Water Potential

Photo credit: City of Winnipeg

Plant Cells in Pure Water

Pure water (a hypotonic solution) will initially move into the cells.

After a period of time the cells will become turgid.

As turgor pressure increases water will diffuse out of the cell… eventually equilibrium will be reached.

Water Potential is…

…a measure of the energy available for reaction or movement.

-measures the ability of water to move.

-water always moves from areas of high potential to areas of low water potential.

-The symbol for water potential is the Greek letter P_{si}

Ψ

Water Potential

Two components:

- **Osmotic potential** (due to solutes)

- **Pressure potential** (due to turgor pressure).

These two pressures have opposite effects on water movement.

As one rises, the other decreases…

water potential is just the sum of the pressure and osmotic components.

Water Potential = Osmotic Potential + Pressure Potential

$$\psi = \psi_p + \psi_\pi$$

Pure water has ψ_π of 0

ψ_π is *negative* for all solutions

Pure water always flows to the lower potential, so, ψ_π must be *negative* (lower than zero) for any water containing solutes.

Water under pressure (high P)

- few solutes (low π,- *not* very negative ψ_π).

Water will flow from the cell to the solution, from high (nearly zero) potential to low (very negative) potential.

Water at low pressure (low P)

- lots of solutes
- high π
- very negative ψ_π

Some Basic Principles

- Water always moves from high water potential to low water potential.
- Water potential is a measure of the tendency of water to move from high free energy to lower free energy.
- Distilled water in an open beaker has a water potential of 0(zero).
- The addition of solute decreases water potential.
- The addition of pressure increases water potential.
- In cells, water moves by osmosis to areas where water potential is lower.
    - A hypertonic solution has lower water potential.
    - A hypotonic solution has higher water potential.