

Size - Chloroplasts are of different sizes in different plants. In higher plants, chloroplasts are about 2-10 μm in size.

Number - The number of chloroplasts per cell varies in different plants. In higher plants, there are 20-40 chloroplasts per cell.

Ultrastructure - Chloroplasts consist of a smooth unit membrane (stroma) and internal membranes (grana). The grana are stacked and separated by intergranal space. The membranes contain proteins, lipoproteins, and chlorophyll. The chloroplast is a semi-autonomous organelle.

- (A) The matrix in stroma
- (B) The grana

(A) The matrix in stroma - Chloroplasts contain a fluid matrix called stroma. It is the site of the dark reaction of photosynthesis. The stroma contains enzymes, DNA, and ribosomes.

(B) The grana - Chloroplasts contain internal membranes called grana. Grana are stacks of thylakoids. The light reaction of photosynthesis takes place in the grana. The size of grana varies from 2-7 μm.

Higher plants chloroplasts have grana. Each granum is a stack of thylakoids. The thylakoids are flattened membrane compartments. In higher plants, grana are interconnected by stroma lamellae.

Thylacoid membranes of Quantasomes

Quantasomes are photosynthetic units which are found in plants. Quantasomes are 300-400 pigment molecules which are found in Quantasomes, stroma lamellae of chloroplasts. In plants, the chloroplasts are found in the stroma lamellae. The chloroplasts are found in the stroma lamellae. The chloroplasts are found in the stroma lamellae. The chloroplasts are found in the stroma lamellae.

Chemical composition of Chloroplasts

Protein - 40-50%, Phospholipids - 25%, Chlorophyll - 5-10%, Carotenoids - 1-2%, RNA - 5%, DNA - 1% **Fig: → here**

(i) Pyrenoid and stigma :- Algae and protozoa have chloroplasts with pyrenoid and stigma (eye spot) and starch. Pyrenoid, polysaccharides and starch are found in the chloroplasts of higher plants.

(ii) DNA of chloroplast :- Algae and chloroplasts have chloroplast DNA. Chloroplast DNA is different from bacterial DNA. Chloroplast DNA is cytoplasmic inheritance and division. DNA is present in chloroplasts.

(iii) Ribosome of chloroplast :- Chloroplasts have ribosomes which are cytoplasmic ribosomes. Ribosomes are 70S type which are similar to bacterial ribosomes.

Function :-

(1) Photosynthesis :- Photosynthesis, chloroplasts are found in plants. Photosynthesis is the process by which chloroplasts convert light energy into chemical energy. Light energy is converted into chemical energy, which is stored in the form of glucose and other chemical bonds.

Photosynthesis is the process by which chloroplasts convert light energy into chemical energy. Light energy is converted into chemical energy, which is stored in the form of glucose and other chemical bonds. Sun light, CO₂, H₂O are the raw materials for photosynthesis. The steps are as follows:-

vesicles and $\frac{1}{2}$ of stroma is present in the $\frac{1}{2}$ of vesicles, basel of lamellae and $\frac{1}{2}$ of stroma. The lamellae are $\frac{1}{2}$ of stroma and $\frac{1}{2}$ of stroma. Light is absorbed by $\frac{1}{2}$ of stroma.

(iii) Nuclear origin - This concept is given by Pringle. It is the initial nuclear membrane at evagination of $\frac{1}{2}$ of stroma.

(iv) Monotropic development - This concept is given by Plastid, Autosomal origin. It is the $\frac{1}{2}$ of stroma and $\frac{1}{2}$ of stroma. It is the $\frac{1}{2}$ of stroma and $\frac{1}{2}$ of stroma.

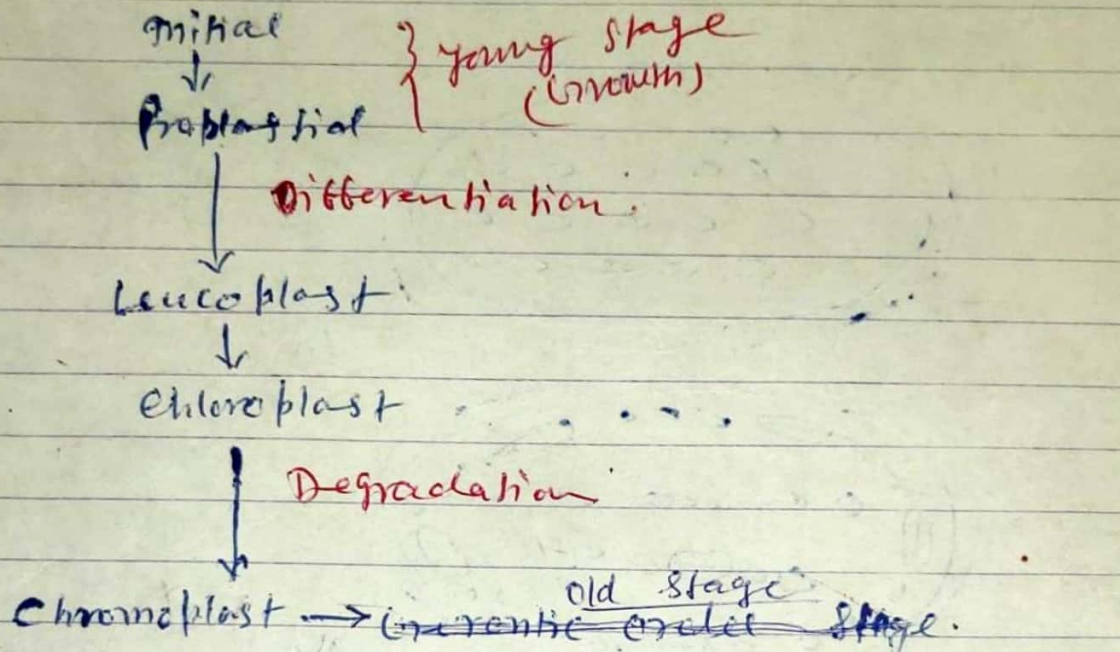
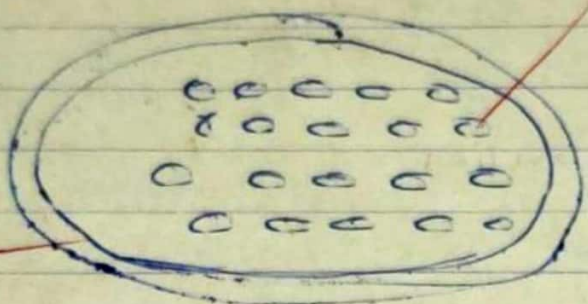
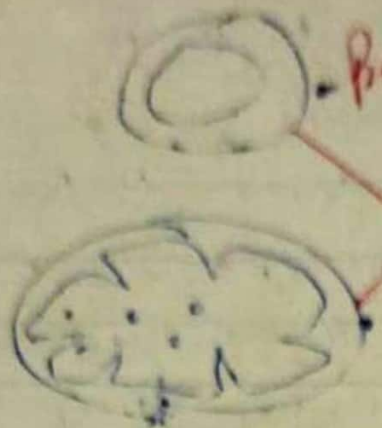


Fig: Monotropic development of plastids.

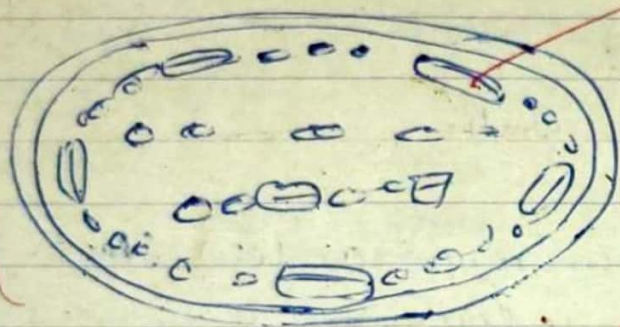
(v) Symbiotic origin of chloroplast - The chloroplast is a symbiotic organism. It is the $\frac{1}{2}$ of stroma and $\frac{1}{2}$ of stroma. It is the $\frac{1}{2}$ of stroma and $\frac{1}{2}$ of stroma. It is the $\frac{1}{2}$ of stroma and $\frac{1}{2}$ of stroma.

Fig: -

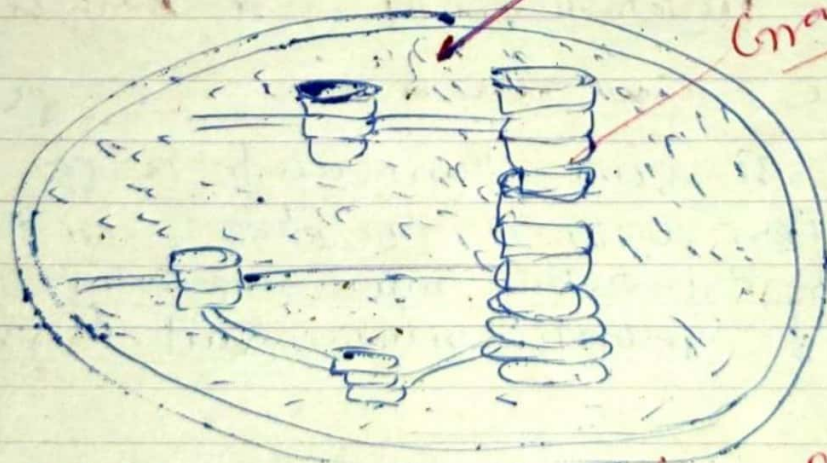
Proplastid phase



Differentiation phase



Maturation phase



Development of chloroplast from sub-microscopic proplastid in the presence of light

(Procl) (Chl)