

MODERN CONCEPT OF STOMATAL MOVEMENT

KUMARI SONA RANI
ASSISTANT PROFESSOR
DEPARTMENT OF BOTANY
S.SINHA COLLEGE, AURANGABAD

FOR M.Sc 2nd semester students

Malate or K⁺ ion pump hypothesis was proposed by Levitt. According to this theory, the change that takes place in the turgor pressure of the guard cells that open and close the stomata causes the absorption and loss of K⁺ ions by guard cells.

Opening of stomata in light:

Starch in guard cells is metabolised into phosphoenol pyruvate (PEP) and later converted into malic acid by the enzyme PEP carboxylase. Malic acid dissociates into H⁺ and malate ions in the guard cells. These H⁺ ions are transported to the epidermal cells and K⁺ ions moves from the epidermal cells to the guard cells through the hydrogen - potassium ion exchange pump in the plasma membrane. It is an active process and requires ATP. In the guard cells, K⁺ ions are balanced by malate ions and a small amount of Cl⁻ ions are also absorbed to neutralize a small percentage of K⁺ ions. Increased K⁺ ions and anion concentration in the guard cells increases their osmotic concentration and results in the water uptake by the guard cells. This osmosis process increases the turgor pressure of the guard cells and so the stoma opens.

Closing of Stomata in Dark:

During night, CO₂ is not utilized in photosynthesis, hence its concentration increases in the sub-stomatal cavity. Organic acids are converted into starch. The abscisic acid (ABA) hormone functions in the presence of CO₂ and inhibits the uptake of K⁺ ions by changing the diffusion and permeability of the guard cells. The K⁺ ions are transported back to the epidermal cells from the guard cells. Due to this, the osmotic concentration of the guard cells decreases and results in the movement of water out of the guard cells by exosmosis. The guard cells becomes flaccid and so the stoma closes.

