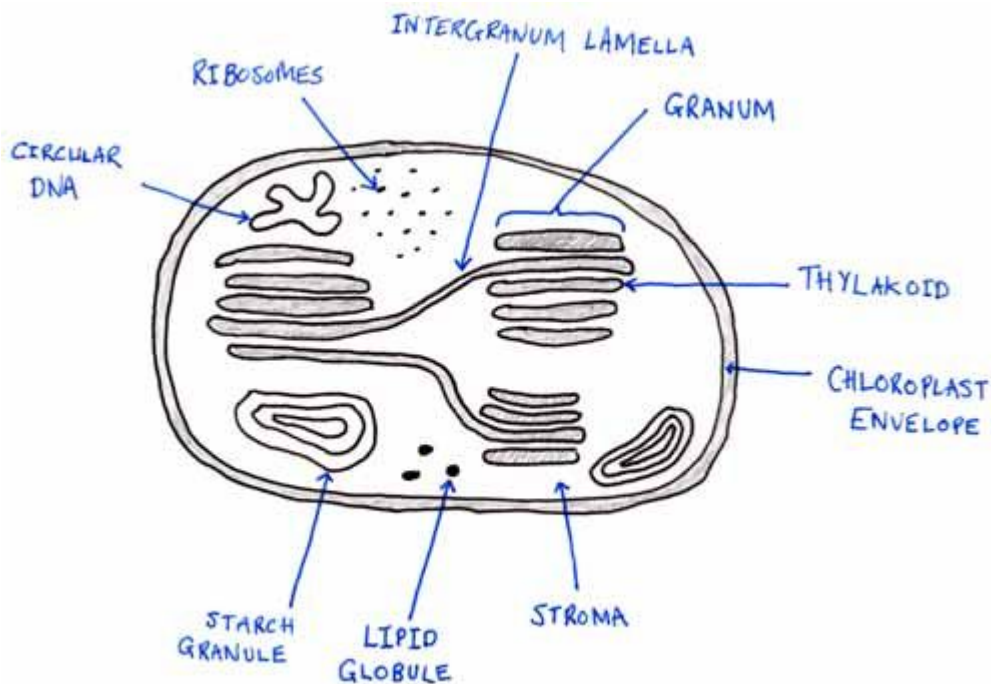


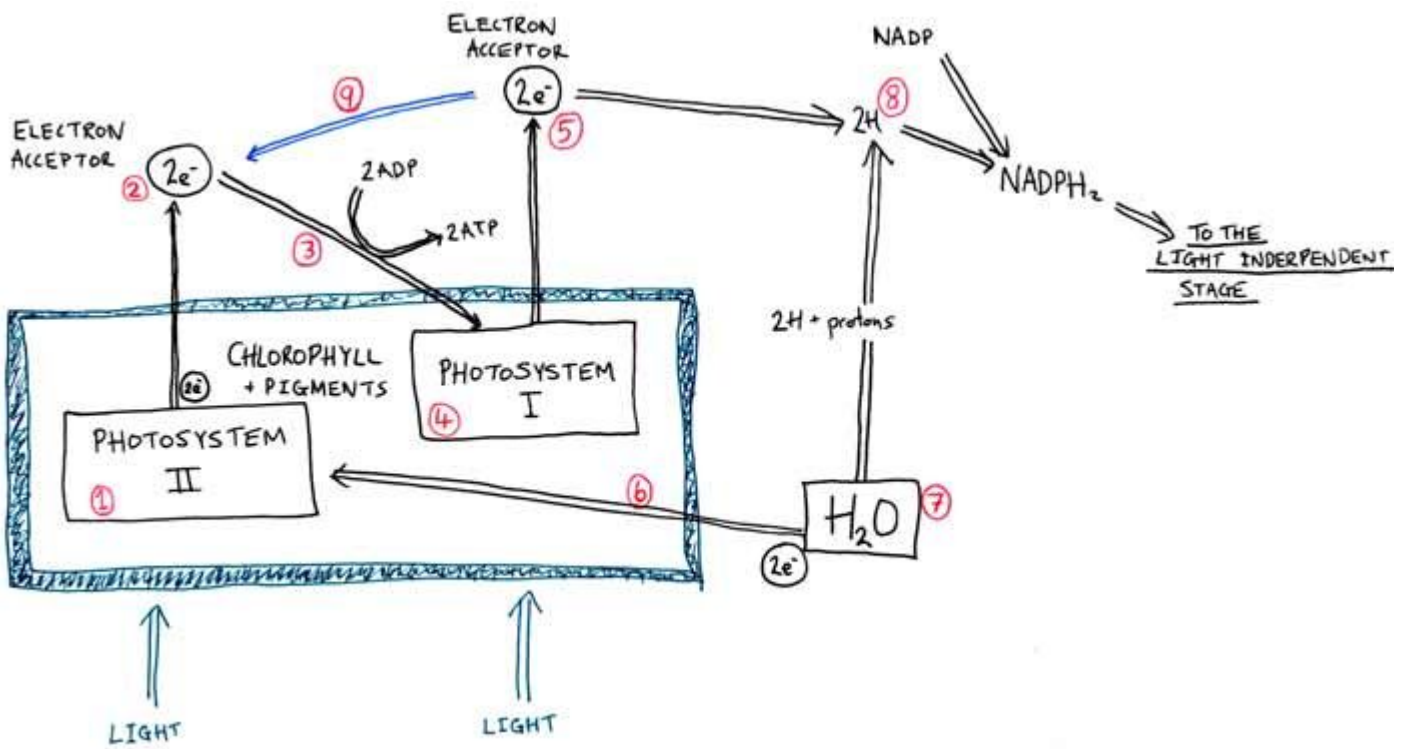
# Photosynthesis



- Chloroplasts are large organelles, usually in a biconvex shape, and about 4-10 $\mu\text{m}$  long and 2-3 $\mu\text{m}$  wide.
- Within plants most chloroplasts are found in the mesophyll cells of leaves.
- The stages of photosynthesis take place within the chloroplast, stage 1 within the granum and stage 2 within the stroma.

## Stage 1 - Light Dependent

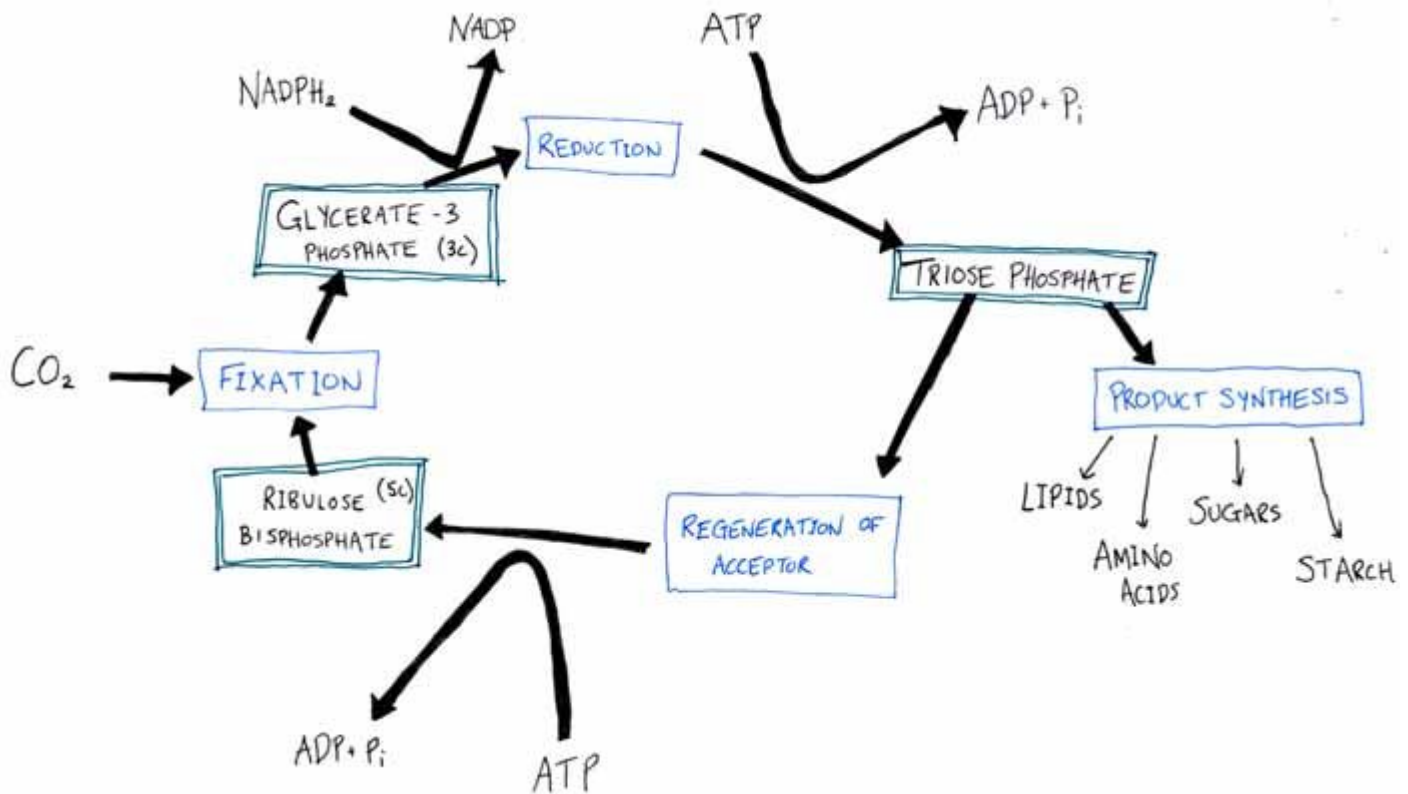
Photosynthesis consists of two main stages, the light dependent stage and the light independent stage. The light dependent stage requires light to take place whereas the light independent stage can function either with light or without.



The Light Dependent Stage Diagram.

- PSII - Light energy is trapped in PSII and boosts electrons to a higher energy level.
- The electrons are received by an electron acceptor.
- The electrons are passed from the electron acceptor along a series of electron carriers to PSI which is at a lower energy level. The energy lost by the electrons is captured by converting ADP to ATP. Light energy has thereby been converted to chemical energy.
- Light energy absorbed by PSI boosts the electron to an even higher energy level.
- The electrons are received by another electron acceptor.
- The electrons which have been removed from the chlorophyll are replaced by pulling in other electrons from a water molecule.
- The loss of electrons from the water molecule causes it to dissociate into protons and oxygen gas.
- The protons from the water molecule combine with the electrons from the second acceptor and these reduce NADP.
- The Cyclic reaction - This causes the electrons to be recycled and is used for forming more ATP.

## Stage 2 - Light Independent

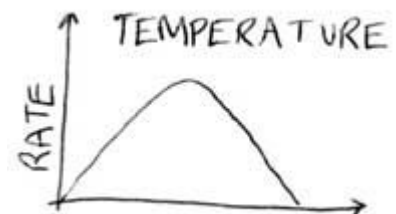


The Light Independent Stage Diagram.

- $\text{CO}_2$  diffuses into the leaf through the stomata. It then travels into the stroma of the chloroplast.
- The  $\text{CO}_2$  then combines with a five carbon ribulose bisphosphate forming an unstable six carbon intermediate.
- The six carbon intermediate breaks down into two, three carbon glycerate 3 phosphate molecules.
- Some of the ATP and  $\text{NADPH}_2$  produced during the LDS is used to convert glycerate 3 phosphate into triose phosphate.
- Pairs of triose phosphate molecules can combine to produce an intermediate hexose sugar, this can then be polymerised to form lipids, amino acids, sugars and starch.
- A portion of the triose phosphate can be regenerate the original  $\text{CO}_2$

## Factors affecting the rate of photosynthesis

- Light Intensity - the more the better (unless it's going to damage the plant)
- Compensation Point - The ratio between photosynthesis and respiration within a plant, if they're equal or more respiration takes place the plant cannot grow.
- Carbon Dioxide - This can be the most common limiting factor with plants wanting as much as possible. The atmosphere is only 0.03%  $\text{CO}_2$ .
- Temperature - since photosynthesis is a biochemical process with enzymes, temperature will affect this.
- Water - is needed during photosynthesis during stage 1.



# Mineral Deficiency in Plants

## - Nitrogen

Without nitrogen plants cannot function as they should effectively. Nitrogen is essential to their well being because it's converted into nitrate ( $\text{NO}_3^-$ ) which is used for DNA bases, amino acids and proteins. With this mineral deficiency the plant will appear smaller than it should and the leaves will be older and yellowy in colour.

## - Magnesium

Magnesium ( $\text{Mg}^{2+}$ ) is a mineral, also absorbed via the roots into the plant from the soil but is used for chlorophyll and is needed for ATPase within plants. Without this mineral the effect on the plant would only appear with the leaves being yellowy in colour.

## - Preventative

Mineral Deficiency within plants and crops can be prevented and cured with artificial fertilisers or by spreading animal manure back onto the soil to replenish any deficiencies.