## Crassulacean Acid Metabolism

**Crassulacean acid metabolism** (CAM) is a mechanism in which $CO_2$ is stored at night as an organic acid. CAM conserves water in plants that live in deserts and other regions with high light intensity and limited water supply. (The Crassulaceae are a family of plants in which the CAM pathway was first investigated.) CAM plants, most of which are succulents (e.g., cacti), open their stomata only at night after the air temperature has decreased and the risk of water loss is low. The $CO_2$ enters mesophyll cells, where it is immediately incorporated into an OAA molecule via the carboxylation of PEP catalyzed by PEP carboxylase (**Figure 1**). OAA is then reduced to malate, which is stored overnight in the vacuoles of mesophyll cells. In the daytime, malate molecules are broken down to pyruvate and the rubisco substrate $CO_2$. The temporal separation of carbon fixation and the Calvin cycle allows CAM plants to close their stomata during daytime, thus minimizing water loss through transpiration.

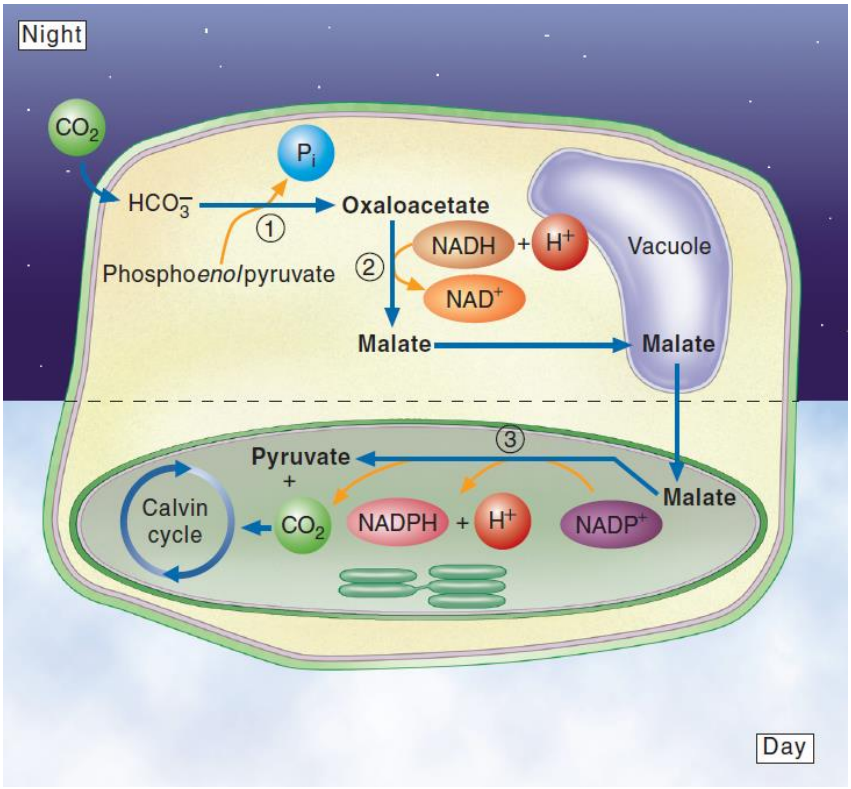


FIGURE 1

**Crassulacean Acid Metabolism (CAM)**

At night the stomata of CAM plants open to allow $CO_2$ to enter. Within mesophyll cells, PEP carboxylase (1) incorporates $CO_2$ (as $HCO^-3$) into oxaloacetate. Afterward, oxaloacetate is reduced by malate dehydrogenase (2) to form malate. Malate is stored in the cell's vacuole until daylight. Light stimulates the decarboxylation of malate by malic enzyme (3) to form pyruvate and $CO_2$. As a result of this temporal separation of reactions, $CO_2$ can be incorporated into sugar molecules via the Calvin cycle during the day, when the plant's stomata are closed to avoid water loss.