

PENANG SANGAM HIGH SCHOOL
P.O.BOX 44, RAKIRAKI
LESSON NOTES

Year/Level: 12C/D

week 21

Subject: Biology

Strand	1 structure & life processes
Sub Strand	1.4 comparative form and function in plants and animals
Content Learning Outcome	describe the different methods of transport in plants

The Transport System

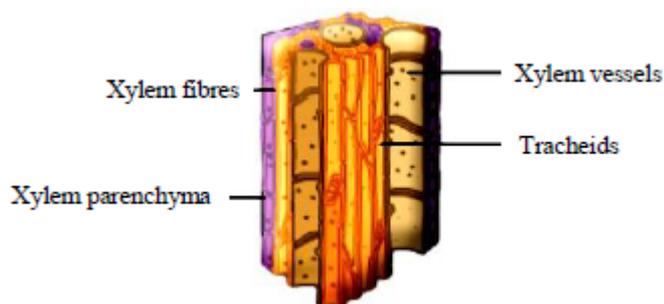
- All organisms have adaptations for getting nutrients and exchange gases.
- Complex organisms have a transport system that connects with their nutrition and gas exchange systems.
- This system delivers nutrients and oxygen and carries away cellular waste.
- In some organisms, the blood carries disease-fighting materials and distributes hormones.
- The transport system of each organism is adapted to its environment and way of life.
- Some organisms do not need a separate system at all if they are very small or inactive.
- Diffusion alone takes care of their transport needs. Other organisms are active and need an efficient transport system to supply their cells with food and oxygen

Transport in Vascular Plants

- Vascular plants are plants with specialized structures for conducting water and food
- Plants absorb water and minerals through their roots and transport them to the leaves and stems for metabolic use, e. g. photosynthesis.
- Examples of vascular plants include flowering and seed plants, trees, ferns, conifers, etc
- Xylem transport water and minerals from roots to shoots.
- Phloem transport sugars and other organic nutrients from where they are produced or stored to where they are needed for growth and metabolism.
- Algae and mosses lack a vascular system, therefore, they live in wet habitat where water and food diffuse directly into their cells.

Xylem – the transport of water and minerals

Xylem cells are specially adapted for carrying water and dissolved minerals through plants.



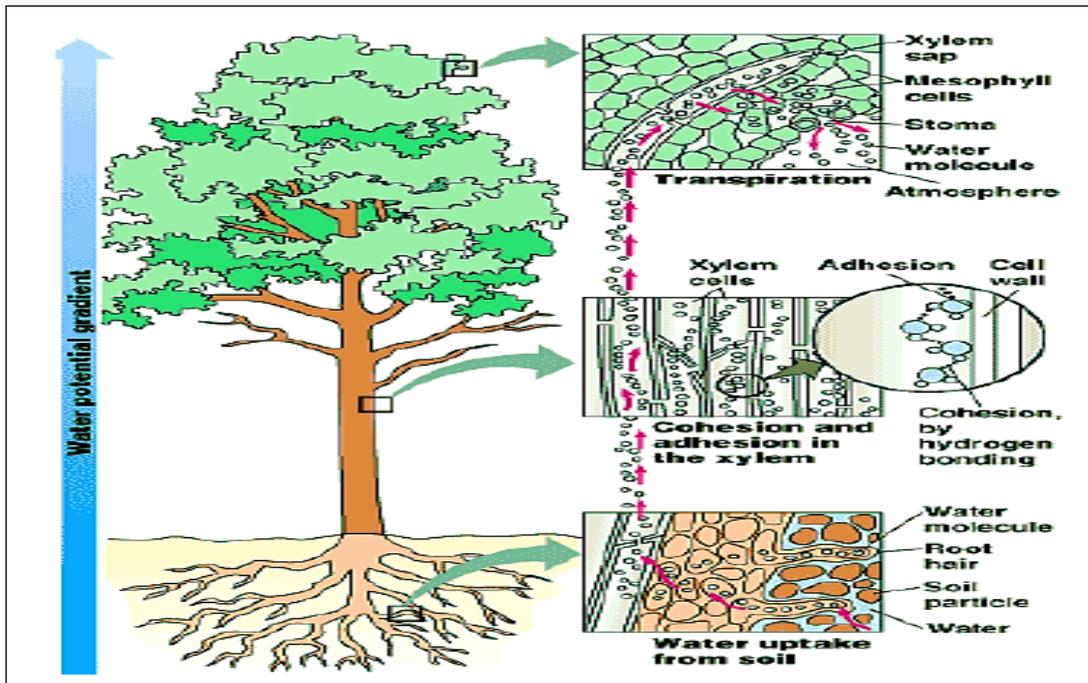
Xylem fibres – provides maximum support to plant.
 Xylem parenchyma – storage of food material in the form of starch and conducts water radially.

Xylem vessels – conducting water

Tracheids- helps in transporting water and minerals

The Cohesion Theory of Water

1. Water evaporates from the leaves via transpiration, mostly through open stomata.
2. The pulling action of transpiration sucks water up through the xylem tubes.
3. Since water molecules stick together (i.e., they are cohesive), when water molecules leave the plant through the stomata, they pull up molecules from below to take their place.
 - ❖ So, according to this theory, water moves up through xylem by a combination of *transpiration pull* and *water cohesion*.



Additionally, the higher concentration of minerals in roots than in soil causes water to move into roots by **osmosis**. The force of water moving into roots is called **root pressure**. This pressure helps to push water up the xylem.

Plants need enough water;

- to remain **turgid**
- to use in photosynthesis

They also must lose a lot of water by transpiration in order to pull water up from the roots.

Mineral Transport

- Water can move easily through the cell membrane of root cells by osmosis.
- Dissolved minerals, however, are charged and so cannot pass through the phospholipid bilayer of cell membranes.
- Also, the concentration of minerals is often higher inside the plants than outside.
- Thus, root cells depend on active transport to bring minerals into the xylem.
- The active transport of minerals into the roots requires ATP from respiration, but food is made far away in the leaves.
- Roots get the glucose required to make this ATP through the phloem

Phloem

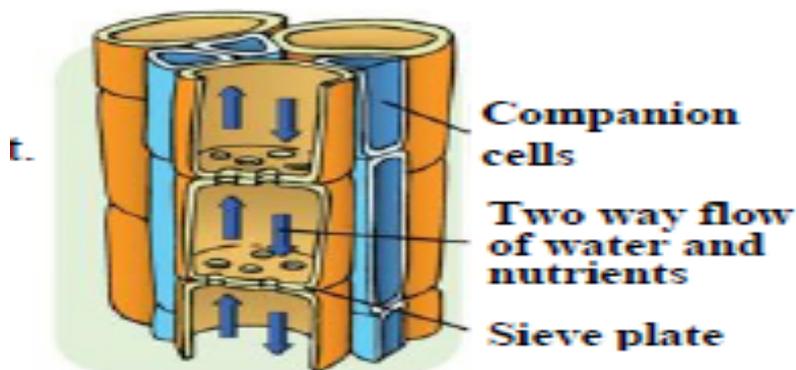
- Phloem cells are adapted for carrying food from leaves to all other parts of plants.
- Plant starch (carbohydrate) is produced by photosynthesis. These starch molecules are too large to pass through cell membranes.
- Starch must be hydrolysed into sucrose for transport through phloem.
- The solution of water, sucrose and other food molecules (organic materials) in the phloem is called **sap**.
- The transport of the sap is called **translocation**.
- Sap in the phloem is under very high pressure (as much as five times higher than air pressure in a car tyre).
- This pressure helps push sap through phloem.
- Phloem tissue is made of two kinds of cells; **sieve cells** and **companion cells**.

Sieve cells

- The sieve cells are continuous tubes throughout the plant.
- The end wall of this continuous tube has lots of little holes in the cells walls at both ends so the sap can pass through more easily.
- These porous ends of sieve cells are called sieve plates

Companion cells

- The companion cells provide the sieve cells with ATP for active transport.
- Sieve cells can carry sap in their own direction, companion cells direct sieve cells to carry food to stems and roots for storage or to cells that need it for energy.



Activity

1. What three factors are believed to help water move up through xylem? Describe how each force works.

2. How do plants absorb water from the soil? How do they absorb minerals?

3. Describe how food is transported in vascular plants.

4. Transport systems often link with the following systems: digestive, gas exchange, and urinary. Explain the reasons for each of these connections.

4. What two kinds of cells make up phloem? What is the function of each?

5. Describe how xylem cells and sieve cells are specially adapted for their functions.
