

Water absorption in plants

Plants absorb water through the entire surface - roots, stems and leaves. However, mainly the water is absorbed by roots. The area of young roots where most absorption takes place is the root hair zone. The root hairs are delicate structures which get continuously replaced by new ones at an average rate of 100 millions per day. The root hairs lack cuticle and provide a large surface area. They are extensions of the epidermal cells. They have sticky walls by which they adhere tightly to soil particles. As the root hairs are extremely thin and large in number, they provide enormous surface area for absorption. They take in water from the intervening spaces mainly by osmosis.

Water in the roots move by two pathways. They can be classified as 1) Apoplast pathway 2) Symplast pathway

Water uptake in the roots

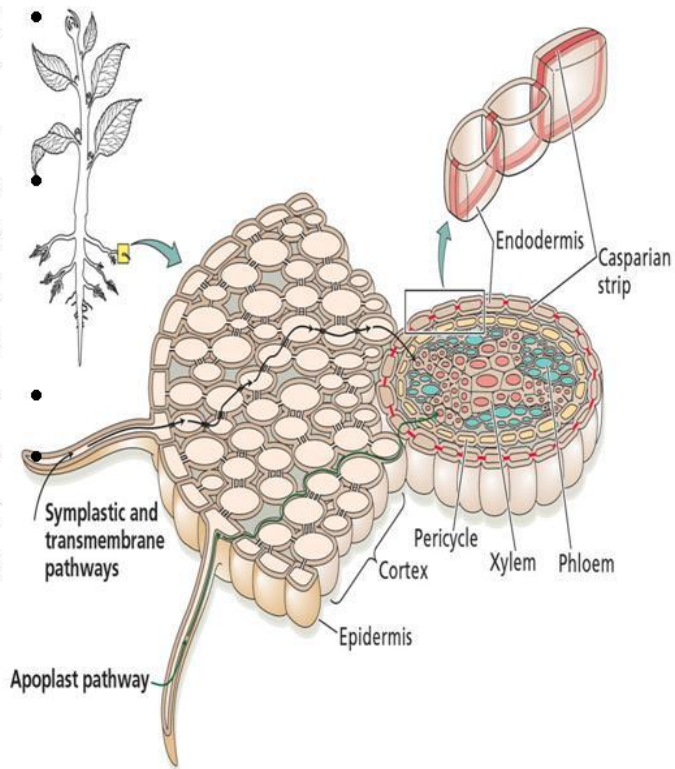
Root hairs increase surface area of root to maximize water absorption.

From the epidermis to the endodermis there are two pathways in which water can flow:

1: Apoplast pathway:

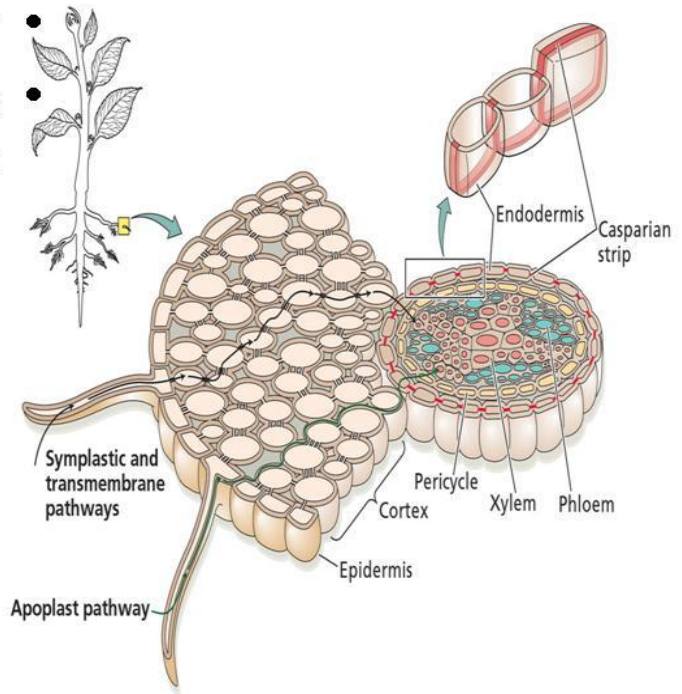
Water moves exclusively through cell walls without crossing any membranes

The apoplast is a continuous – system of cell walls and intercellular air spaces in plant tissue

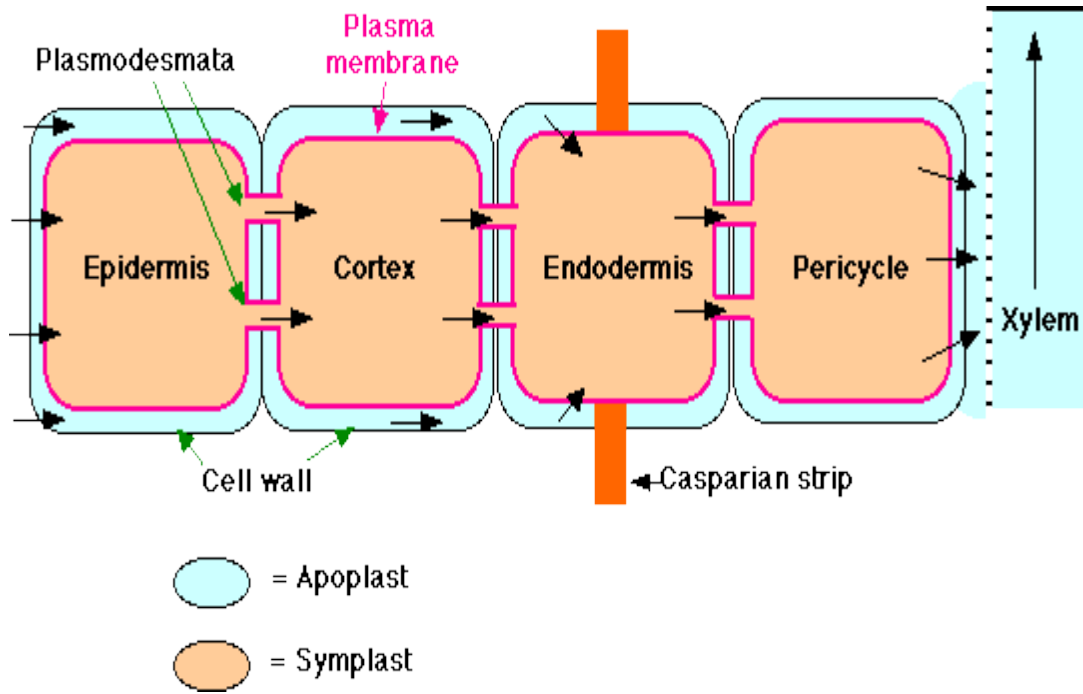


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2: Symplast pathway:
 Water travels from one cell to the next via plasmodesmata.
The symplast consist of – the entire network of cell cytoplasm interconnected by plasmodesmata



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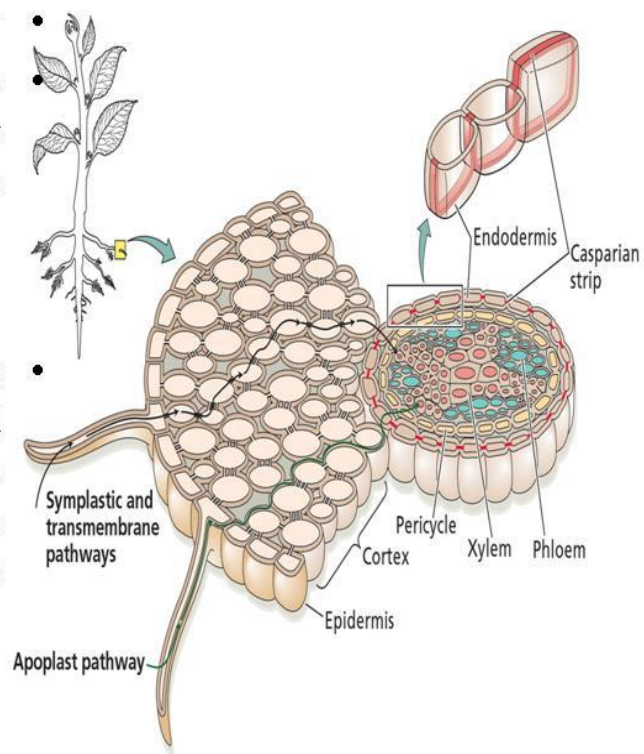
At the endodermis:

Water movement through the apoplast pathway is stopped by the Casparian Strip

Band of radial cell walls – containing suberin, a wax-like water-resistant material

The casparian strip breaks continuity of the apoplast and forces water and solutes to cross the endodermis through the plasma membrane

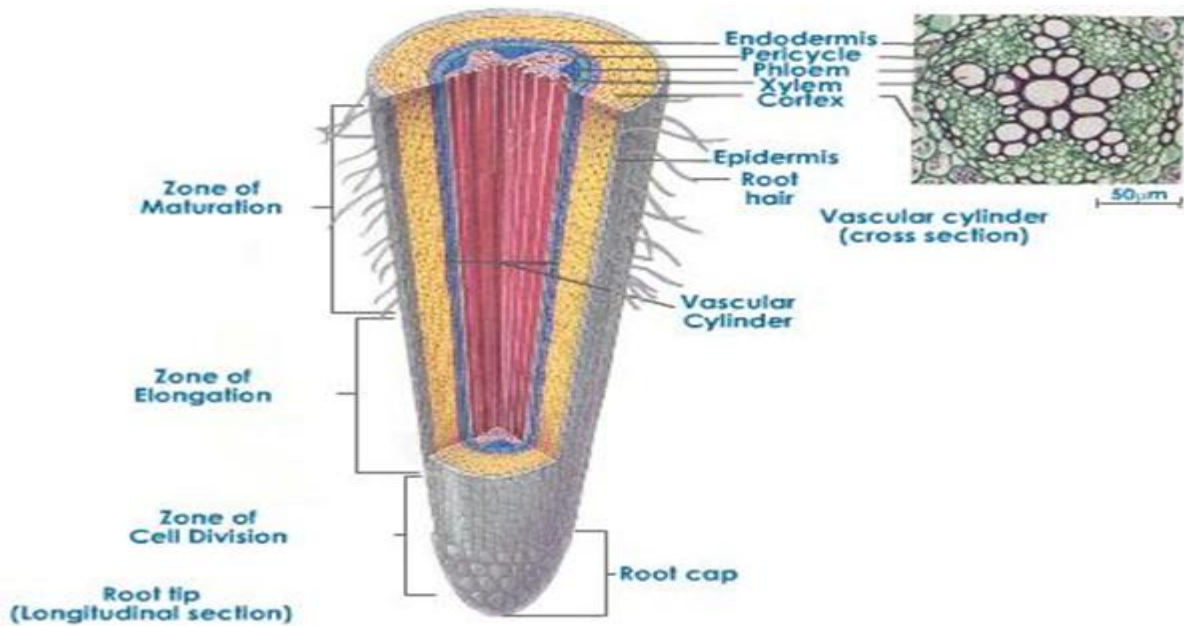
So all water movement across the – endodermis occurs through the symplast



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Factors Affecting Water Absorption

- Water availability in the soil
- Climatic conditions – Temperature, light, wind speed and humidity.
- Concentration of soil solutions
- Aeration of soil - soil deficient in oxygen inhibits absorption
- The rate of transpiration
- Properties of root system – Type and Old



Areas of Root Involved in Absorption and Translocation of Water

Mechanism of Water Absorption

Water can be absorbed by two methods:

- Active absorption
- Passive absorption

Active Absorption

Water is absorbed due to activities going on in roots. Absorption of water occurs with the help of energy in the form of ATP, which is released due to metabolic activities of root cells such as respiration. Absorption takes place against concentration gradient - even when the concentration of cell sap is lower than that of soil water.

Passive Absorption

Passive absorption is by osmosis. Passive absorption takes place along the concentration gradient - when the concentration of cell sap is higher than that of soil water. Water is absorbed when transpiration rate is high or soil is dry. Due to high transpiration rate, water deficit is created in transpiring cells. Rapid transpiration removes water and reduces turgor pressure in living cells of root. The suction force thus developed is transmitted to root xylem. It pulls water from surrounding root cells to make up water deficit.

Practice part:

An experiment explain the effect of (o.p)for the external solution on the rate of absorption.

The absorption occur from higher (w.p).....> lower(w.p)

After 24 hour the solution in the pipet one more than the other which one ?why?

The exp. Prove that the xylem tissue responsible for translocate the water & salts.

D.W out side , NaCl in side..... the water absorbed more than other because the (W.P)of external solution is higher.

Temperature increase from the response.

