

# Plastids

- Introduction
- Types and functions of plastids
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- Functions of chloroplasts

## • INTRODUCTION

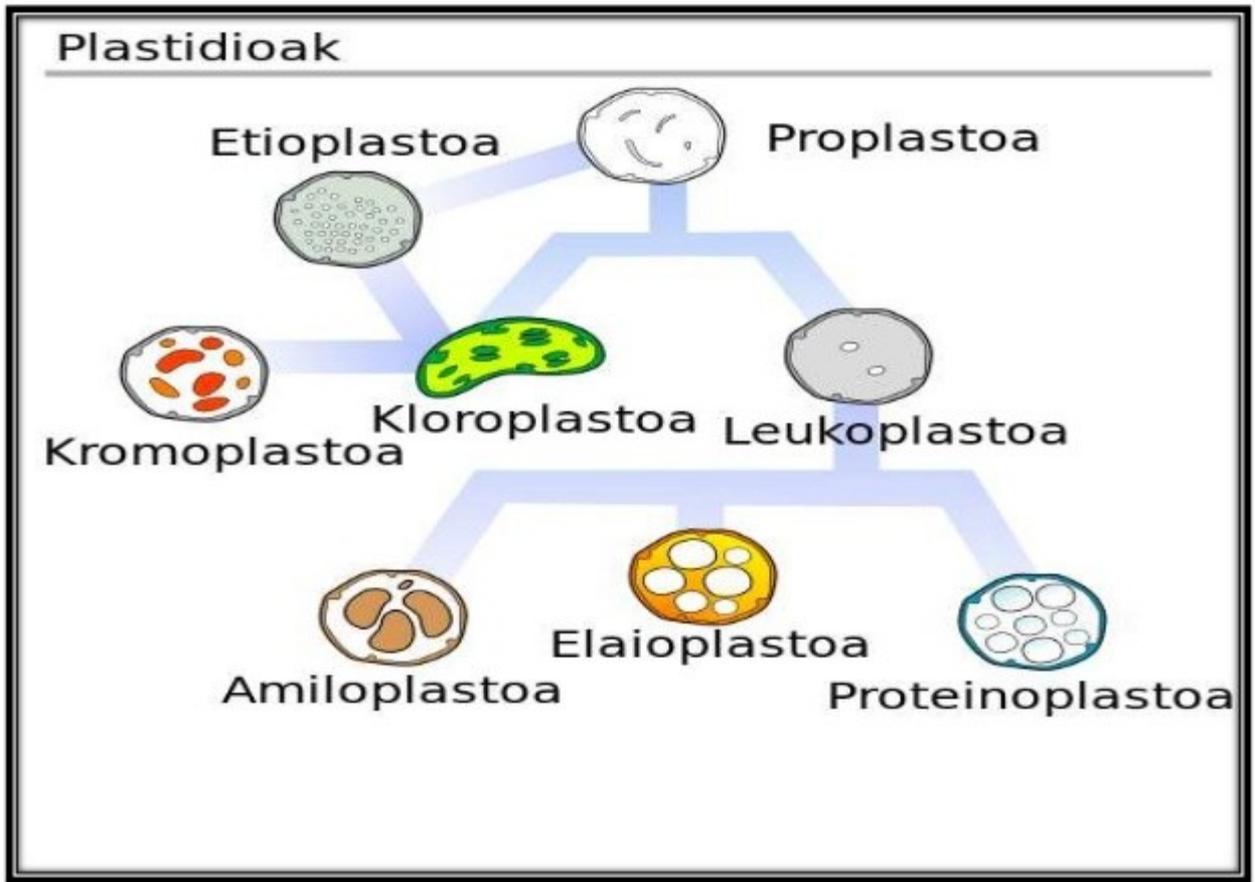
- *Plastids are large cytoplasmic organelles.*
- *Plastids are major organelles found in the cells of plants and algae.*
- *Plastids are the site of manufacture and storage of important chemical compounds used by the cell.*
- *Plastids often contain pigments used in photosynthesis and the types of pigments present can change or determine the cell's colour.*

- *The term plastid was derived from the greek word plastikas meaning formed or moulded.*
- *This term was coined by schimper in 1885.*
- *In plants, plastids may differentiate into several forms, depending upon which function they need to play in the cell.*
- *The plastids are broadly classified into two main types namely chromoplasts and leucoplasts.*

## • TYPES AND FUNCTIONS OF PLASTIDS

• *Some of the most common plastids include :*

- *CHROMOPLASTS*
- *GERONTOPLASTS*
- *LEUCOPLASTS*
- *CHLOROPLASTS*



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## **•CHROMOPLASTS**

- *Chromoplasts are what the name describes, a place for the pigments to be stored and synthesized in the plant.*
- *These are found in flowering plants, fruits, and aging leaves.*

- *The chloroplasts actually convert over to chromoplasts.*
- *There are carotenoid pigments here that allow for the different colours you see in fruits and the fall leaves.*
- *One of the main reasons for these structures and the colours is to attract pollinators.*

## **•GERONTOPLASTS**

- *Gerontoplasts are basically chloroplasts that are going through the aging process.*
- *These are chloroplasts of the leaves that are beginning to convert into different organelles or are being repurposed, since the leaf is no longer utilizing photosynthesis ( such as in the fall months ).*

## •LEUCOPLASTS

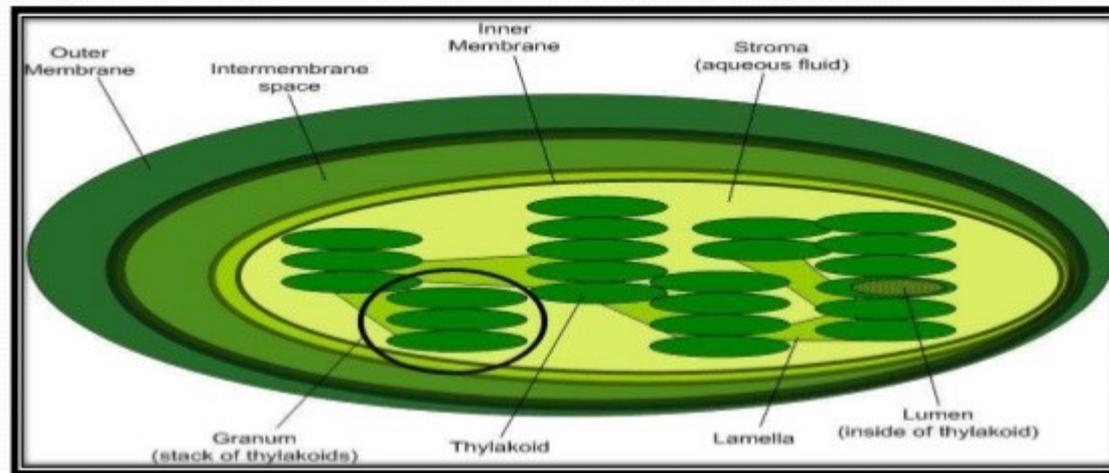
- *Leucoplasts are the non-pigmented organelles. Unlike the others we have talked about, leucoplasts have no colour at all.*
- *They are found in the non-photosynthetic parts of the plants, such as the roots.*
- *Depending on what the plant needs, they may become essentially just storage sheds for starches, lipids, and proteins.*

- *They are more readily used for synthesizing amino acids and fatty acids.*
- *Leucoplasts are further subdivided into three different plastids :*
  - *Amyloplasts*
  - *Proteinoplasts*
  - *Elaioplasts*

- *Amyloplasts are the largest of the three and are charged with storing starch.*
- *Then there are the proteinoplasts that help to store the proteins that a plant needs and are typically found in seeds.*
- *Finally, the elaioplasts are used to store fats and oils that are needed by the plant, specifically in seeds.*

## • CHLOROPLASTS

- *The chloroplasts are probably the most known of the plastids. These are responsible for photosynthesis. The chloroplast is filled with thylakoids, which is where photosynthesis occurs.*



- *Chloroplasts are organelles found in plant cells and other eukaryotic organisms that conduct photosynthesis.*
- *The word chloroplast is derived from the greek words chloros, which means green, and plast, which means form or entity.*
- *Chloroplasts are members of a class of organelles known as plastids.*
- *Shape :*  
*chloroplast varies in shape. They are spheroid or ovoid or discoid in higher plants. They are cup-shaped in chlamydomonas and spirally coiled in spirogyra.*

- Size :

- *The size of the plastids varies from species to species. But the size remains constant for a given cell type. In higher plants, it is 4-5 microns in length and 1-3 microns in thickness. Generally chloroplasts of plants growing in shady places are larger in size.*

- Number :

- *The number of chloroplasts varies from plant to plant, but it remains constant for a given plant. In higher plants there are 20 to 40 chloroplasts per cell or upto 1000 chloroplasts.*

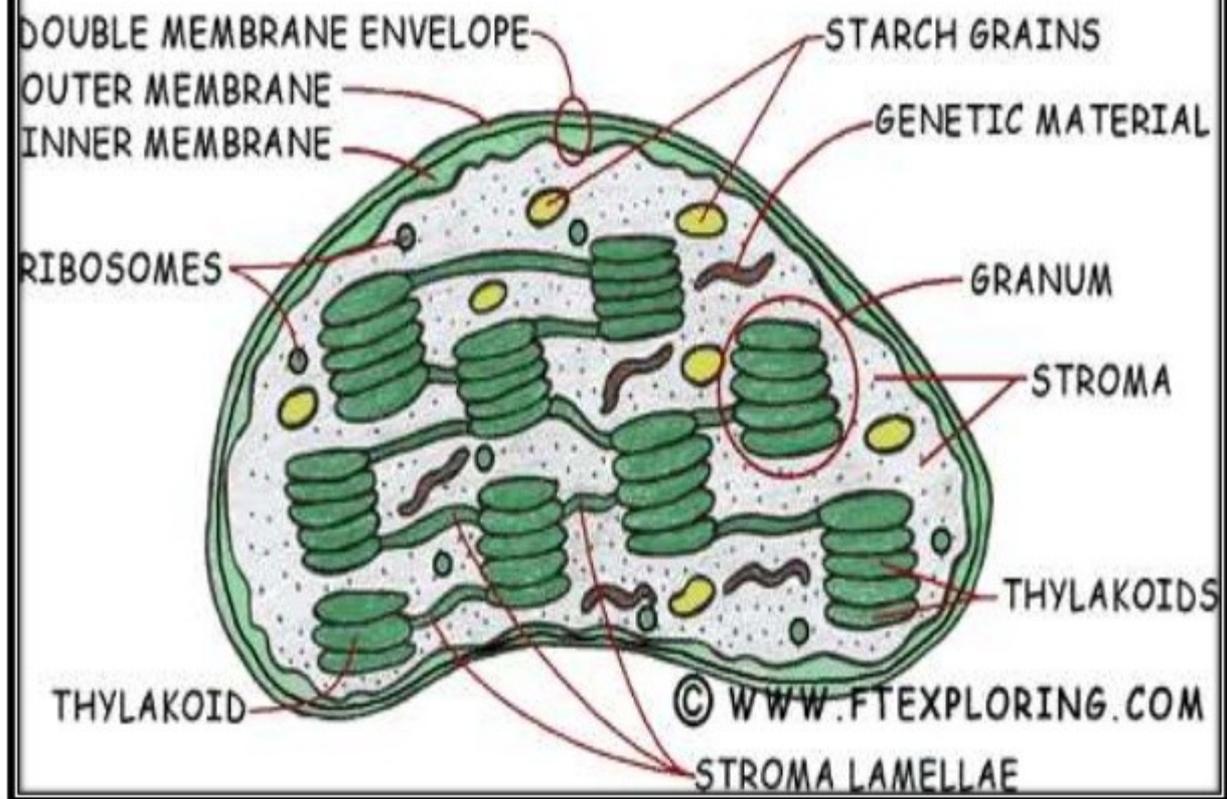
## • structure :

- *Plant chloroplasts are large organelles that, like mitochondria, are bounded by a double membrane called the chloroplast envelope.*
- *In addition to the inner and outer membranes of the envelope, chloroplasts have a third internal membrane system, called the thylakoid membrane.*
- *The thylakoid membrane forms a network of flattened discs called thylakoids, which are frequently arranged in stacks called grana.*
- *Grana are interconnected by branching membraneous tubules called frets (stromal lamellae).*

- *Because of this three-membrane structure, the internal organization of chloroplasts is more complex than that of mitochondria.*
- *In particular, their three membranes divide chloroplasts into three distinct internal compartments:*
  1. *The intermembrane space between the membranes of the chloroplast envelope*
  2. *The stroma, which lies inside the envelope but outside the thylakoid membrane*
  3. *The thylakoid lumen.*

- *A thylakoid has a flattened disk shape. Inside it is an empty area called the thylakoid space or lumen.*
- *Photosynthesis takes place on the thylakoid membrane; as in mitochondrial oxidative phosphorylation, it involves the coupling of cross-membrane fluxes with biosynthesis via the dissipation of a proton electrochemical gradient.*
- *Embedded in the thylakoid membrane are antenna complexes, each of which consists of the light-absorbing pigments, including chlorophyll and carotenoids, as well as proteins that bind the pigments. These complexes are called as quantosomes.*

# CHLOROPLAST



- *Chloroplast contains proteins, lipids, carbohydrates, DNA, RNA, carotenoids, chlorophyll and minerals. Composition of these chemical were indicated in the following table :*

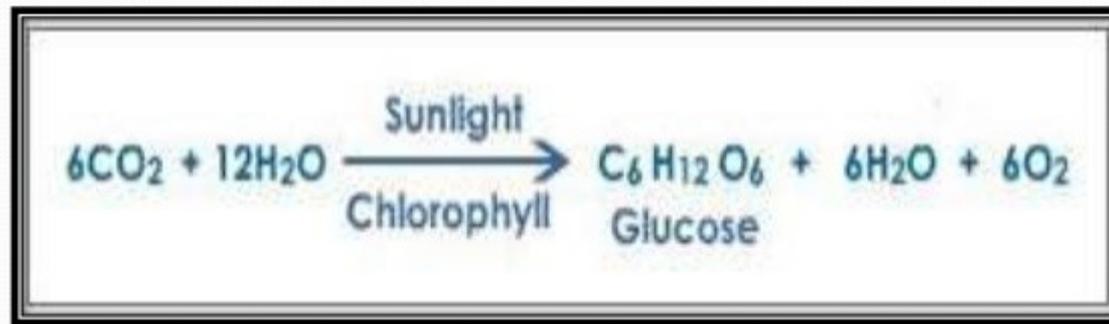
<b>S.NO.</b>	<b>Chemical</b>	<b>Percentage</b>
<b>1.</b>	<i>Proteins</i>	<b>35 - 55%</b>
<b>2.</b>	<i>Lipids</i>	<b>20 - 30%</b>
<b>3.</b>	<i>Carbohydrates</i>	<i>Variable</i>
<b>4.</b>	<i>Chlorophyll</i>	<b>9%</b>
<b>5.</b>	<i>Carotenoids</i>	<b>4.5%</b>
<b>6.</b>	<i>RNA</i>	<b>3 - 4%</b>
<b>7.</b>	<i>DNA</i>	<b>0.5%</b>
<b>8.</b>	<i>Minerals</i>	<b>0.2%</b>

- *This complex both increases the surface area for light capture, and allows capture of photons with a wider range of wavelengths.*
- *The energy of the incident photons is absorbed by the pigments and funneled to the reaction centre of this complex through resonance energy transfer.*
- *Two chlorophyll molecules are then ionised, producing an excited electron, which then passes onto the photochemical reaction centre.*

## Function of chloroplast

- *1. Chloroplast are the centres of synthesis and metabolism of carbohydrates. During photosynthesis, carbon dioxide and water are converted into organic substances ( sugars, polysaccharides, fats and amino acids ) in the presence of light :*
- *Thus can be represented by general equation :*

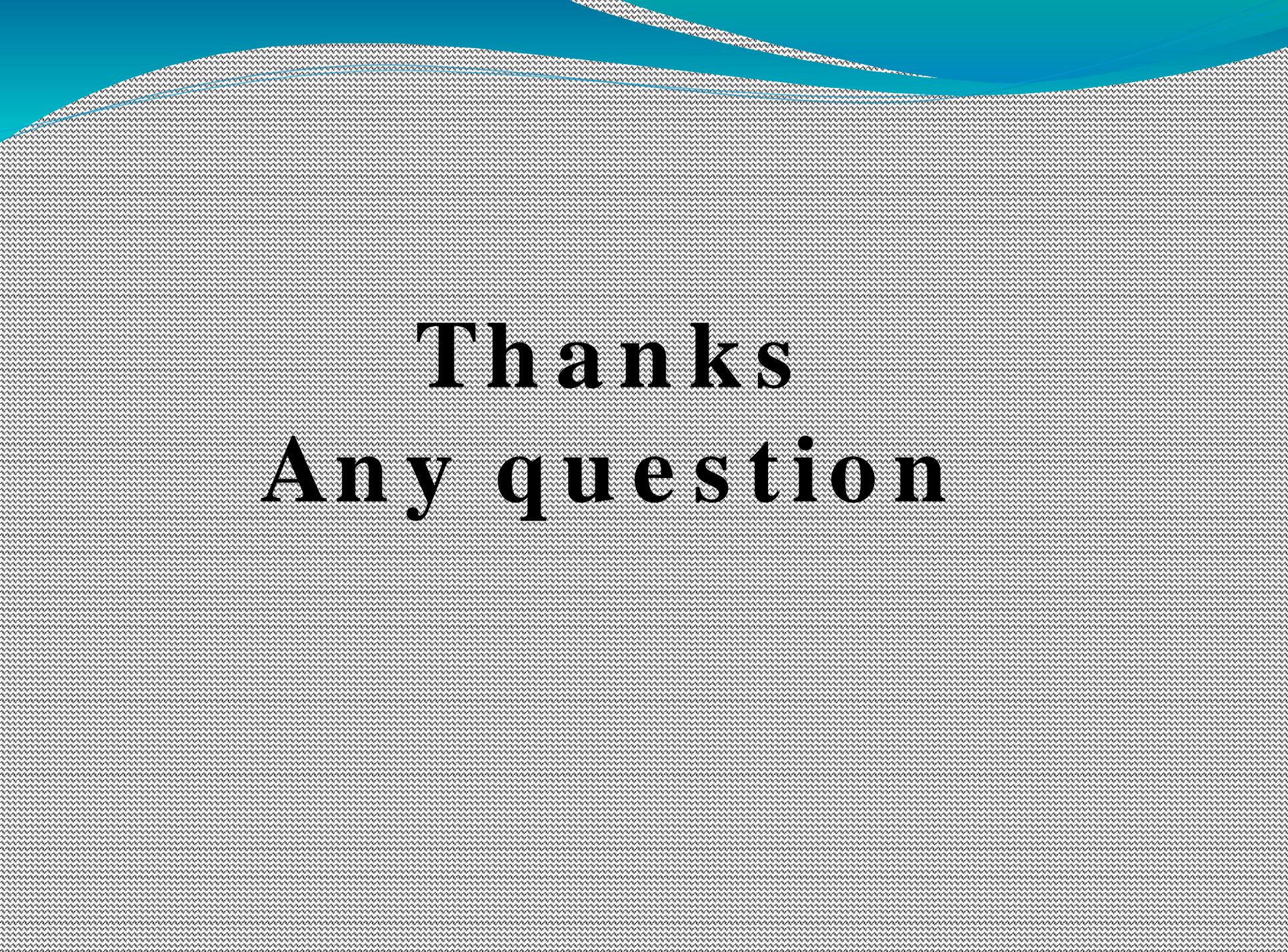
- *When hexose sugar is formed the equation is as follows :*



- *Photosynthesis consists of a primary light reaction and a dark reaction ( which is independent of light ).*

- *During the primary light reaction, 'photolysis' or splitting of water takes place.*
- *The hydrogen causes the reduction of an acceptor such as NADP.*
- *During the dark reaction the reduced acceptor NADPH is utilized for the reduction of CO<sub>2</sub> to a primary product which eventually becomes a carbohydrate. During the light reaction ADP is phosphorylated to ATP. (photophosphorylation)*

- *2. The similarities which chloroplast has with the mitochondria as regards structure and function, led to believe that they contain the enzymes for the kreb's cycle and for the synthesis of fatty acids.*
- *Chloroplast actively incorporates amino acids in the presence of ATP and capable of a certain degree of protein synthesis.*



**Thanks**  
**Any question**