

Introduction to Botany. Lecture 9

Alexey Shipunov

Minot State University

September 20, 2013



Outline

1 Questions and answers

2 Plant cell

- Cells from cells: mitochondria and chloroplasts



Outline

1 Questions and answers

2 Plant cell

- Cells from cells: mitochondria and chloroplasts



Previous final question: the answer

What is the symbiogenesis?



Previous final question: the answer

What is the symbiogenesis?

- Making one organism from two in the process of evolution



Plant cell

Cells from cells: mitochondria and
chloroplasts

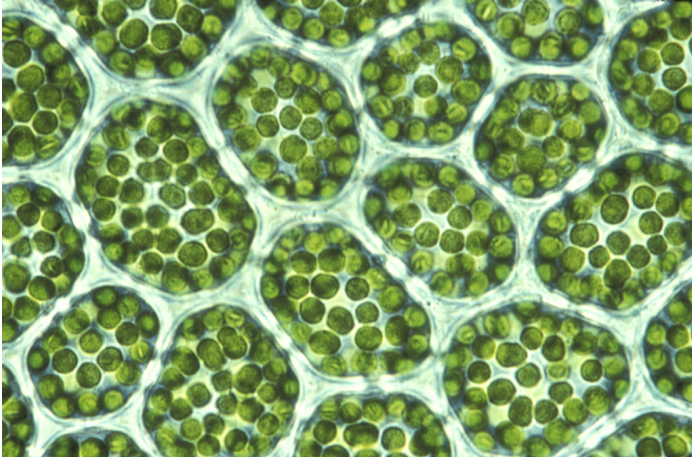


Symbiogenesis

- Small, rigid procaryotic cells became larger to escape from predators
- To keep all parts of larger cell communicable, they developed cytoplasm motility based on actin protein
- Cytoplasm motility allowed for phagocytosis so they became predators
- These predator cells captured many bacteria and digested them in lysosomes; they also developed nucleus to (a) guard DNA and (b) prevent the horizontal transfer of genes from alien organisms
- Some of prey were not digested (probably, by mistake) but were still useful because they provide ATP
- This condition were naturally selected, and these prey became mitochondria; mitochondria originated from purple bacteria
- Some mitochondrial eukaryotes also captured cyanobacteria (plants₁) and became algae with chloroplasts



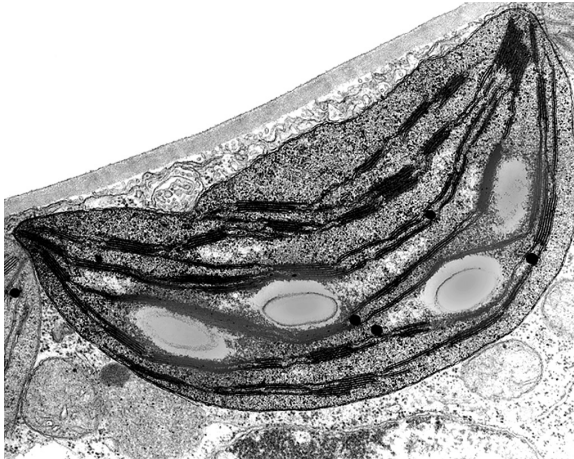
Plastids



Chloroplasts in leaf cells of *Rhizomnium pseudopunctatum* (LM $\times 500$)



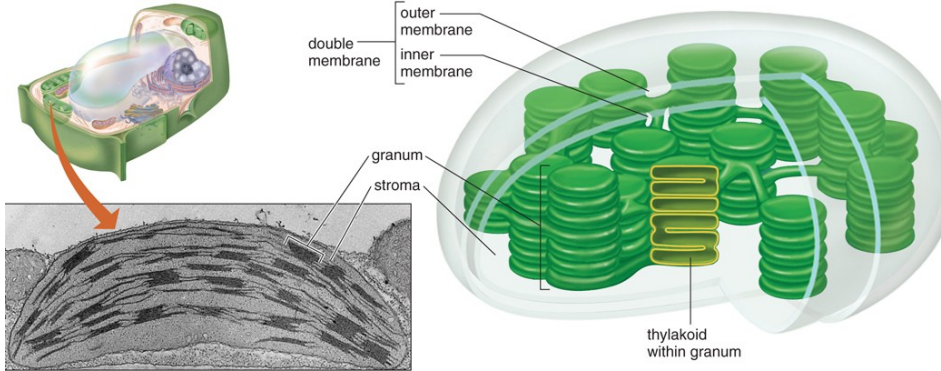
Plastid structure



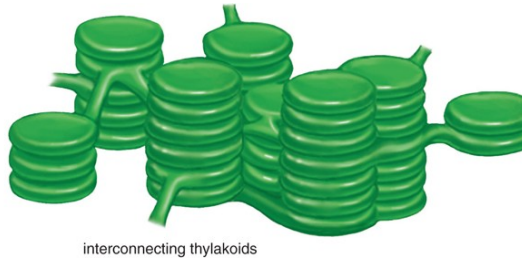
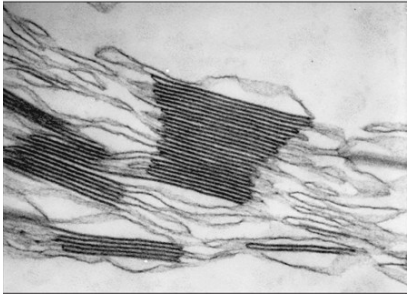
Tylacoids, stroma and starch granules (TEM $\times 37,500$)



Scheme of plastid



Grana

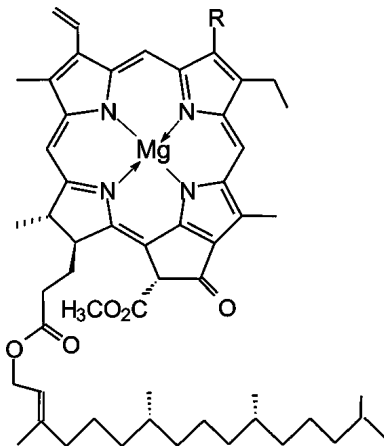


Pigments

- Chlorophylls (*a* and *b*) are photosynthetic lipids, including magnesium (Mg)
- Carotenoids facilitate photosynthesis, responsible for autumn colors



Chlorophylls *a* and *b*



chlorophyll *a* (R = CH₃)

chlorophyll *b* (R = CH=O)

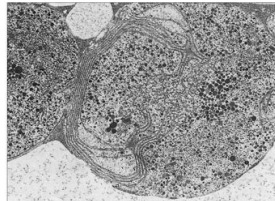
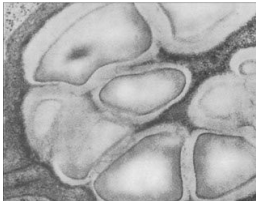
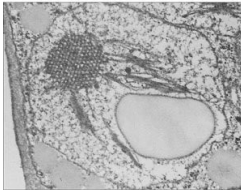
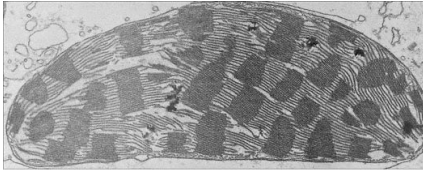


Plastid types

- **Chloroplast** (from “chloro-” = “yellow-green”). Photosynthesis, convert light energy into chemical energy, store carbohydrates as starch grains
- **Leukoplast** (from “leuko-” = “white”). Store carbohydrates in form of starch
- **Amyloplast** (from “amylo-” = “starch”). Leukoplasts that contain large granules of starch
- **Chromoplast** (from “chromo-” = “color”). Stores carotenes and xanthophylls, give orange-to-red color to certain plant tissues.



Plastid types: chloro-, leuco-, amylo- and chromo-



Mitochondria



Mitochondrion showing foliate *cristae* and matrix granules. Mitochondria are the main energy source (in form of ATP) of the cell (TEM)



Final question (2 points)



Final question (2 points)

What are differences between chloroplasts and mitochondria?



Summary

- Eukaryotic cell is a “second-level” cell, cell from cells
- Chloroplasts and mitochondria are both results of symbiogenesis



For Further Reading



A. Shipunov.

Introduction to Botany [Electronic resource].

2010—onwards.

Mode of access:

http://ashipunov.info/shipunov/school/biol_154



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.

Plant Biology. 2nd edition.

Thomson Brooks/Cole, 2006.

Chapter 3.

