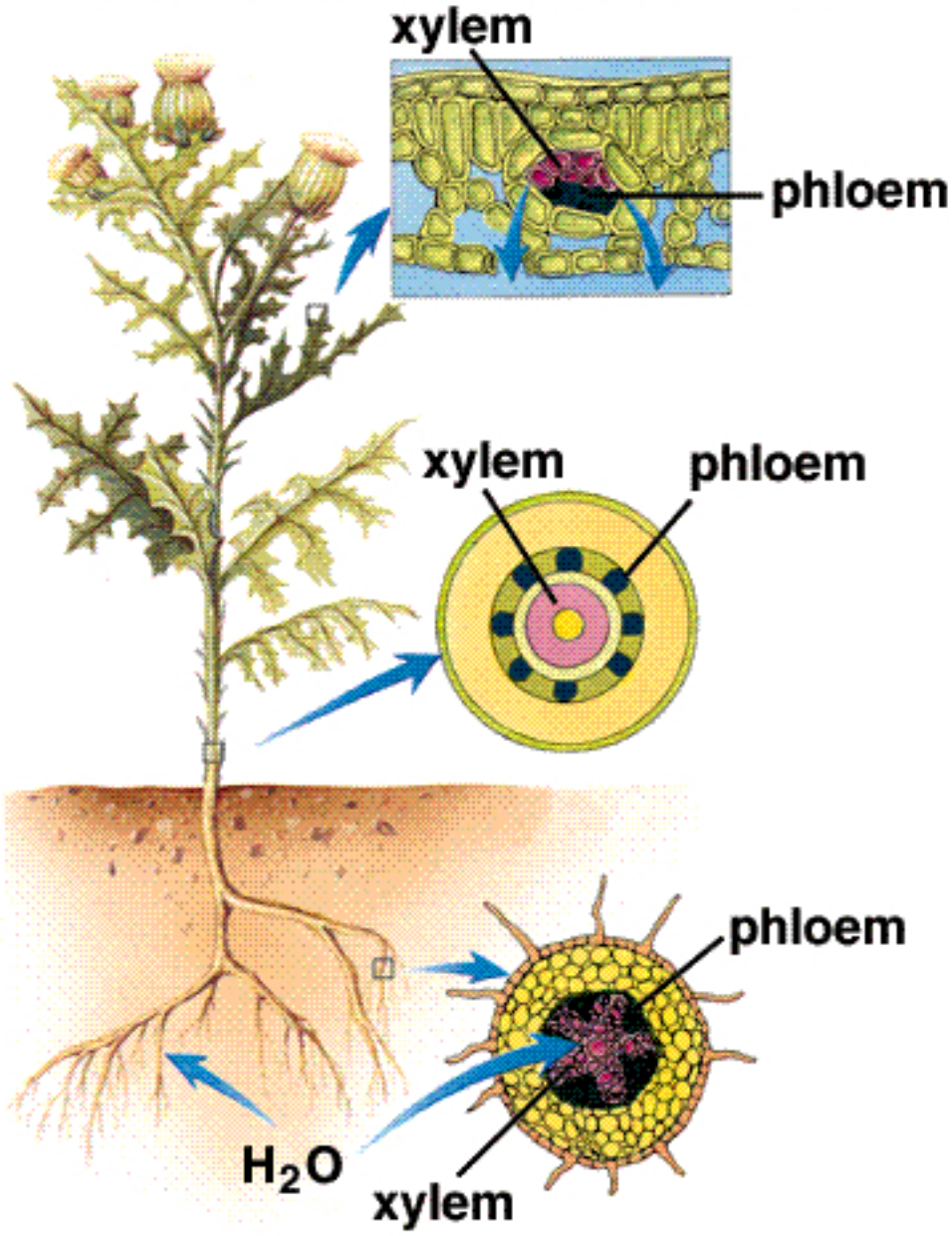
Complex Permanent Tissue

- **Complex tissues are made of more than one type of cells. All these cells coordinate to perform a common function.** **Xylem** and **phloem** are examples of such complex tissues.

- They are both **conducting tissues** and constitute a **vascular bundle**. Vascular or conductive tissue is a distinctive feature of the complex plants, one that has made possible their survival in the terrestrial environment.

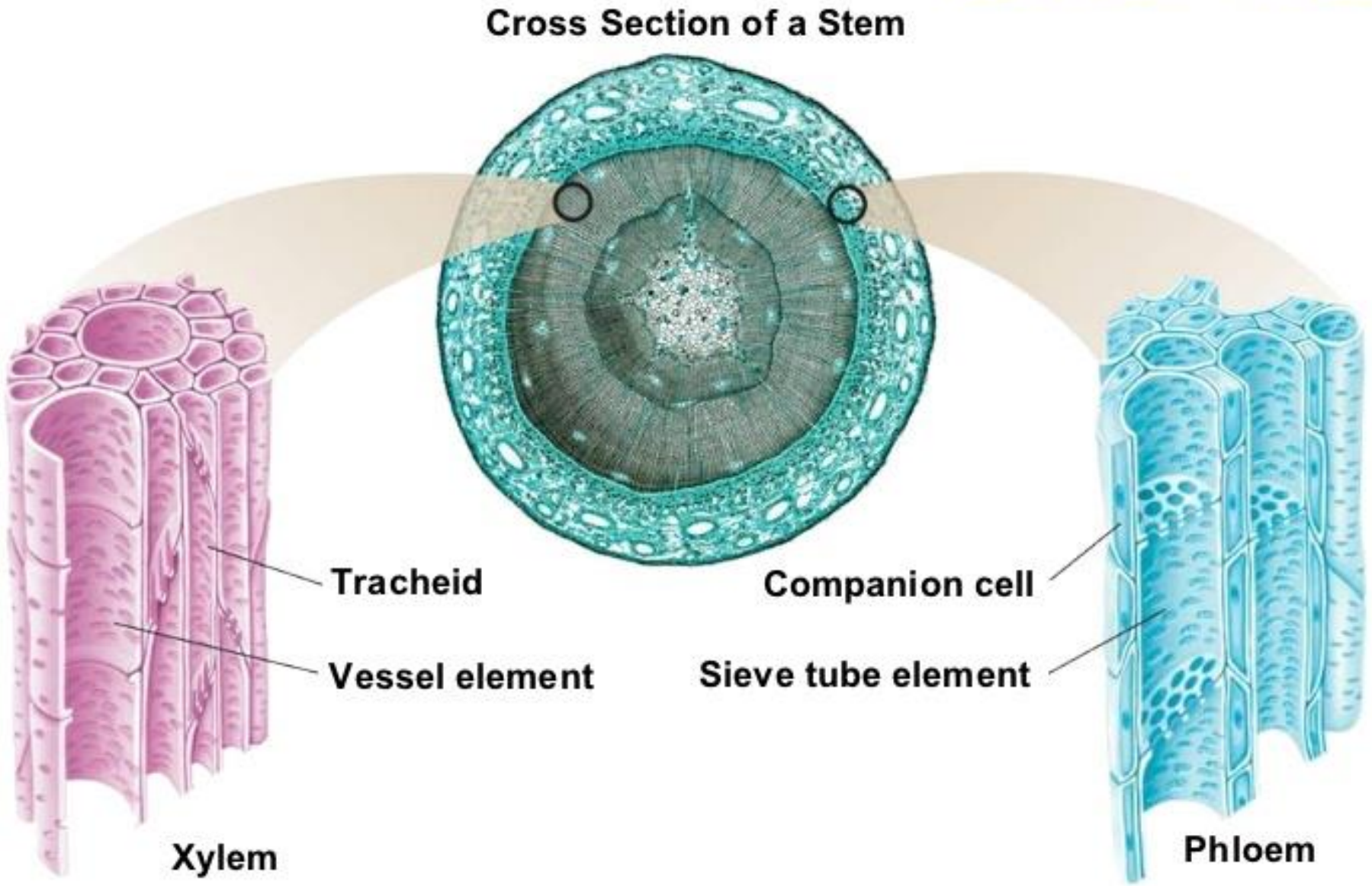
Plant Transport System



Key:

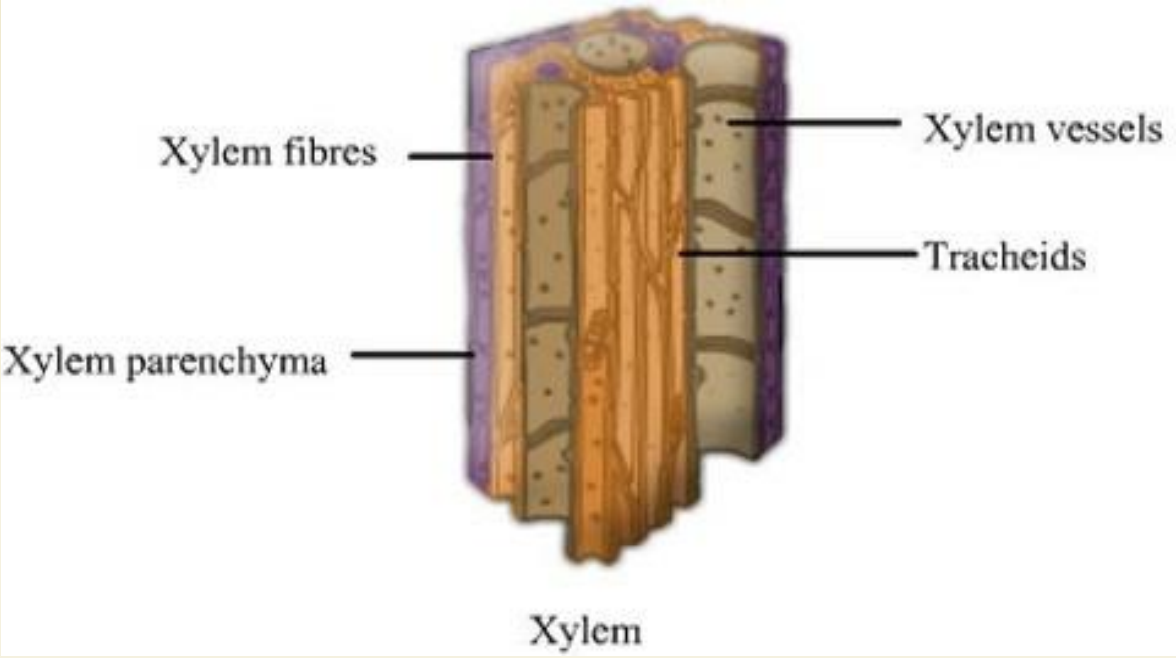
- phloem
- xylem

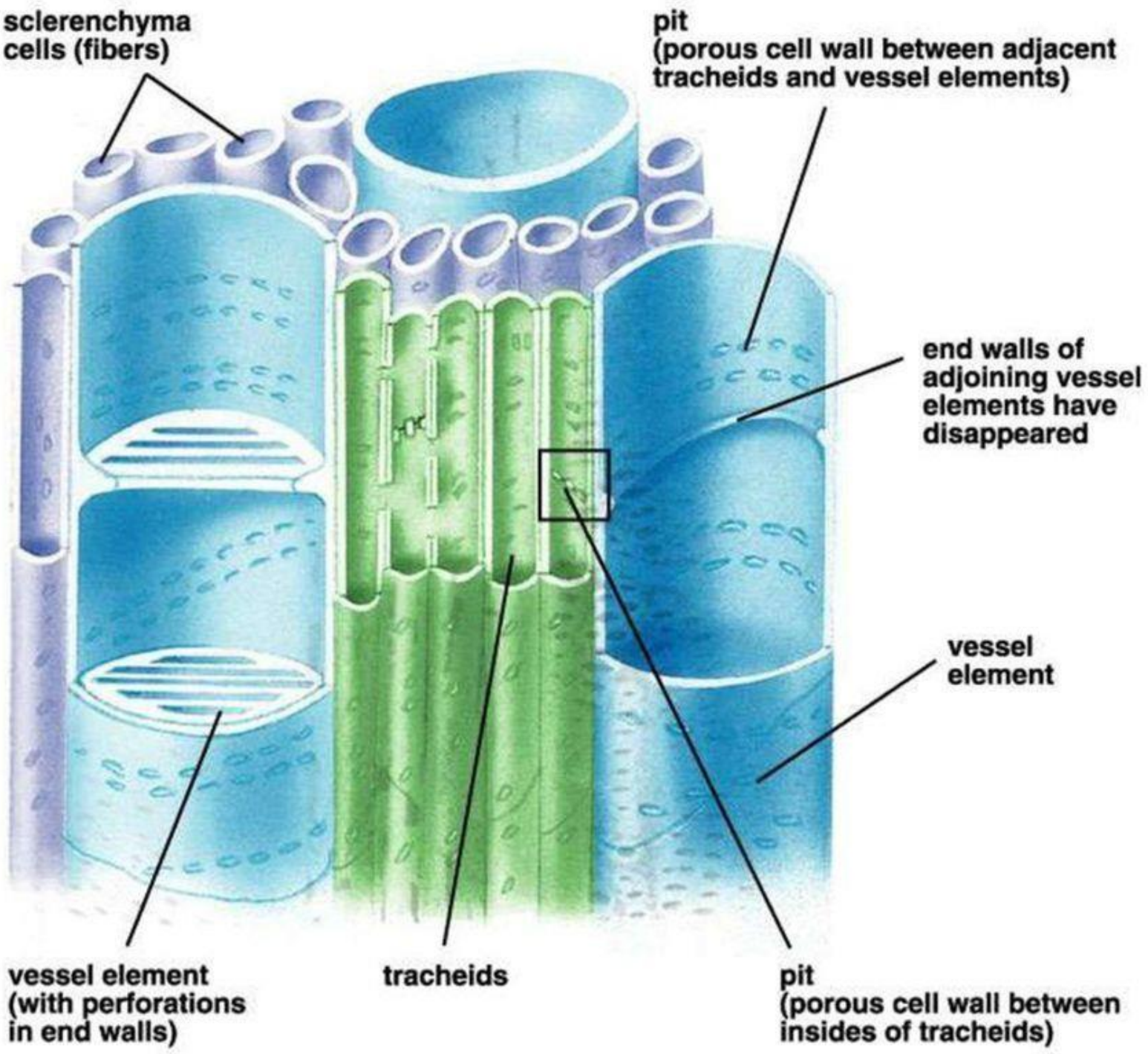
Vascular Tissue



Components of Xylem

- Tracheids
- Vessel
- Xylem parenchyma
- Xylem fibre




sclerenchyma cells (fibers)
pit (porous cell wall between adjacent tracheids and vessel elements)
end walls of adjoining vessel elements have disappeared
vessel element
vessel element (with perforations in end walls)
tracheids
pit (porous cell wall between insides of tracheids)

Components of Phloem

- Sieve Tube
- Companion Cell
- Phloem Parenchyma
- Phloem fibre

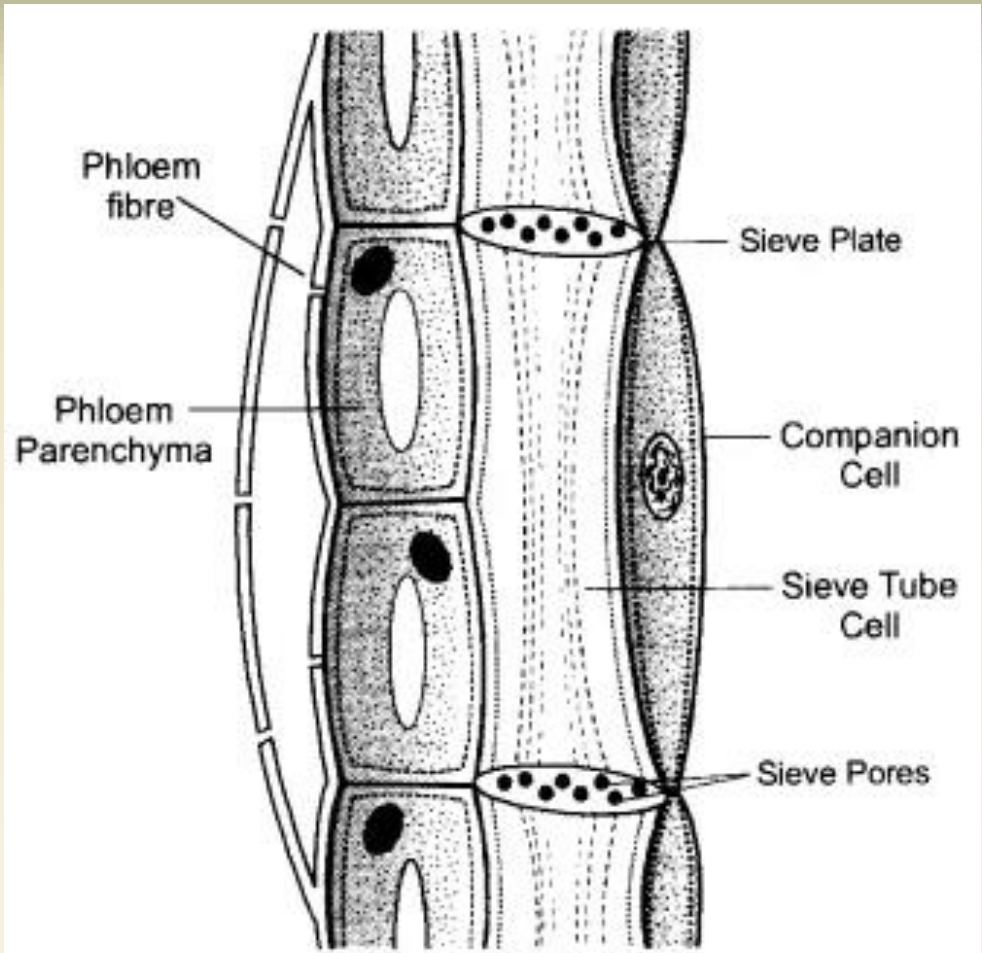
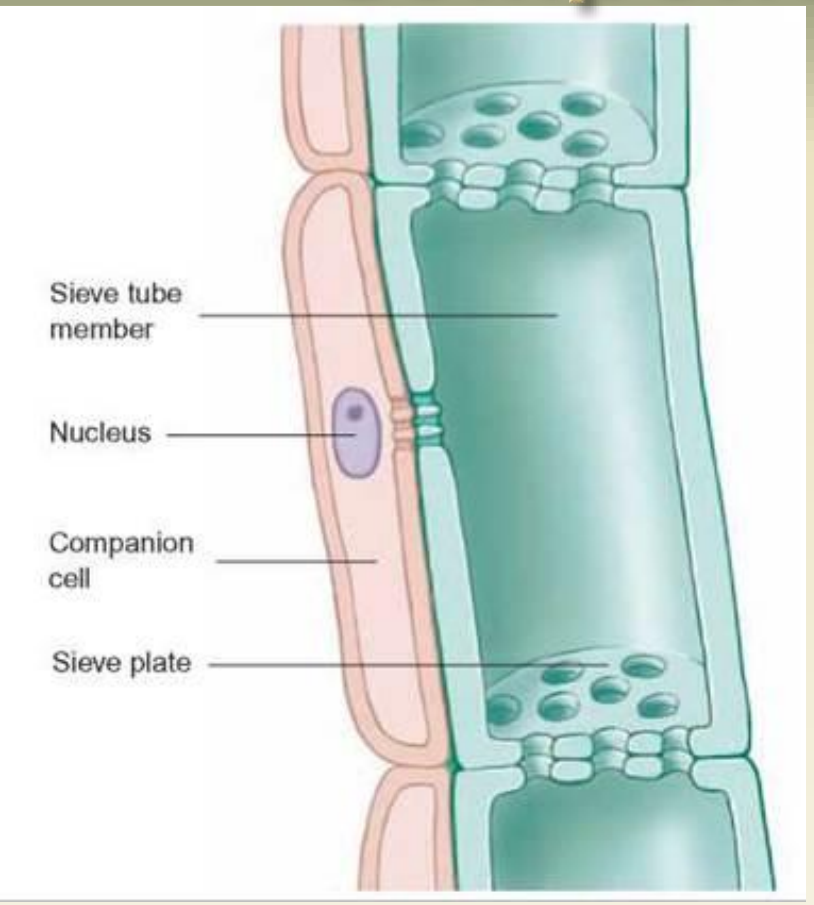
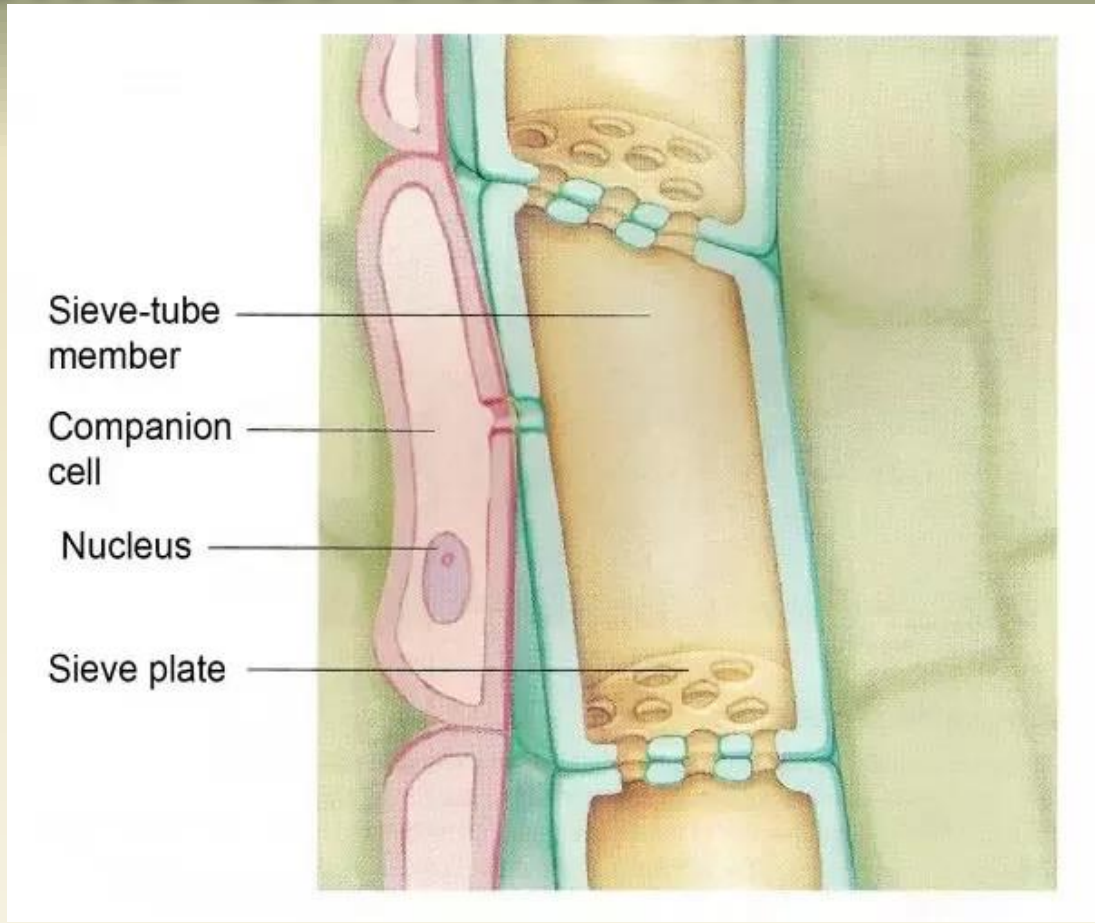


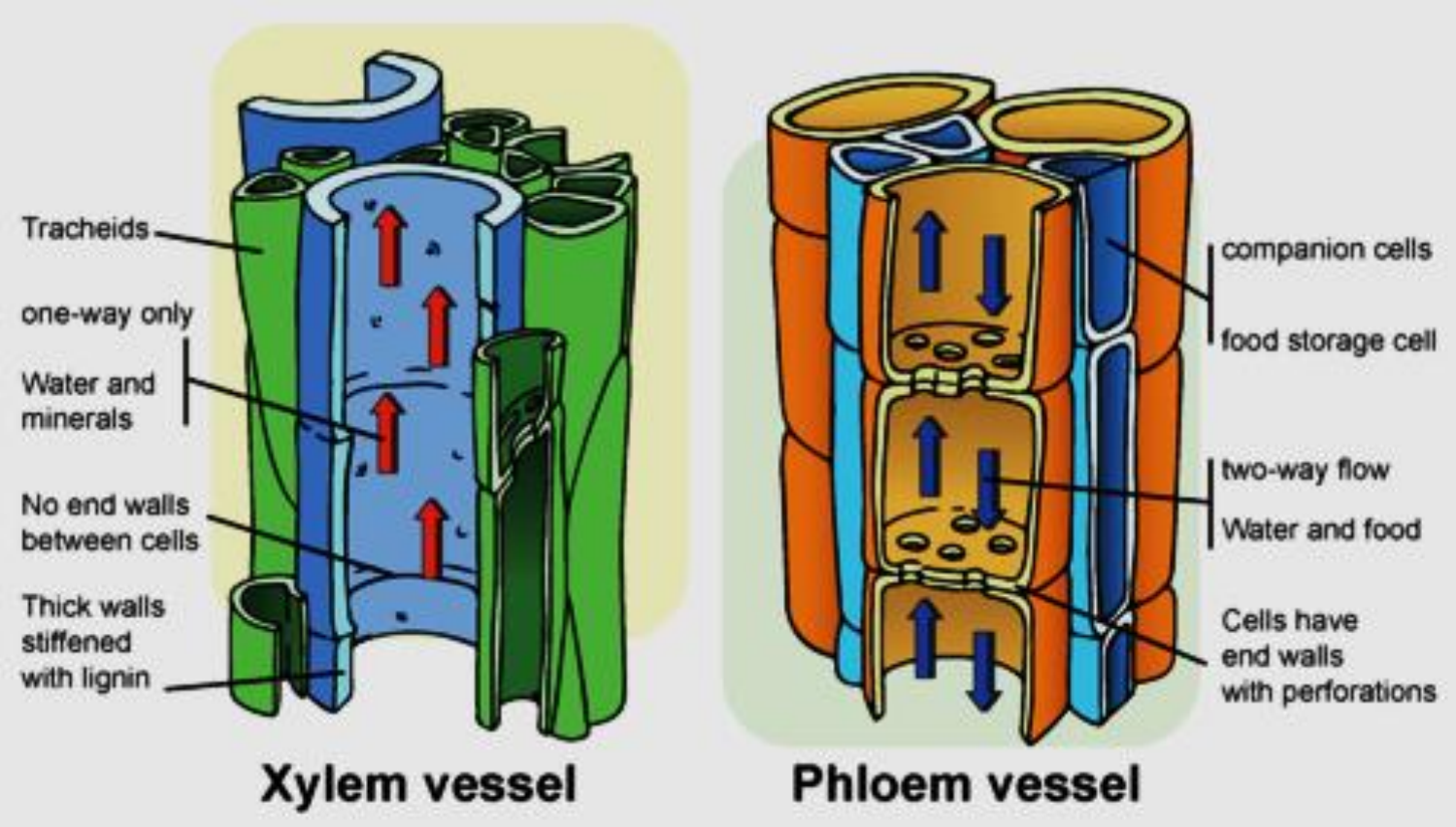
Fig. 2.10. Elements of phloem.

Components of Phloem



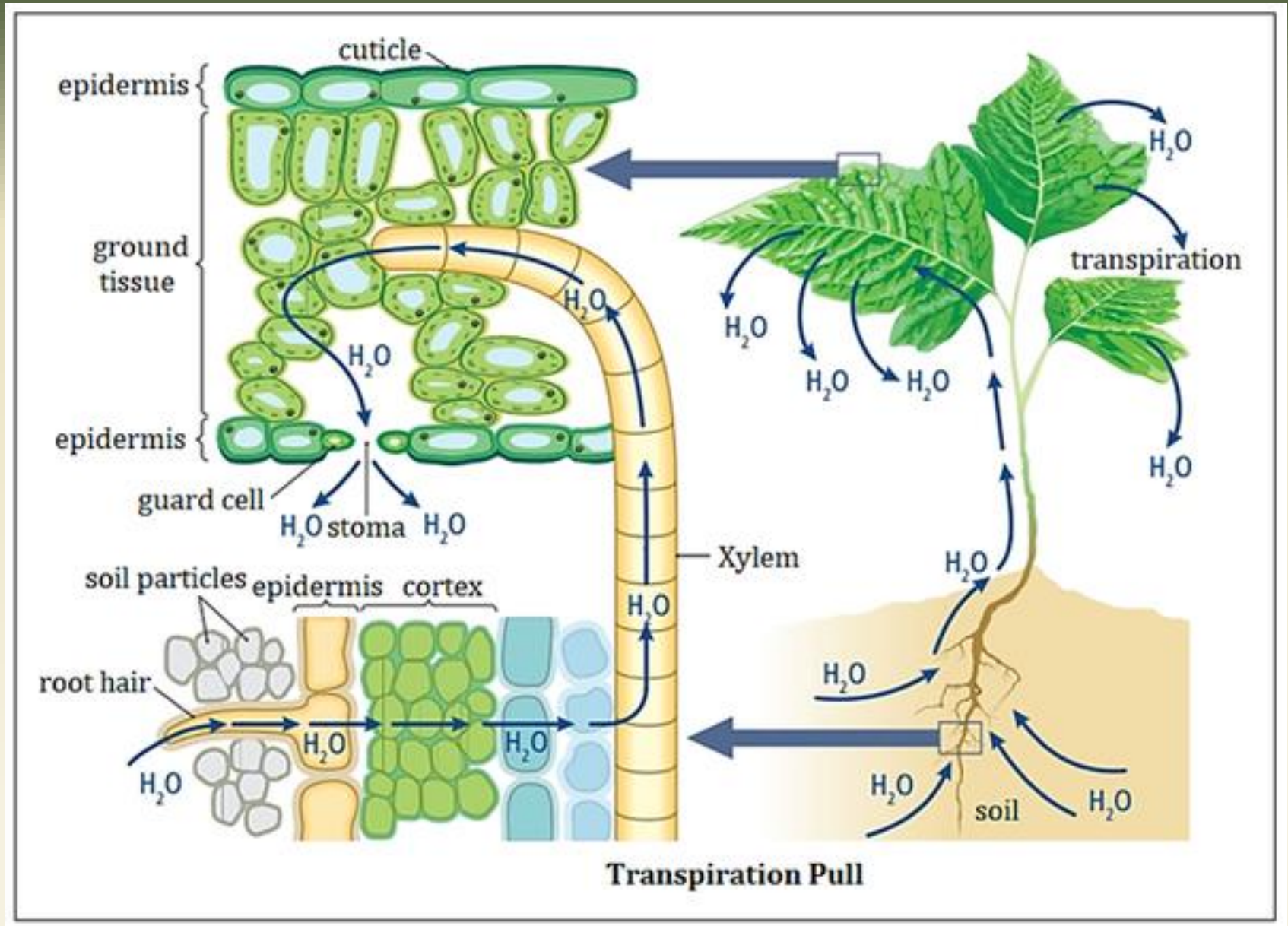


Functions


Tracheids
one-way only
Water and minerals
No end walls between cells
Thick walls stiffened with lignin
Xylem vessel
companion cells
food storage cell
two-way flow
Water and food
Cells have end walls with perforations
Phloem vessel

The basic difference between xylem and phloem is listed below

Xylem	Phloem
It conduct water and minerals.	It conducts organic solutes or food materials
Conduction is mostly unidirectional, *i.e.*, from roots to apical parts of the plant.	In it conduction may be bidirectional, *i.e.*, from leaves to storage organs or growing parts or from storage organs to growing parts of plants.
Conducting channels or treachery elements are tracheids and vessels.	Conducting channels are sieve tubes.
Three of the four elements of xylem are dead (*i.e.*, tracheids, vessels and fibre). Only xylem parenchyma is the living element.	Three of four elements are living *i.e.*, sieve tubes, companion cells and phloem parenchyma while phloem fibre are dead elements.
In addition to conduction, xylem provides mechanical strength to the plant.	Phloem performs no mechanical function for the plants.



Transpiration Pull

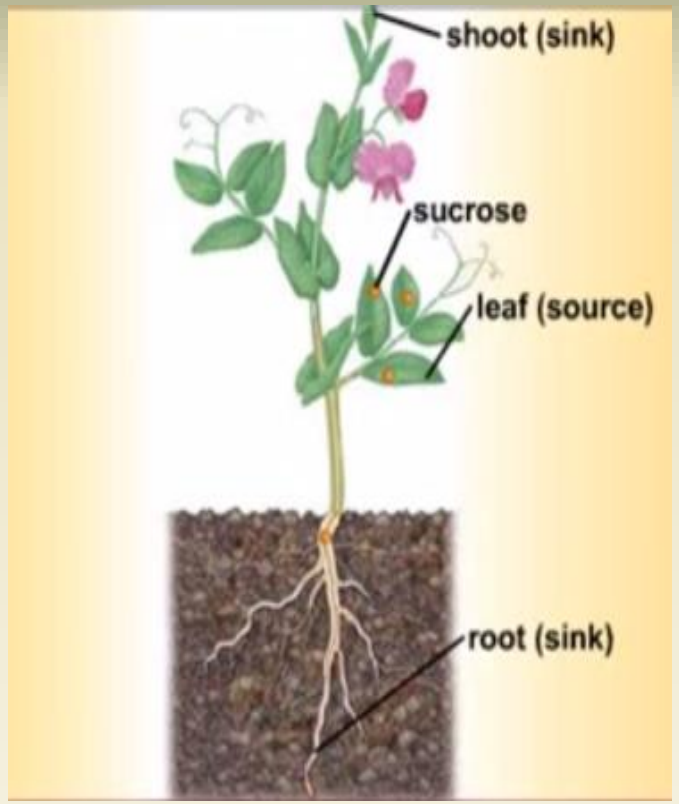
Translocation of sucrose and other assimilates is an energy-requiring process.

The movement of substances in phloem tissue is called **translocation**. The main substances that are moved are **sucrose** and **amino acids**, which are in solution in water. These substances have been made by the plant and are called **assimilates**.

- **Sources and sinks**

A **source** is an organ that produces more sugar than it requires. The leaves are referred to as the source.

A **sink** is an organ that consumes sugar for its own growth and storage. the shoot and root tips – sink.

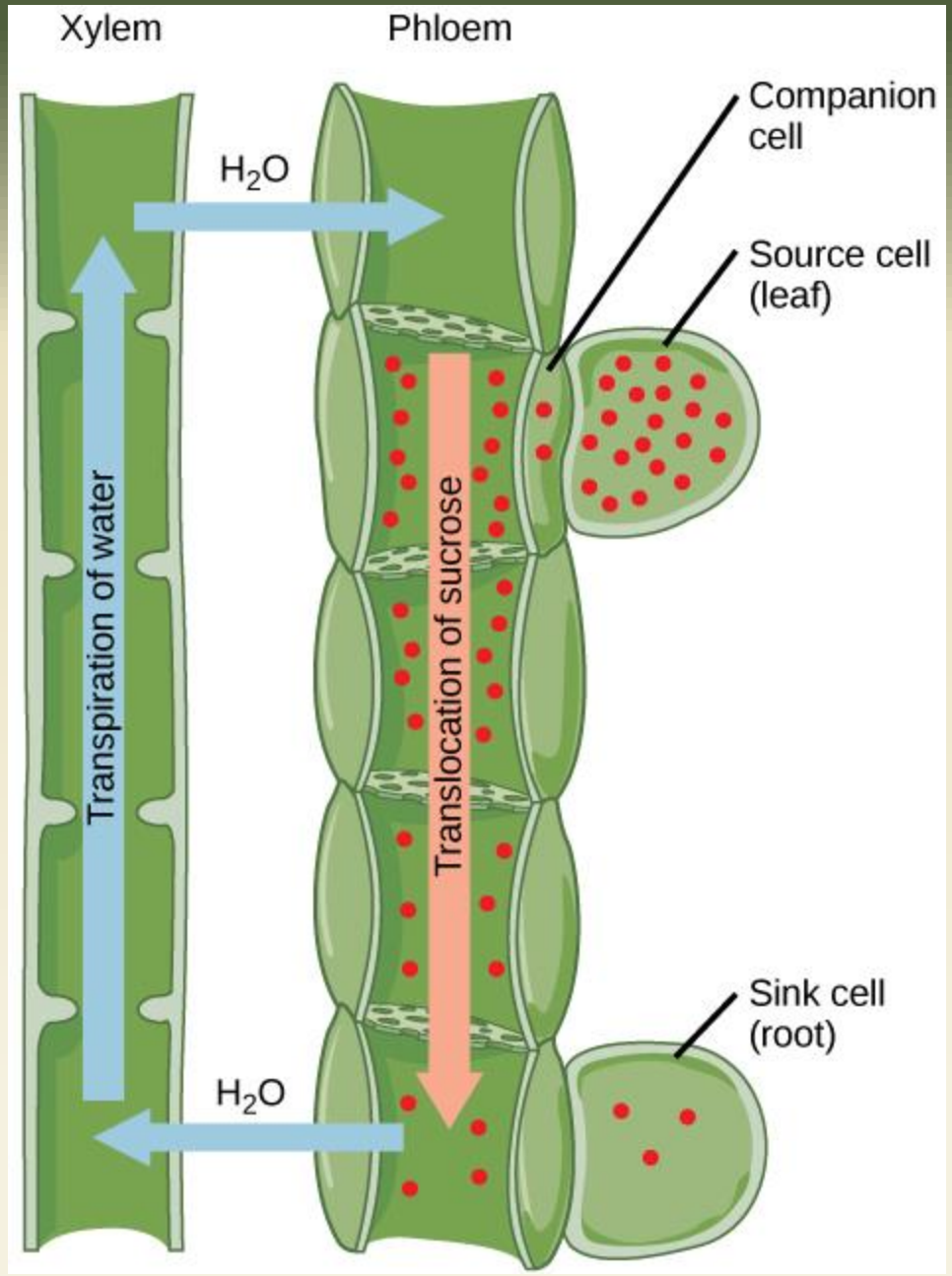


Assimilates (sucrose and amino acids) move between sources (leaves and storage organs) and sinks (buds, flowers, fruits, roots and storage organs) in phloem sieve tubes in a process called **translocation**.

The products from the source are usually translocated to the nearest sink through the phloem. The multidirectional flow of phloem contrasts the flow of xylem, which is always unidirectional (soil to leaf to atmosphere).

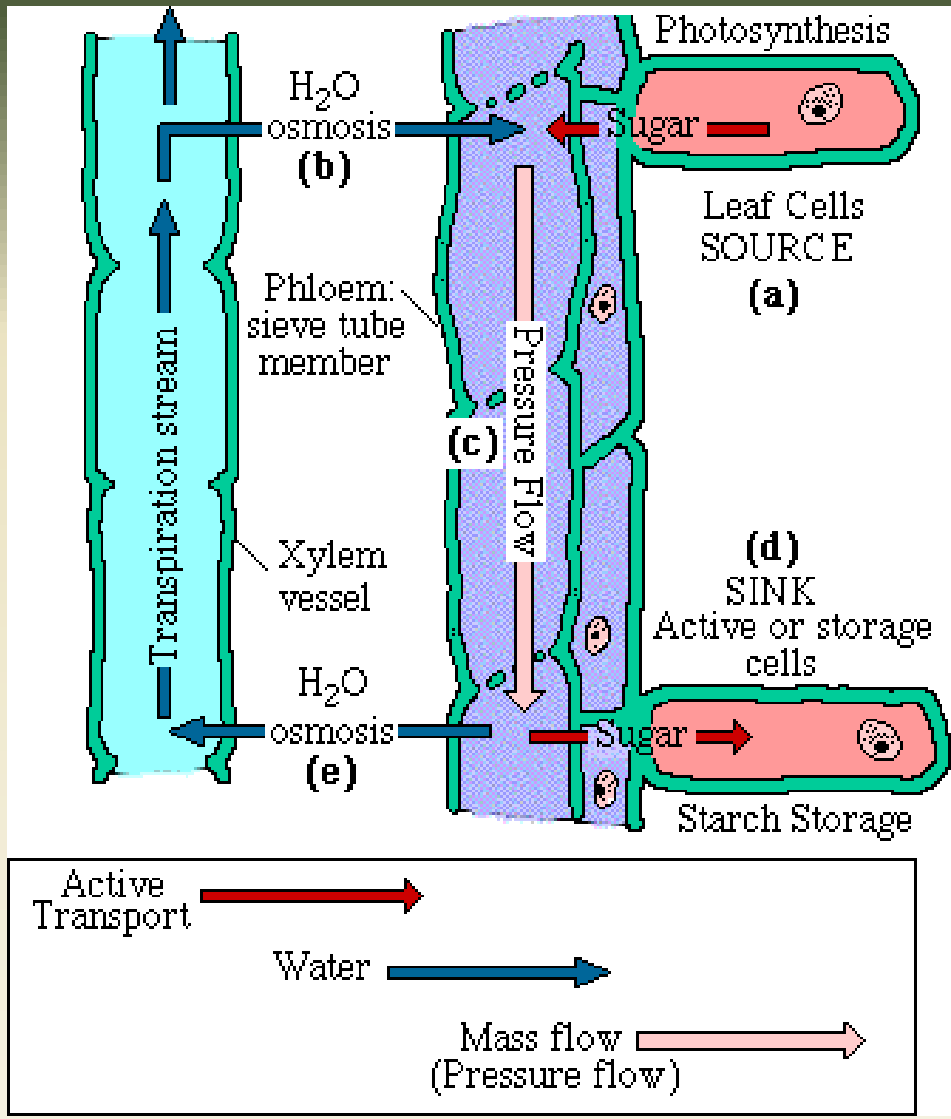
Translocation of sucrose and other assimilates is an energy-requiring process.

Photosynthates (Sucrose) move through plasmodesmata to reach phloem sieve-tube elements (STEs) in the vascular bundles. From the mesophyll cells, the photosynthates are loaded into the phloem STEs. The sucrose is actively transported against its concentration gradient (a process requiring ATP) into the phloem cells.



The most commonly accepted hypothesis to explain the movement of sugars in phloem is the **pressure flow model** for phloem transport.

the pressure flow model works like this: a high concentration of sugar at the source creates a low solute potential (Ψs), which draws water into the phloem from the adjacent xylem. This creates a high pressure potential (Ψp), or high turgor pressure, in the phloem. The high turgor pressure drives movement of phloem sap by "bulk flow" from source to sink, where the sugars are rapidly removed from the phloem at the sink. Removal of the sugar increases the Ψs, which causes water to leave the phloem and return to the xylem, decreasing Ψp



Questions ??

1. What are the components of xylem and phloem?
2. Why xylem and phloem called vascular tissue?
3. Write the functional differences between xylem and phloem.
4. Write structural differences between xylem and phloem.
5. Who is responsible for the control of sieve tubes?
6. How is water transported through xylem without energy?


Thank you very much