

9.2 Transport in the Phloem of Plants

Active Translocation

Describe the structure of the phloem

Phloem tubes are composed primarily of two main types of cells: Sieve elements and companion cells

Sieve elements are long, narrow cells connected by porous sieve plates, with no nuclei and reduced organelles

Companion cells sustain the sieve elements and possess an infolding plasma membrane to increase SA:Vol ratio

Plasmodesmata connect the two cell types to mediate symplastic exchange

Compare the structure and function of the xylem and phloem

Xylem	Phloem
Moves materials via the process of transpiration	Moves materials via active translocation
Transports water and minerals unidirectionally	Transports nutrients bidirectionally
Xylem occupy the inner portion of the vascular bundle	Phloem occupy the outer portion of a vascular bundle
Vessel wall made of fused cells (continuous tube)	Vessel wall made of cells connected by sieve plates
Vessels are hollow with no cell contents	Vessels are composed of living tissue

Explain the process of active translocation

Plants transport organic molecules from source (photosynthetic tissue) to sink (storage organs)

These organic molecules are transported via a tube system called the phloem in a viscous fluid called sap

Organic molecules are loaded / unloaded via companion cells (either by a symplastic or apoplastic pathway)

Active loading of solutes into phloem creates high concentrations that draw water (from xylem) via osmosis

The incompressibility of water causes the sap volume/pressure to increase resulting in mass flow

Organic molecules are actively unloaded at the sink which causes water to return to the xylem

Describe how aphid stylets can be used to measure translocation rates

Aphids are insects that feed on sap in phloem via a stylet (which can be severed to collect the sap)

If plants are exposed to radioactive CO₂, they will produce radioactively labelled sugars

Translocation rate can be identified by the time taken for radioisotopes to be detected at various points