Introduction to Botany. Lecture 9

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Outline

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Previous final question: the answer

Name at least two differences between prokaryotic and eukaryotic cell.

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Name at least two differences between prokaryotic and eukaryotic cell.

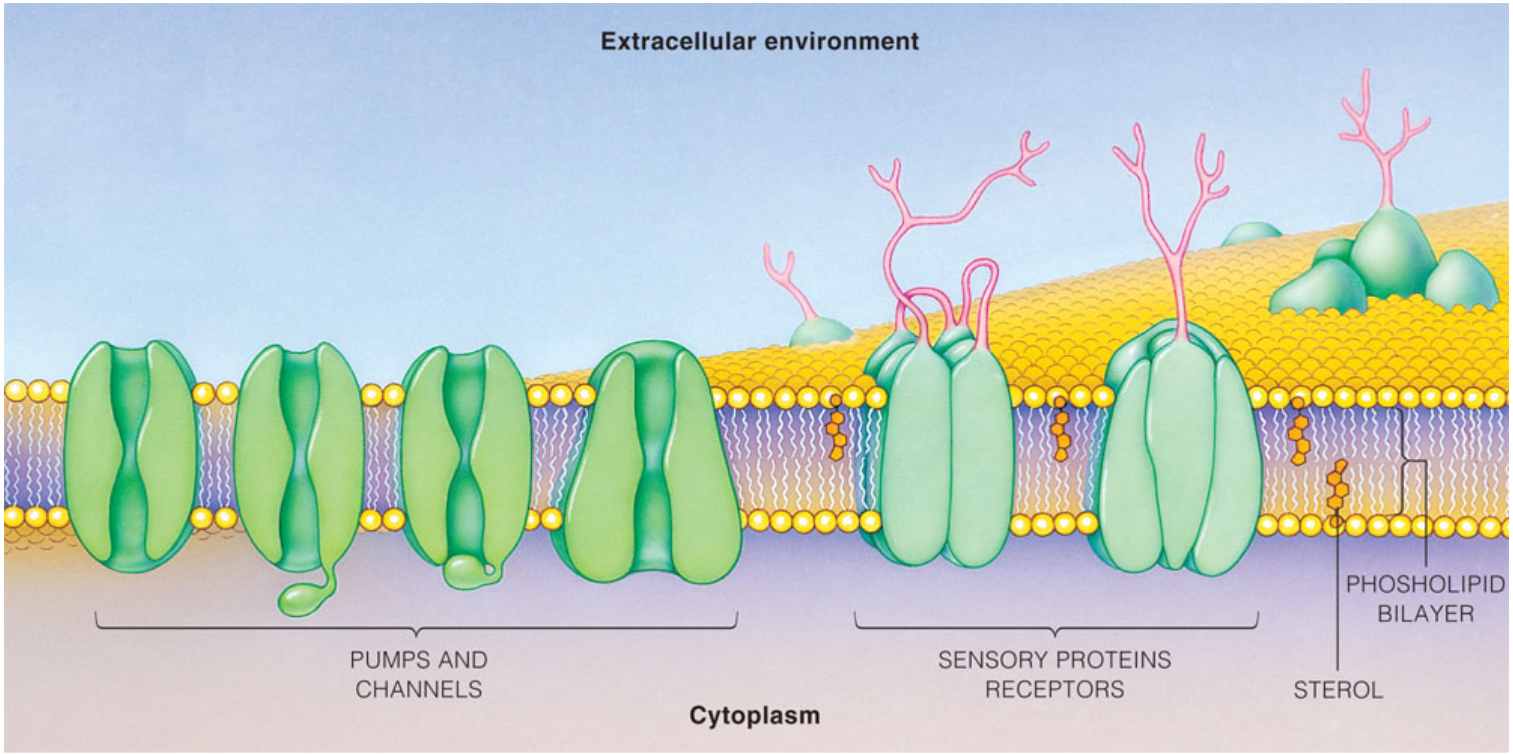
- Nucleus
- Amount of DNA
- Size
- Complexity

Cells

List of cell structures

- Cell membrane
- Cytoplasm
- Nucleus, nuclear pore, nucleolus, chromatine
- Chloroplast, thylakoids
- Mitochondrion, cristae
- ER (endoplasmatic reticulum/network)
- Goldgi apparatus (AG)
- Vacuoles, lysosomes, peroxisomes
- Ribosomes
- Cell wall

Plasma mebmrane



Phospholipids, sterols, proteins: pumps, receptors, channels

Plant cell

Cells from cells: mitochondria and chloroplasts

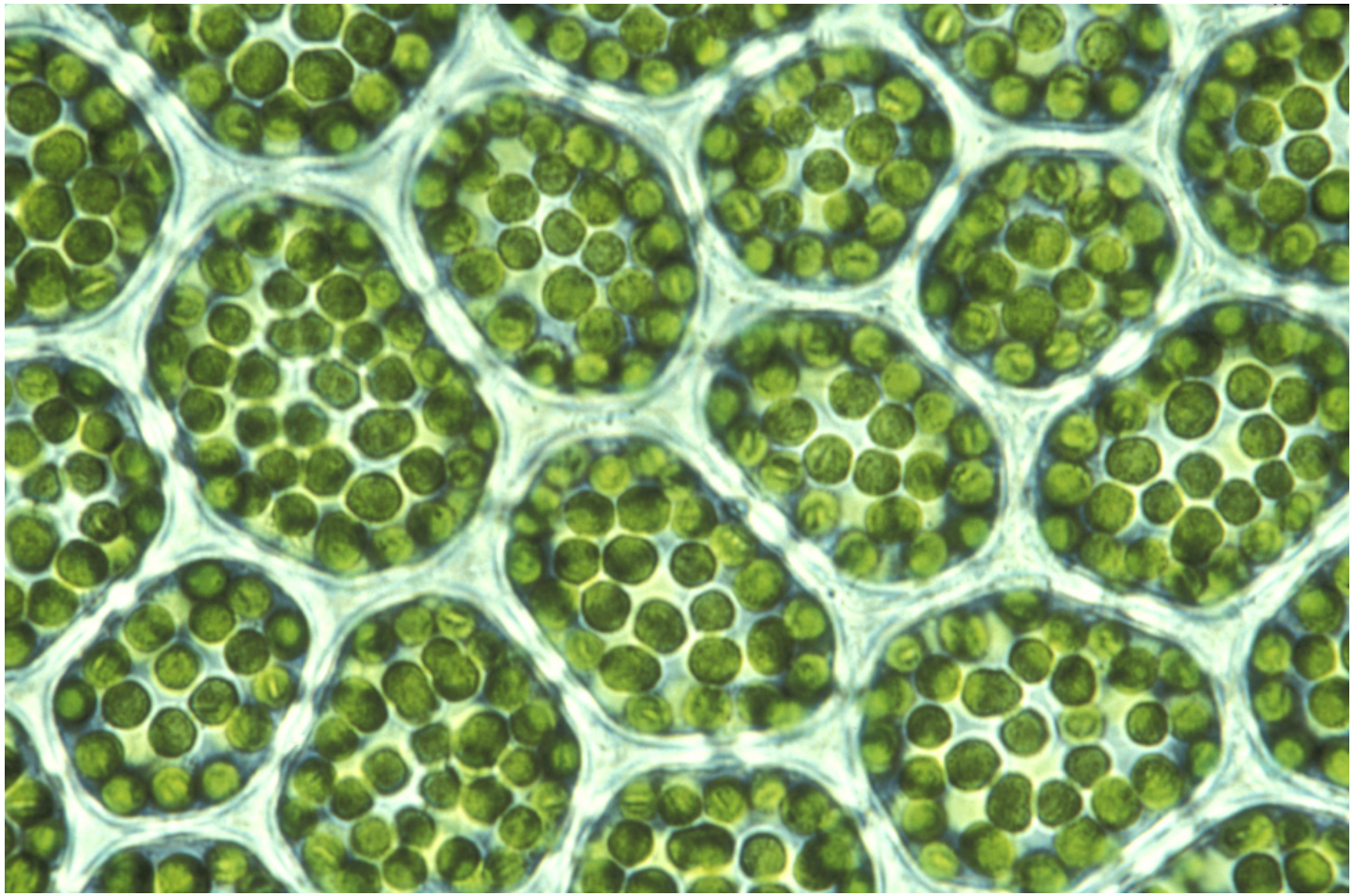
Symbiogenesis

- Small, rigid procaryotic cells became larger to escape from competition
- 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 mitochondial eukaryotes also *captured cyanobacteria* (plants_1) and became *algae with chloroplasts*

Genomes

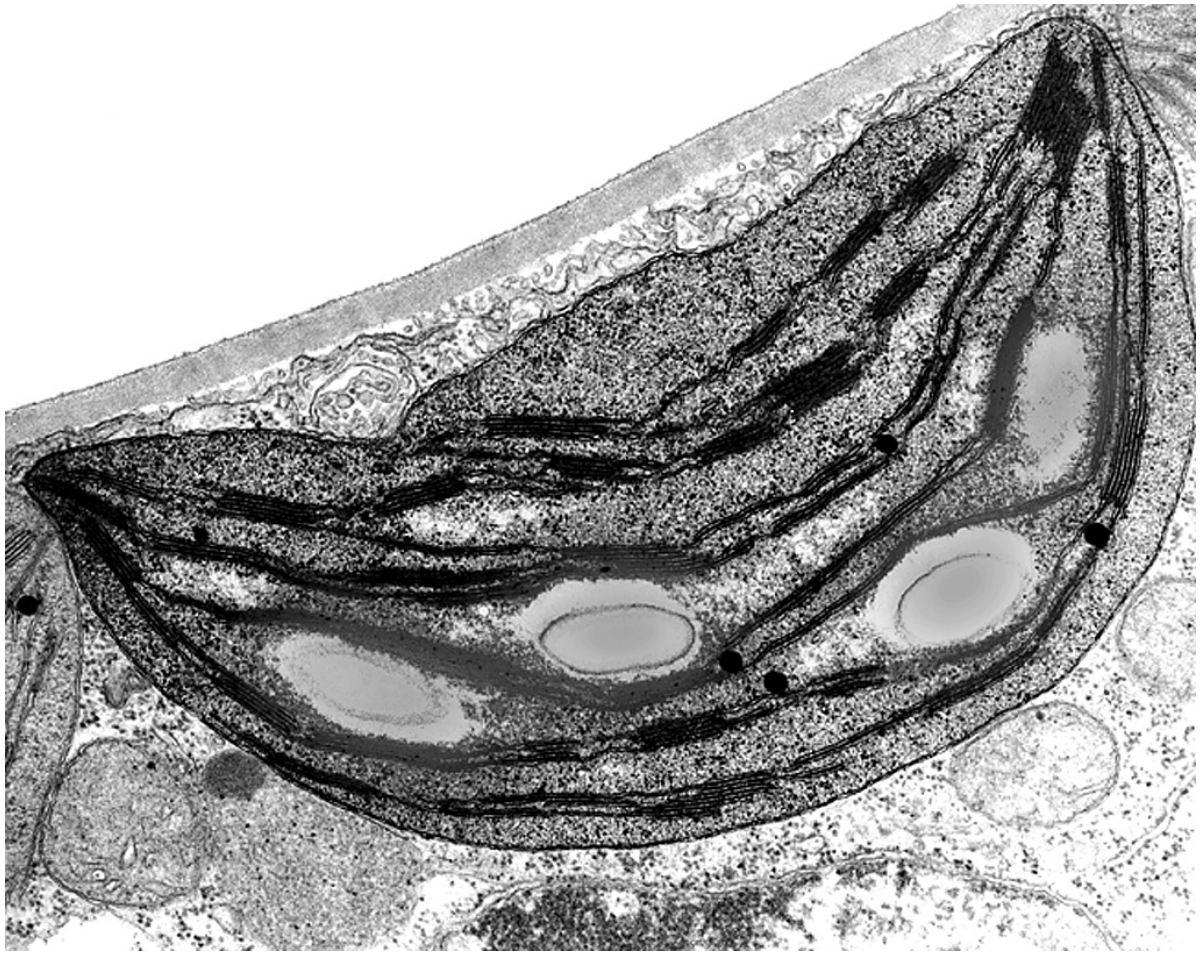
- Cells of all eukaryotes have two genomes
- Nuclear genome usually has biparental origin
- Mitochondia normally originate only from mother
- Plant cells *have three genomes*
- Chloroplast genome is inherited maternally.

Plastids



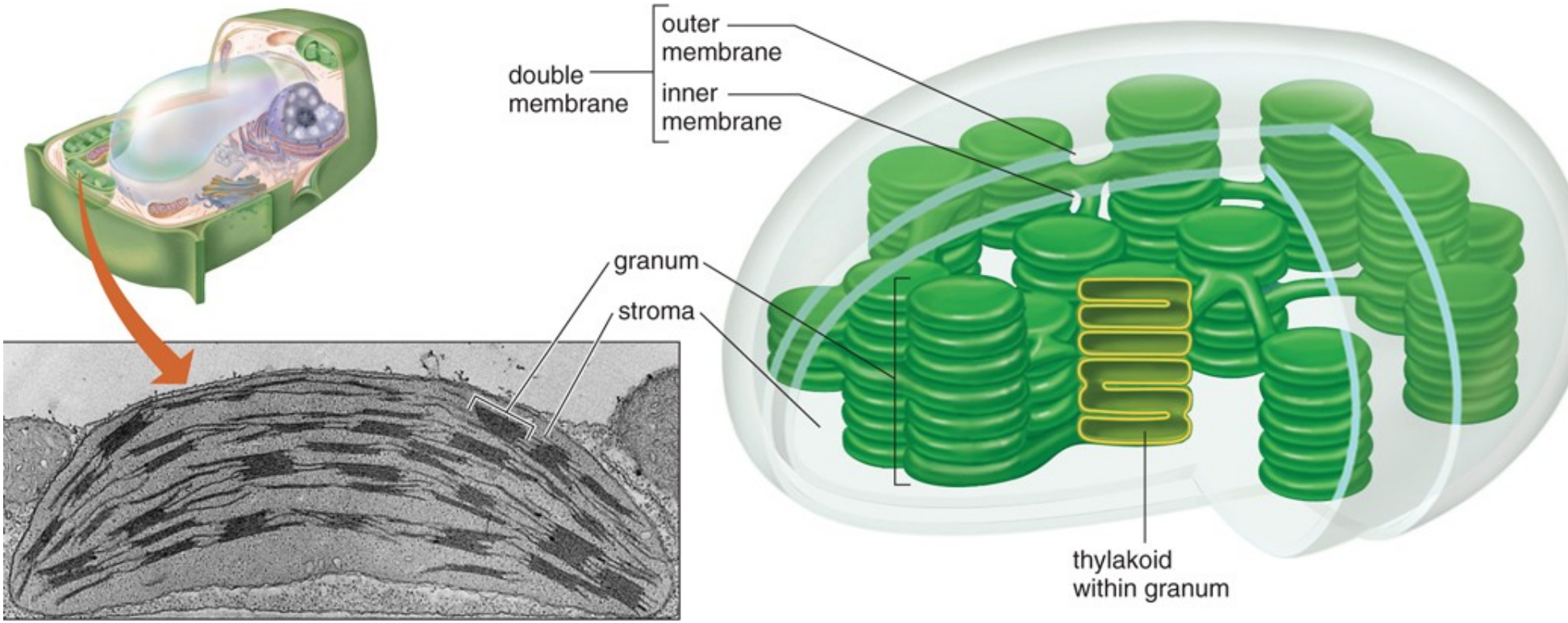
Chloroplasts in leaf cells of *Rhizomnium pseudopunctatum* (LM $\times$500)

Plastid structure

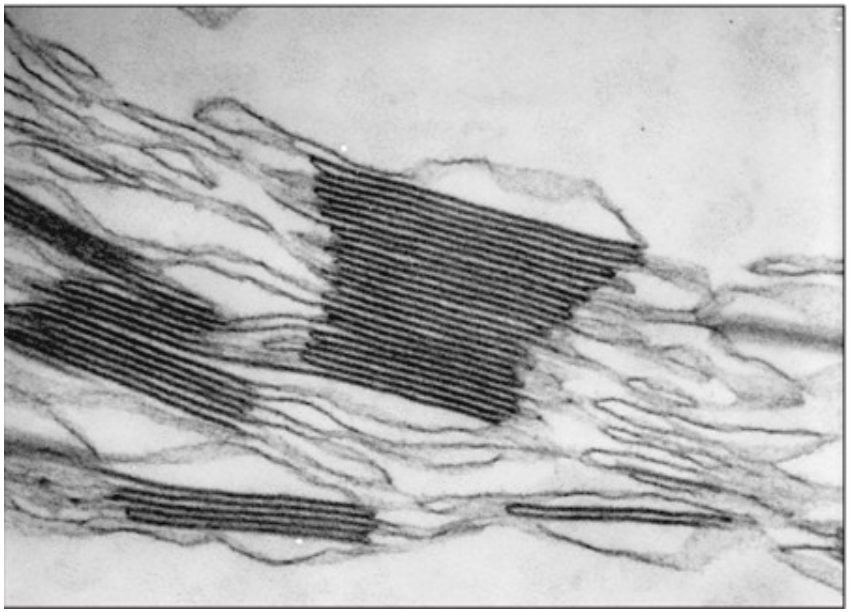


Tylacoids, stroma and starch granules (TEM $\times 37,500$)

Scheme of plastid



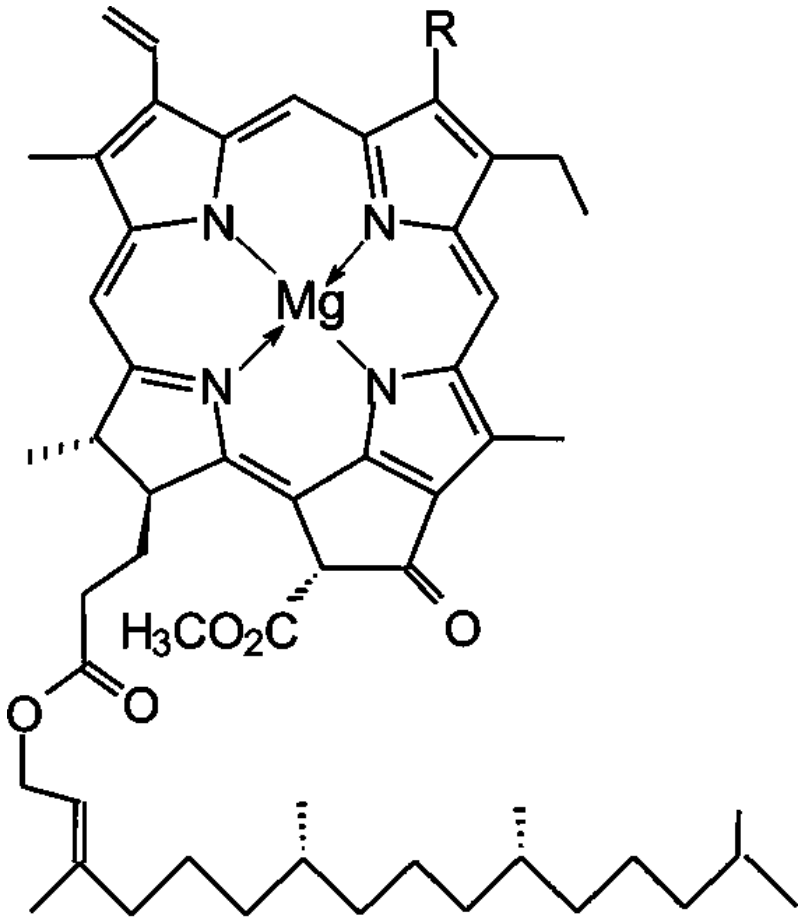
Grana



Pigments

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

Chlorophylls *a* and *b*

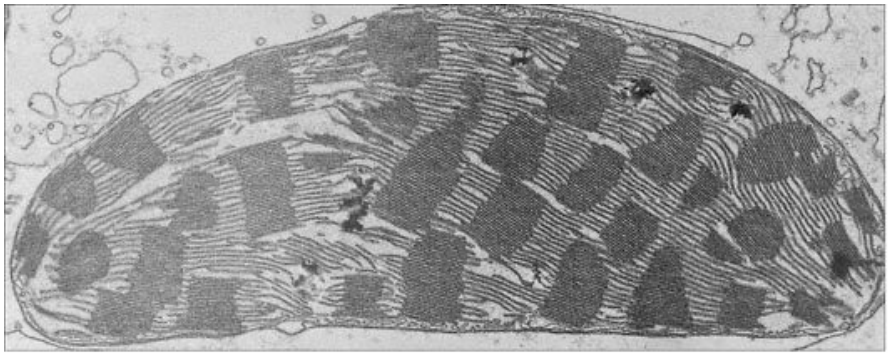


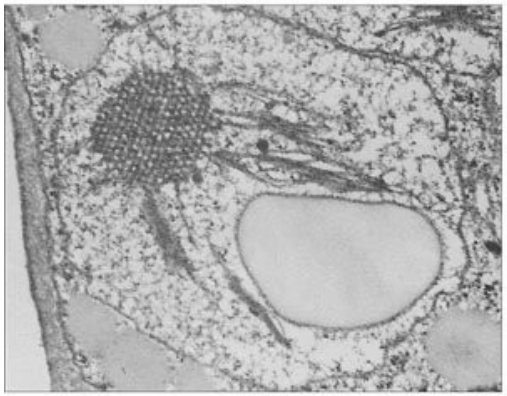
chlorophyll *a* (R = CH_3)
chlorophyll *b* (R = CH=O)

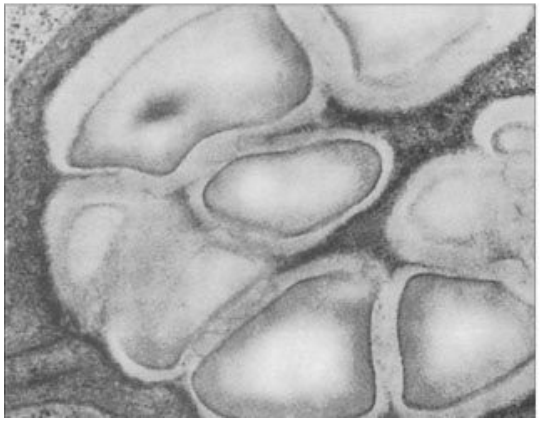
Plastid types

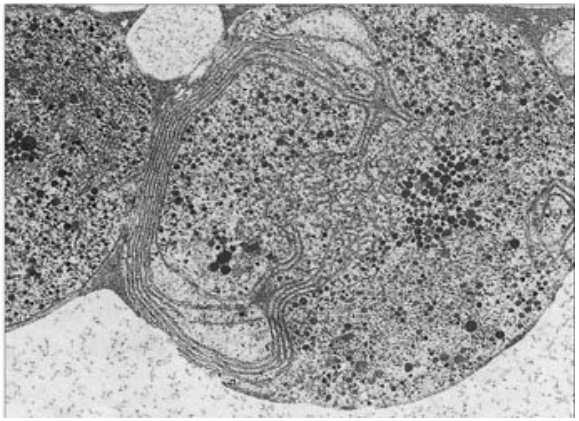
- **Chloroplast** (from “chloro-” = “yellow-green”). Photosynthesis, convert light energy into chemical energy, store carbohydrates as starch grains
- **Leukoplast** (from “leuko-” = “white”). Store carbohydrates in form of starch
- **Amyloplast** (from “amylo-” = “starch”). Leukoplasts that contain 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)

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What is the symbiogenesis?

Summary

- Eukaryotic and prokaryotic cells are cells of different levels of organization; in essence, eukaryotic cells are ecosystems, cells 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

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Plant Biology. 2nd edition.
Thomson Brooks/Cole, 2006.
Chapter 3.