E-Study material
For 1st Semester Botany Honours (CBCS)
Course Code: BC102 T
Core Course II: BIO-MOLECULES AND CELL BIOLOGY
Unit 1: The cell, cell wall and plasma membrane
Topic: Plastids

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PLASTIDS

Plastids are largest cell organelles. These are involved in the formation and storage of soluble and insoluble carbohydrates. **PLASTIDS** were discovered by **Schimper (1880).** The term 'plastid' was coined by **E. Haeckel (1866).**
Schimper divided plastids into three types on the basis of presence or absence of different pigments.

a. **Leucoplasts :**(Leukos-white + plast - living) These are colourless plastid., found in the under ground parts of plants which are not exposed to light. They are also found in embryonic cells, germ cells and meristematic cells. They are classified into:

i) Amyloplasts: store starch.
(ii) Elaioplats or oleosomes store fats and essential oils and
(iii) Proteinoplasts or aleuroplasts store proteins.

b. **Chromoplasts** (Chroma - colour + plast - living)**:**

They are coloured plastids found in petals, fruits and root of certain higher plants.
The red colour of ripe tomatoes is the result of chromoplasts which contain the red pigment lycopene. The chromoplasts of Capsicum fruits (red pepper) contain capsanthin pigment. Chromoplasts containing phycocyanin and phycoerythrin are found in algae.

c. **Chloroplasts** (Chloro-green + plast - living)**:**

These are the most important and common plastids found in all the photosynthesizing cells except prokaryotes. Blue-green algae lack chloroplasts and have loosely arranged membrane in the cytoplasm. These membranes are in the form of sacs or thylakoid of typical unit membrane structure called lamellae. In photosynthetic bacteria (e.g. purple sulphur bacteria), vacuole-like chromatophore containing pigments are present.

Ultra structure of Chloroplasts:

Chloroplasts are plant cell organelles that convert light energy into relatively stable chemical energy via the photosynthetic process. Each chloroplast is bounded by two unit membranes separated by space called **periplastidial space.** Outer membrane contains integral proteins called **porins**, which make the membrane permeable to solutes. The inner membrane is relatively impermeable and inner to membranes; matrix is present which is divided into two portions:

(i) Grana,
(ii) Stroma

1. **Grana:**

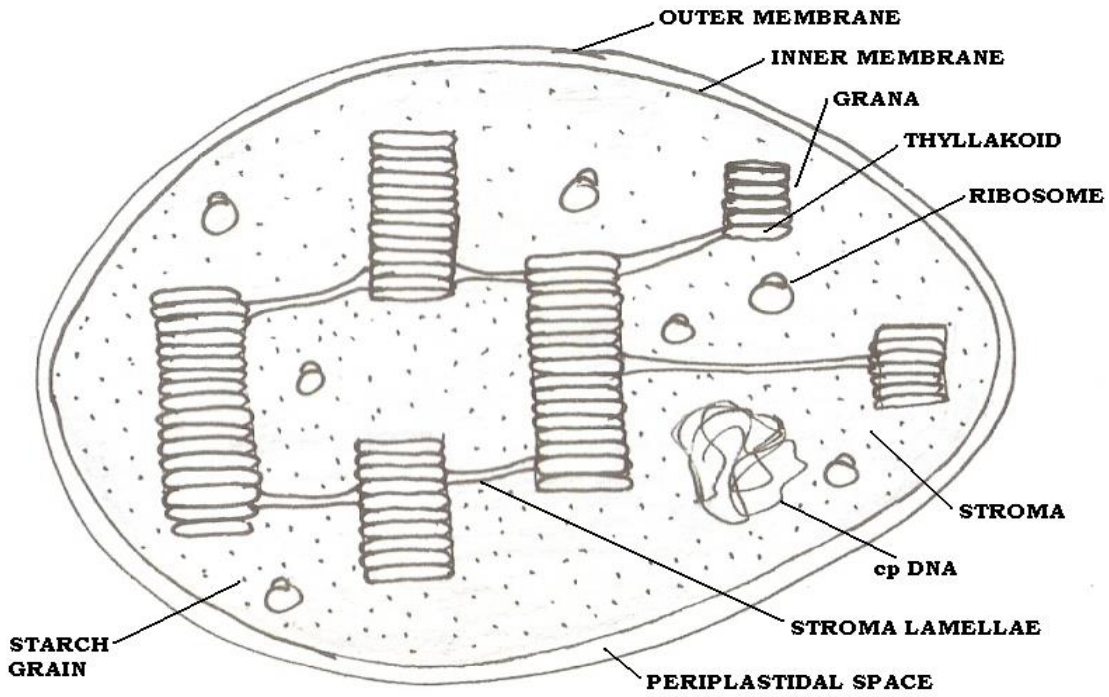
Light reaction of photosynthesis occurs in this fraction. Grana consists of membranous or lamellar system. This lamellar system is made up of thylakoids (term given by Menke, 1961), which are of two types:

(a) Smaller thylakoids : These are placed one above the other in form of stacks of coins and form a granum. The number of grana per chloroplast is 40-60 and the number of thylakoids per granum is 10-100. On the inner face of thylakoid membrane, there are present minute granular structures called **quantasomes,** which are morphological expressions of photosynthetic units. **Park and Biggins (1964) discovered quantasomes**. Each quantasome is having 230 chlorophyll molecules.

(b) Larger thylakoids : These are long membranous structures which are named as inter-granal lamellae or stroma lamellae or fret channels.

2. Stroma:

Dark reaction of photosynthesis occurs in this fraction. The stroma is proteinaceous matrix. It has 20-60 copies of circular double stranded DNA. Each DNA copy is 40 □ in length which can code for 125 proteins. Chloroplast shows semi-autonomous nature due to presence of DNA, DNA polymerase, RNA polymerase enzymes and ribosomes (ribosomes of chloroplast are of 70S type).



STRUCTURE OF CHLOROPLAST

Chloroplasts are also like mitochondria in being semi-autonomous. They can grow and divide and their DNA contains a portion of genetic information needed for the synthesis of chloroplast protein.

Functions of Chloroplast:

Following are the important chloroplast functions:

The most important function of the chloroplast is to synthesize food by the process of photosynthesis.

Absorbs light energy and converts it into chemical energy.

Chloroplast has a structure called chlorophyll which functions by trapping the solar energy and is used for the synthesis of food in all green plants.

Produces NADPH and molecular oxygen (O2) by photolysis of water.

Produces ATP – Adenosine triphosphate by the process of photosynthesis.

The carbon dioxide (CO_2) obtained from the air is used to generate carbon and sugar during the Calvin Cycle or dark reaction of photosynthesis