

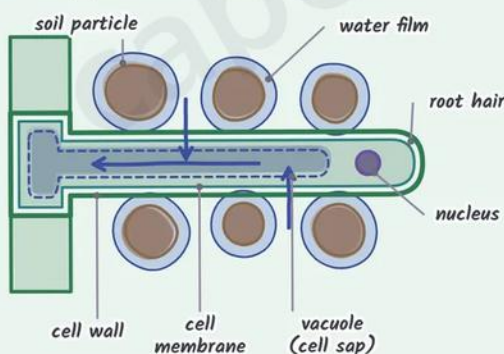
a root hair's three-step pull, and the tension it hands all the way up to the topmost leaf

Water, the elixir of life

- water is 90 to 95% of most plant cells and tissues, and keeps cells turgid
- best solvent, a neutral pH, pure, inert compound; transport medium for minerals/food, and all biochemical reactions
- high specific heat, heat of vaporization/fusion make it a thermal buffer, via hydrogen bonding
- high adhesive/cohesive forces plus surface tension let it rise in capillaries: basis of sap's ascent

Root, the water absorbing organ

- terrestrial roots absorb liquid soil water; epiphytes (orchids) absorb air vapour via epiphytic roots' velamen
- the zone of absorption carries unicellular hair-like extensions of epidermal (epiblema) cells, the root hairs
- root hair: 1-10 mm, colourless, unbranched, ephemeral; large vacuole, thin cytoplasm, wall pectin outside/cellulose inside
- cell wall is freely permeable; plasma membrane is selectively permeable, enabling osmosis next



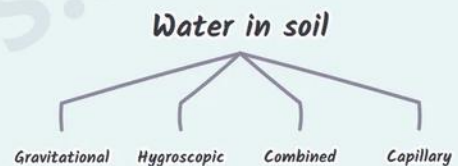
a root hair: one epiblema cell grown out between soil particles, touching their water films; wall outside the membrane, a large vacuole; blue arrows show water entering the hair

Imbibition, step one *

- imbibition: swelling of hydrophilic colloids by adsorption of water, no solution forms
- imbibant: the adsorbing substance (root hair wall: pectic compounds, cellulose); imbibate: the water taken up
- water moves along a concentration gradient until equilibrium; visible in soaking seeds, swelling raisins, kneading flour
- explains why wooden doors swell and jam shut in the rainy season

water absorption by a root hair is one continuous relay: imbibition into the wall, then diffusion, then osmosis into the cytoplasm, always in that order

Soil water, four kinds



only capillary water, held between soil particles, is available to roots; gravitational water percolates away, hygroscopic water is bound too tightly by fine particles, and combined water is locked in hydrated oxides

Diffusion, step two

- movement of ions/atoms/molecules from higher to lower concentration, driven by kinetic energy, continuing until equilibrium
- diffusion pressure (DP) of pure solvent is always more than DP of solvent in a solution
- Diffusion Pressure Deficit (DPD) (B.S. Meyer, 1938): DP of pure solvent minus DP of solution
- colloquially a cell's "thirst"; DPD is now called water potential
- wall water's DP exceeds the cell sap's, so it diffuses in first, to the wall-membrane interface

