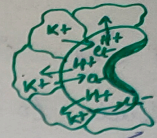


## 2) Potassium Pump & Proton Secretion Theory:



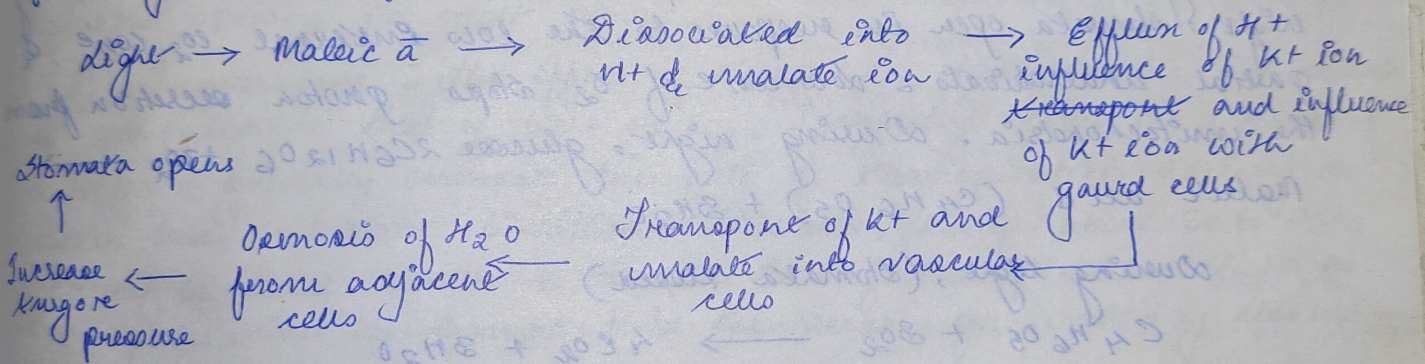
Although several hypotheses were advanced to explain the stomatal mechanism but now was found to be completely satisfactory. In the late 1960's accumulation of potassium ions generated the interest for stomatal opening mechanism. The role of potassium ion in stomatal movement was 1st observed by Tomamura in 1943, Fuzino, 1967 observed that opening of stomata is accompanied by increase in potassium ion conc in the guard cells during day time and a decrease at night. It has been demonstrated that <sup>stomatal</sup> opening induced by light is accompanied by the transport of  $K^+$  ions into guard cells from adjacent cells. In order to maintain electroneutrality within the guard cells, some anions mostly malic  $\bar{a}$  accumulate within it.

The synthesis of malic acid in guard cells is not known well. One possibility is that reserve carbohydrate (starch) in guard cells are metabolized into malic  $\bar{a}$ . Another possibility is reported by Levitt in 1974, that light triggers the excretion of malic  $\bar{a}$  from chloroplast into the cytoplasm of guard cells.

Malic acid then dissociated into  $H^+$  and malate ion. During day time, efflux of  $H^+$  ion by the activity of some proton pump mechanism present in guard cell membrane takes place. Effluxion of  $H^+$  ion from guard cells make the cell more

negatively charged & thus the pH is increased. To balance the guard cells internal -ve charge influx of  $K^+$  ion from surrounding cells takes place. Increased accumulation of  $K^+$  ion & organic anions induces the osmosis of  $H_2O$  from neighboring epidermal cells into guard cells leading to increase turgor pressure necessary for stomatal opening.

The light induced stomatal opening takes place acc. to the following sequence of events:



In dark, the sequence of events is reversed. Now,  $K^+$  ions are transported & the organic acid are consumed by metabolic processes. As a consequence,  $H_2O$  osmoses out of guard cells & their turgor pressure decreases, thus stomatal closure takes place.

