Plant cell, Photosynthesis, and Ecological biology

405 Biochem

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ALTERNATES OF CALVIN CYCLE

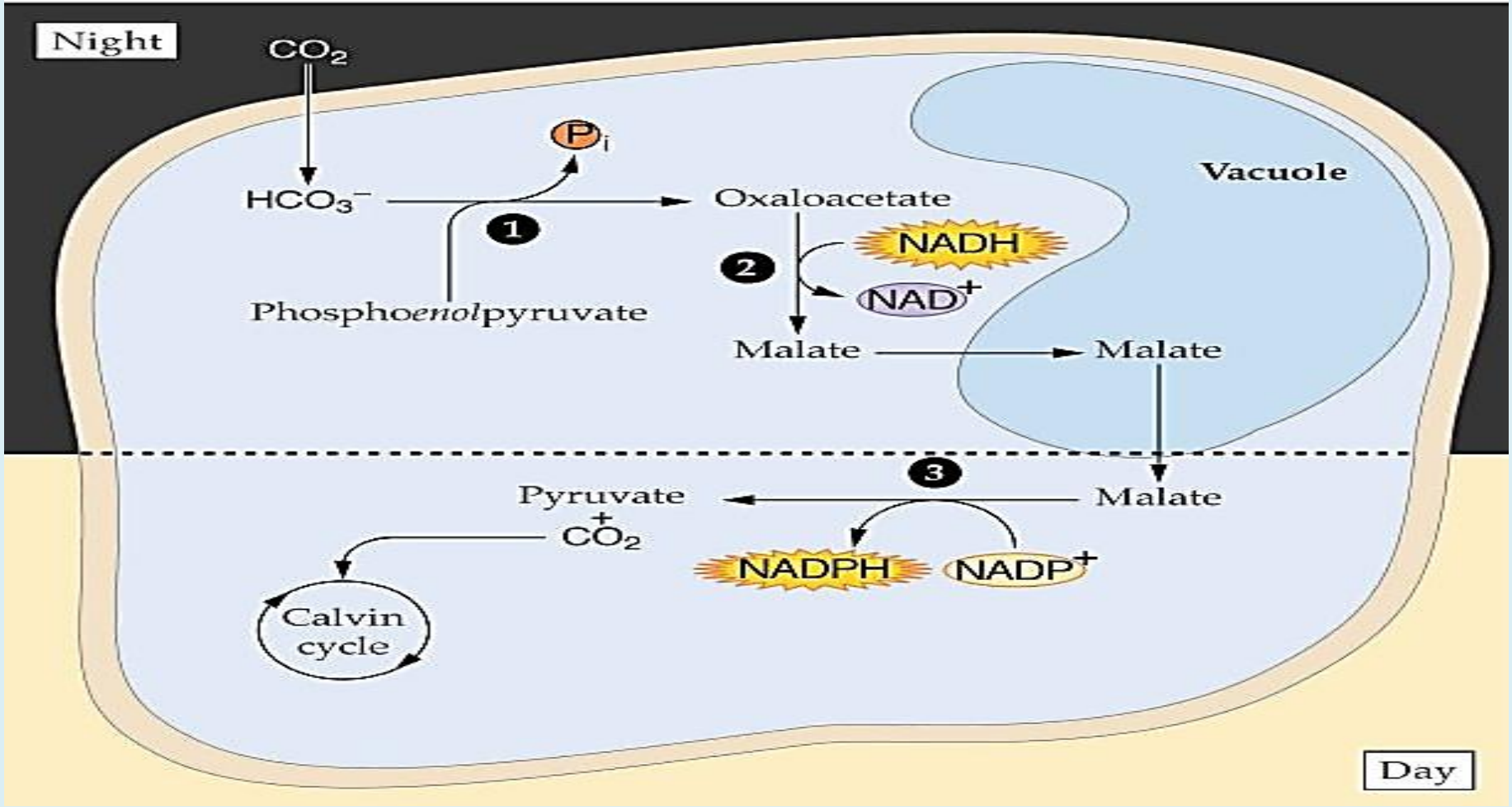
(Adaptions for hot/arid conditions)

2. **CAM** –

CAM – short for "Crassulacean Acid Metabolism" – is a method of carbon fixation evolved by some **plants** in dry circumstances.

Open stomata at night, close in day

- **Grow slow, lose less water**
- **E.g. for CAM plants cactus صبار, pineapple**



CAM pathway: During the night, CO_2 is taken up through the open stomata, converted into malate by phospho*enol*pyruvate carboxylase (PEPC), and stored in the vacuole. During the day, CO_2 is produced by a decarboxylation reaction and used by RuBisCO. By utilizing the CO_2 stored in the vacuole, stomata can be kept closed during the day to reduce water loss by transpiration. From Borland *et al*. (2014).

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2. **CAM** –

- In this type of photosynthesis, organisms absorb sunlight energy during the day then use the energy to fix carbon dioxide molecules during the night.
- During the day, the organism's stomata close up to resist dehydration while the carbon dioxide from the previous night undergoes the Calvin cycle.
- CAM photosynthesis allows plants to survive in arid climates and therefore is the type of photosynthesis used by cacti and other desert plants. However, non-desert plants like pineapples use CAM photosynthesis.

Types of photosynthesis

Three important types of photosynthesis are C3, C4 and CAM photosynthesis.

The key difference between C3, C4 and CAM photosynthesis is the way plants extract carbon dioxide from sunlight, which depends largely on the plant's habitat:

C3 photosynthesis produces a three-carbon compound via the Calvin cycle while C4 photosynthesis makes an intermediate four-carbon compound that splits into a three-carbon compound for the Calvin cycle. Plants that use CAM photosynthesis gather sunlight during the day and fix carbon dioxide molecules at night.

Types of photosynthesis

- Roughly 85% of the plants on earth utilize C3 photosynthesis.

- The benefit of C4 photosynthesis is that it produces a higher concentration of carbon, making C4 organisms more adept at surviving in habitats with low light and water.

- CAM photosynthesis allows plants to survive in arid climates and therefore is the type of photosynthesis used by cacti and other desert plants.

Factors affecting Photosynthesis

Light Intensity

- High Intensity Light causes the rate of photosynthesis to increase
- The rate will increase until it reaches its saturation point
- At the saturation point, the rate of photosynthesis remains constant

Factors affecting Photosynthesis

Temperature

- As the temperature increases, so does the rate of photosynthesis
- Enzymes function at an optimal temperature
- If the temperature is too high or too low, then the enzyme will not function properly
- The rate of photosynthesis will slow down or stop, entirely

Factors affecting Photosynthesis

Water

- Water is one of the raw materials of photosynthesis
- A shortage of water can slow or even stop photosynthesis
- Water stress causes stomata to close, preventing CO_2 from entering the leaf

Factors affecting Photosynthesis

Carbon Dioxide (CO_2) Concentration

- An increase in CO_2 concentration causes the rate of photosynthesis to increase
- More CO_2 available means more sugar being made in the light independent reaction