Introduction to Botany

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Minot State University

Lecture 12

Outline

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Questions and answers

Quiz

Quiz question (2 points)

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Plant cell

List of cell structures

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

Chloroplasts and mitochondria are both results of 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

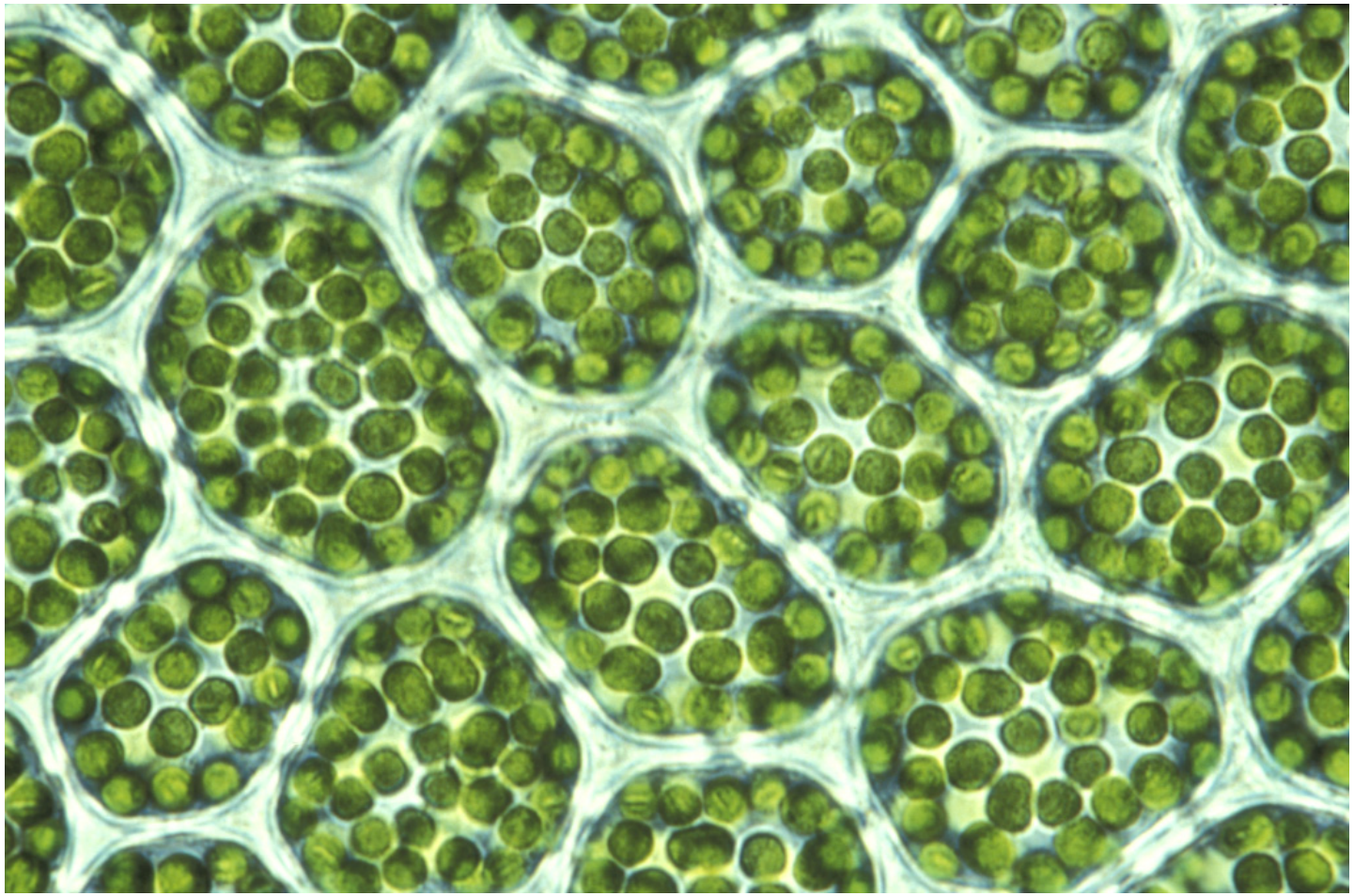
These predator cells captured many bacteria and digested them in lysosomes; they also developed nucleus to (a) guard DNA and (b) prevent the horizontal transfer of genes from alien organisms

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

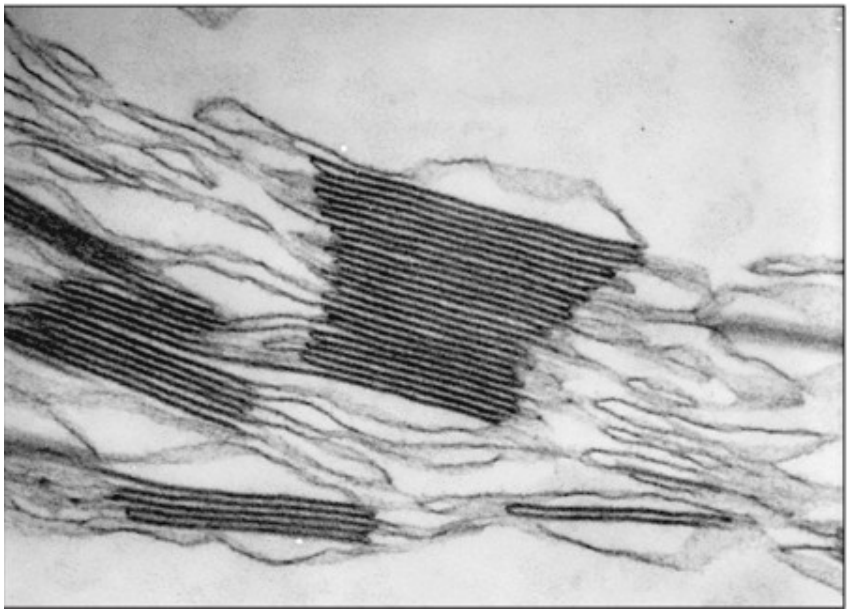
Some mitochondial eukaryotes also captured cyanobacteria (plants$_1$) and became algae with chloroplasts

Plastids



Green plastids (chloroplasts) in leaf cells of Rhizomnium pseudopunctatum (LM $\times$500)

Grana

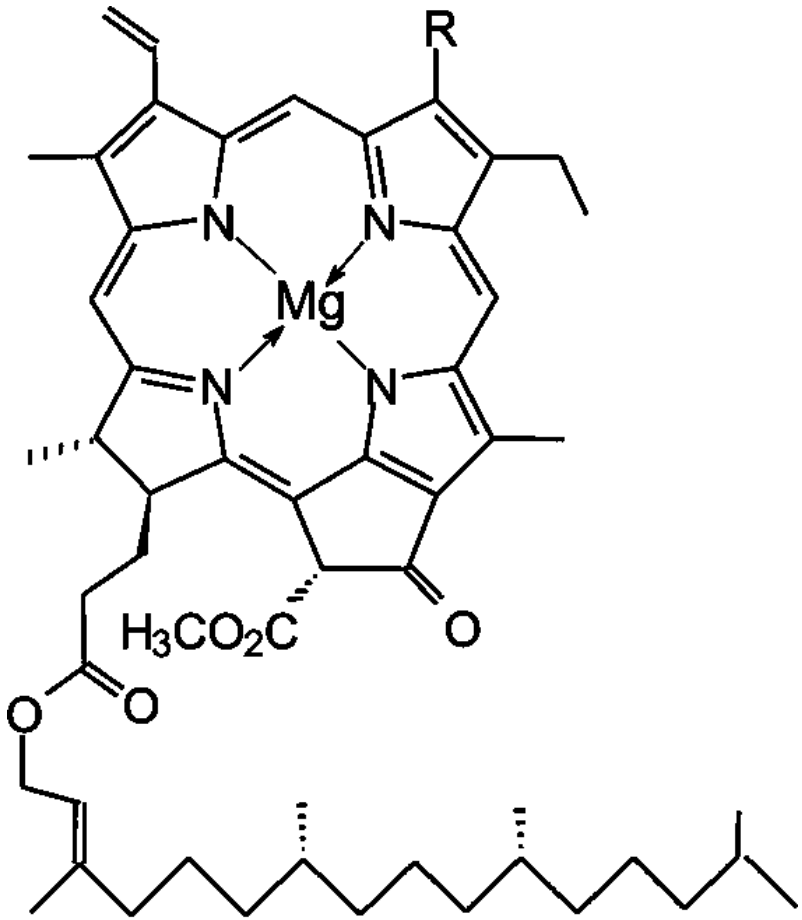


Grana is plural, granum singular.

Pigments

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

Chlorophylls a and b



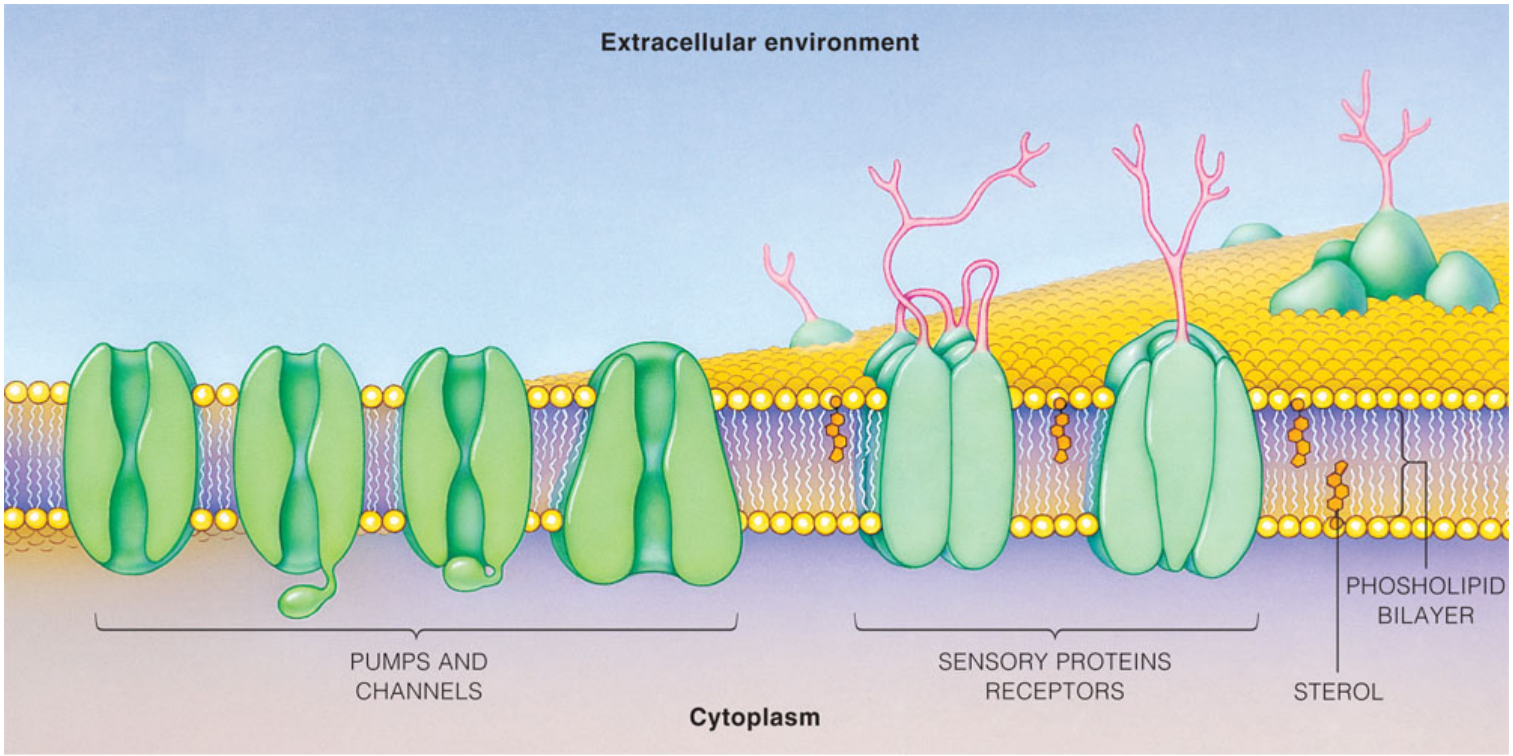
chlorophyll *a* (R = CH_3)
chlorophyll *b* (R = CH=O)

Mitochondria

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

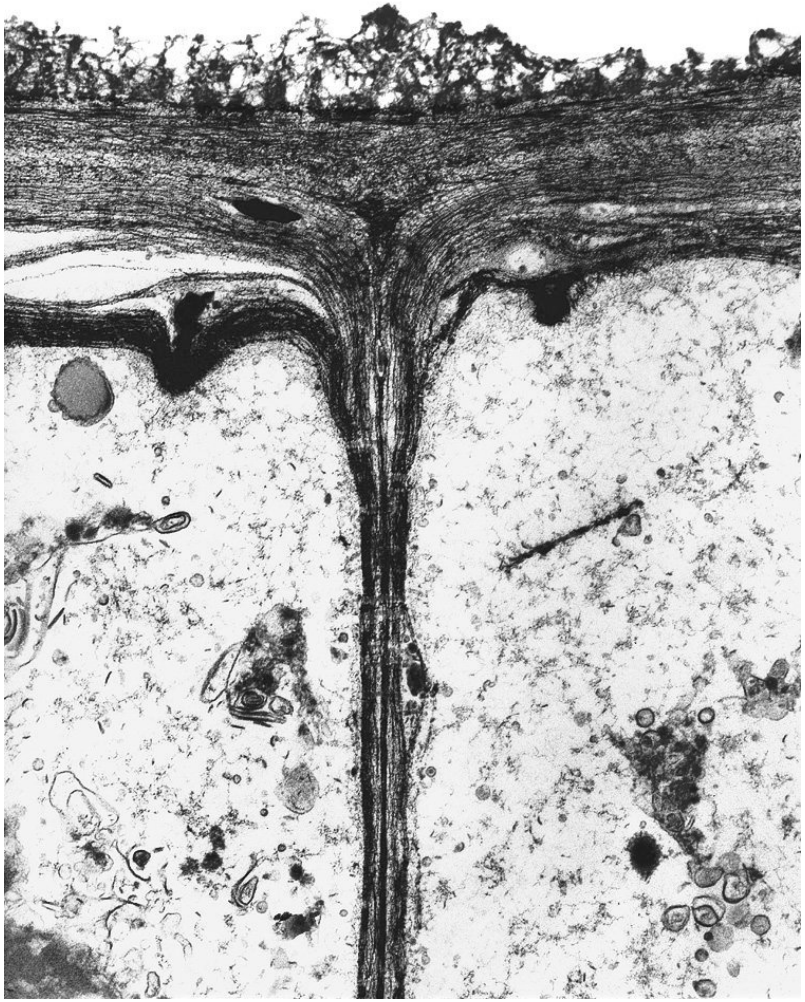
Plant cell
Cell boundaries

Plasma mebmrane



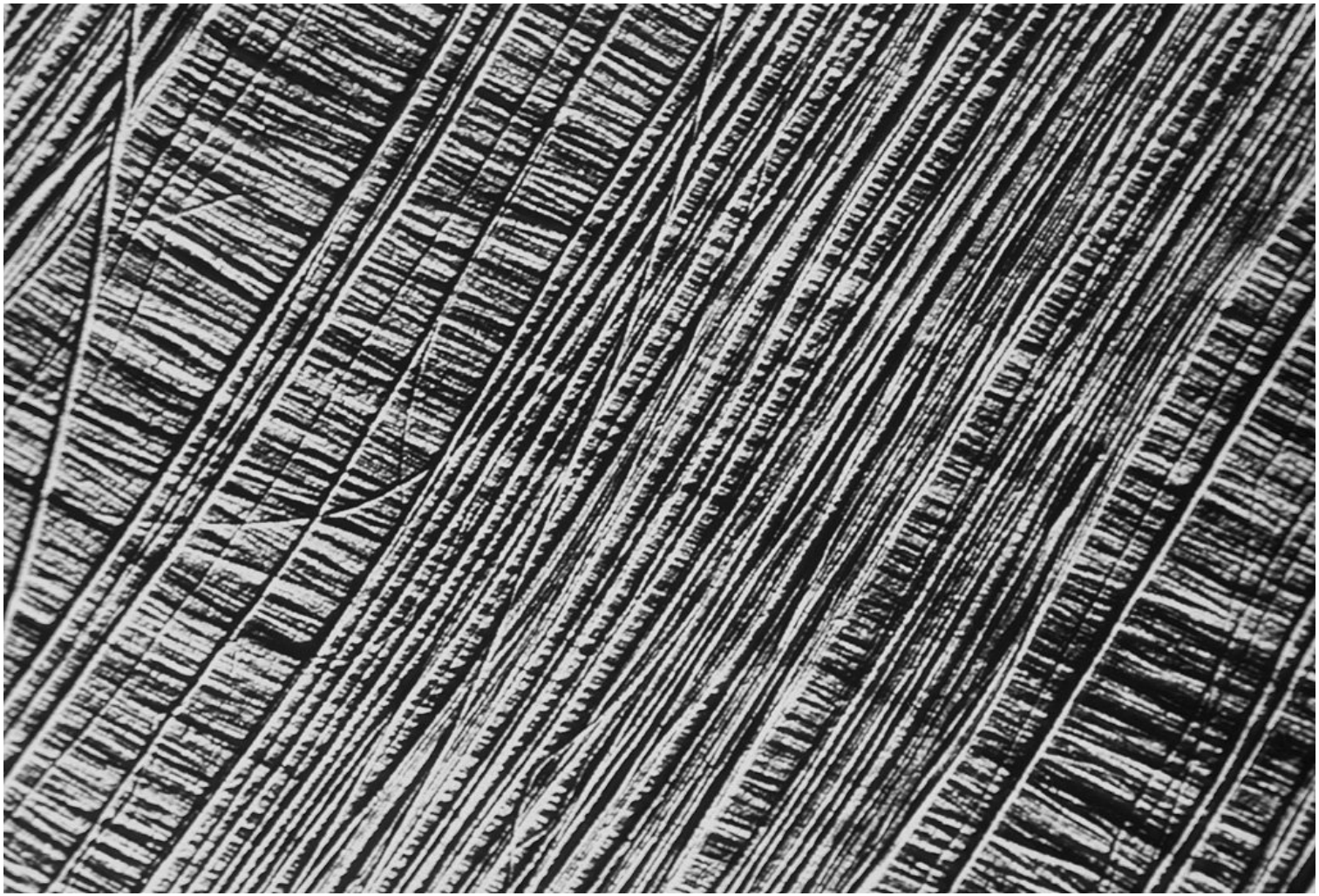
Phospholipids, sterols, proteins: pumps, receptors, channels

Cell wall



Root cells of an onion showing the cell wall (TEM $\times 47,000$)

Fibers

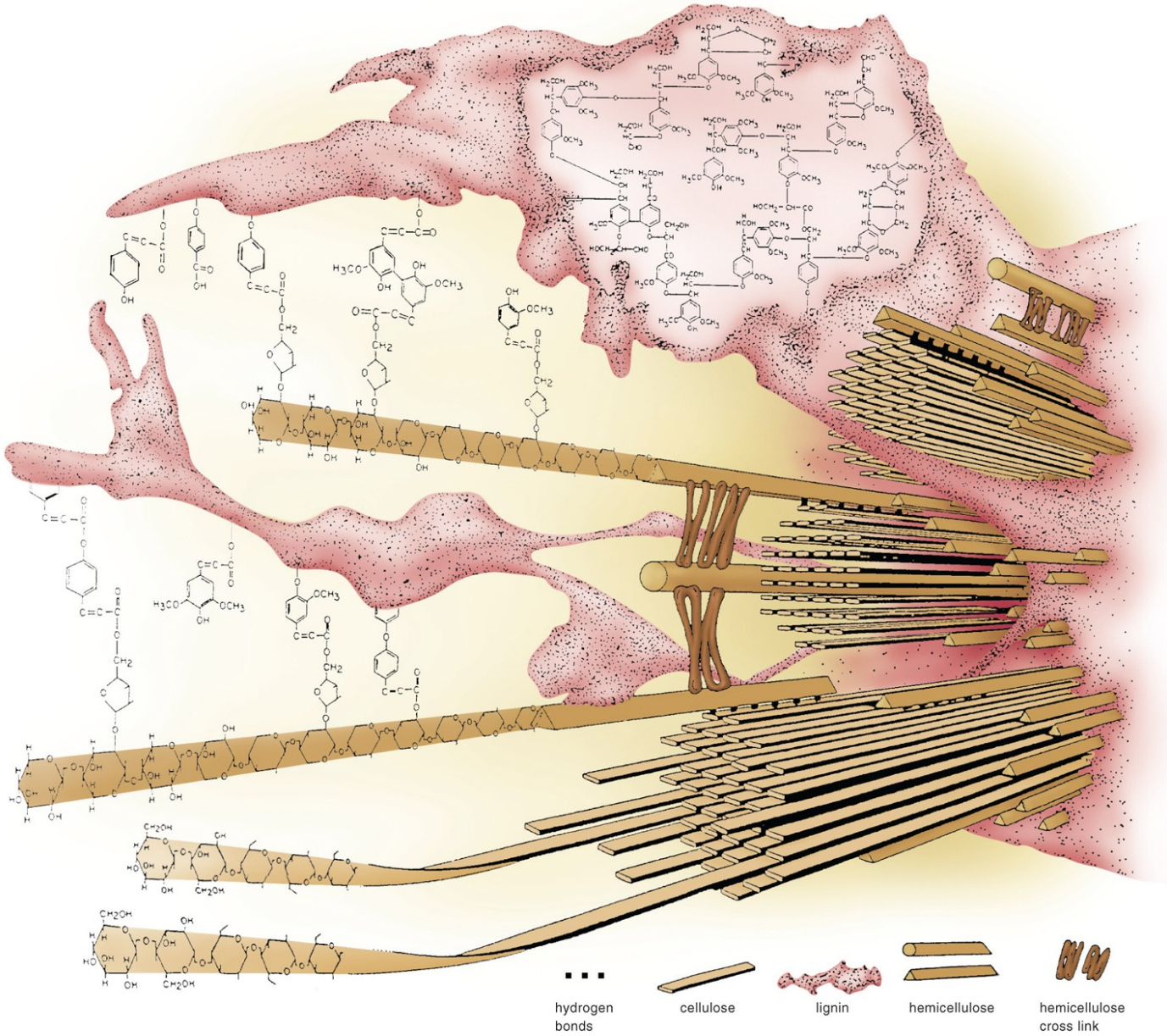


Cellulose fibers in the plant cell wall (SEM)

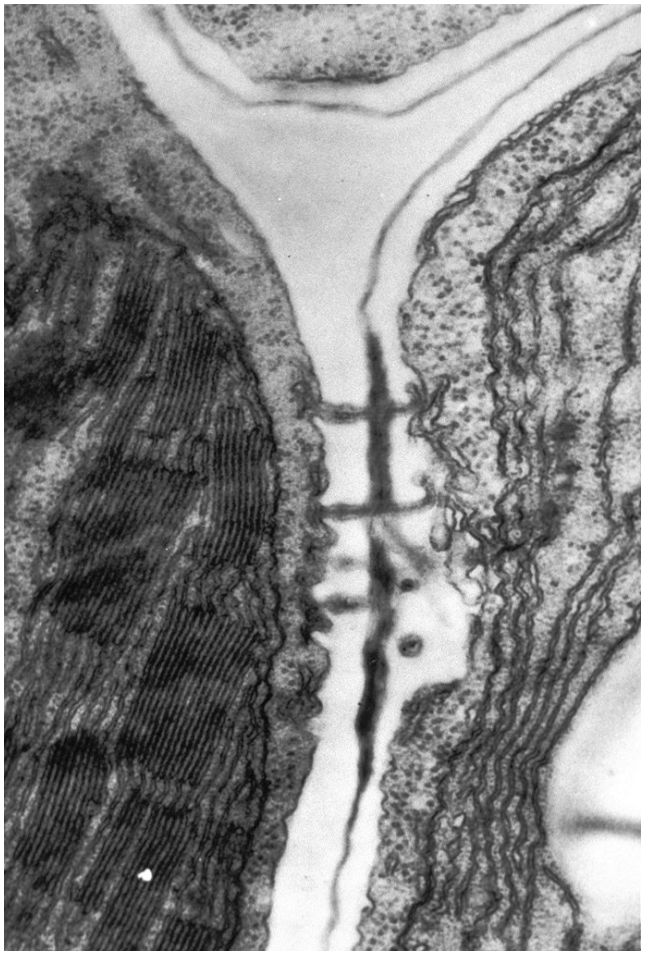
Primary cell wall consists mostly of cellulose and proteins, they are thin and exible

Secondary cell wall includes hydrophobic lignine and suberine; this inclusion leads to the death of cell. However, dead cells are very useful for plants

Secondary cell wall: molecules

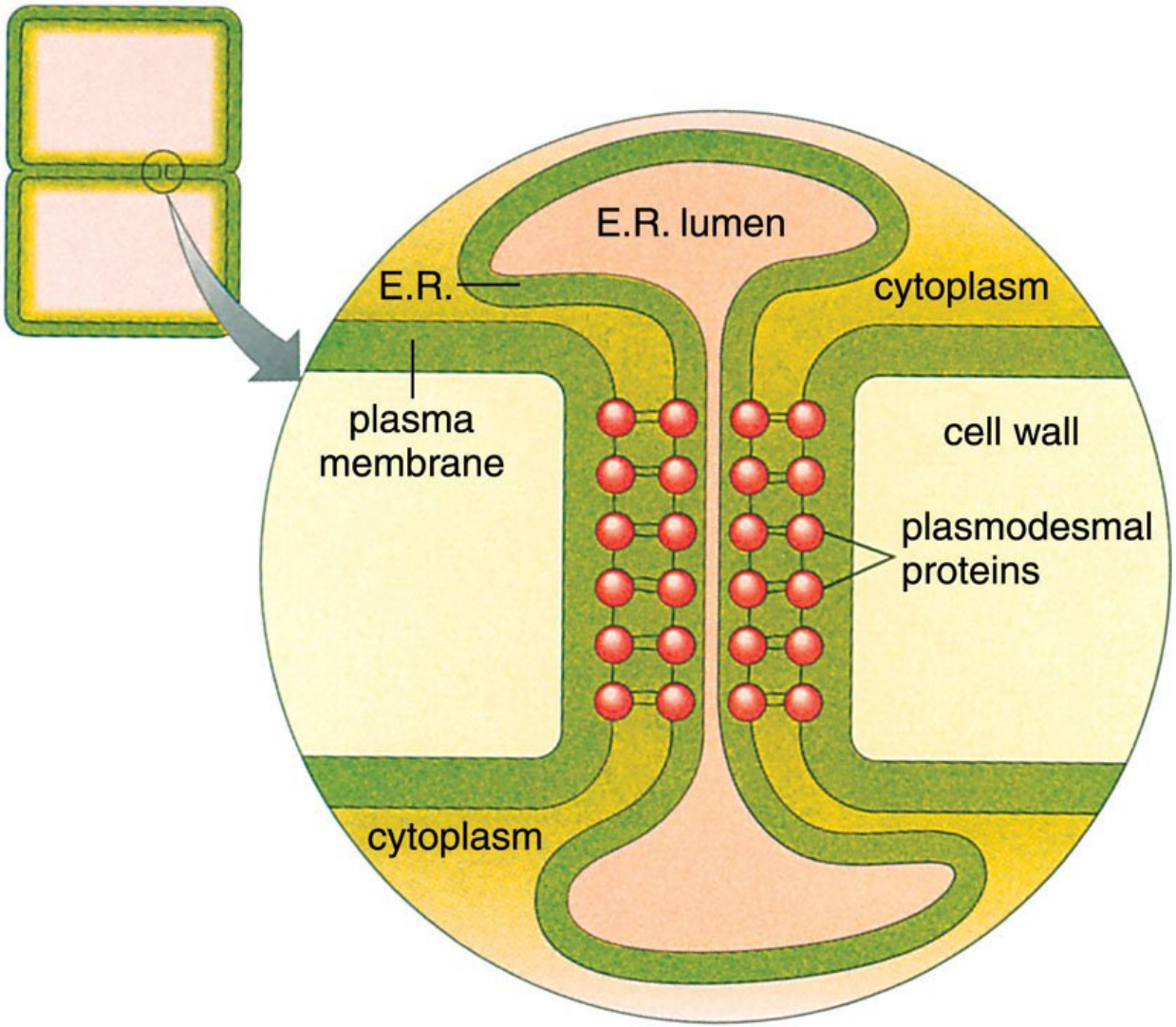


Plasmodesmata



Plasmodesmata in a corn leaf between a mesophyll cell and a bundle sheath cell (TEM)

Plasmodesmata: shematic view



E.R. = endoplasmic reticulum (endoplasmic network)

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Summary

- Eukaryotic and prokaryotic cells are cells of different levels of organization
- Eukaryotic cell is a “second-level” cell, cell from cells, ecosystems
- Chloroplasts and mitochondria are both results of symbiogenesis
- Secondary cell walls cover dead cells

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For Further Reading

A. Shipunov.
Introduction to Botany [Electronic resource].
Mode of access:
http://ashipunov.info/shipunov/school/biol_154