

# Introduction to Botany

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Lecture 13

# Outline

## 1 Questions and answers

- Quiz

## 2 Plant cell

- Cell boundaries
- Protein synthesis
- Other cell structures

## 3 Mitosis and meiosis

- Mitosis

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# Questions and answers

## Quiz

# Quiz question (... points)

...

# Quiz question (... points)

...

● ...

# Plant cell

## Cell boundaries



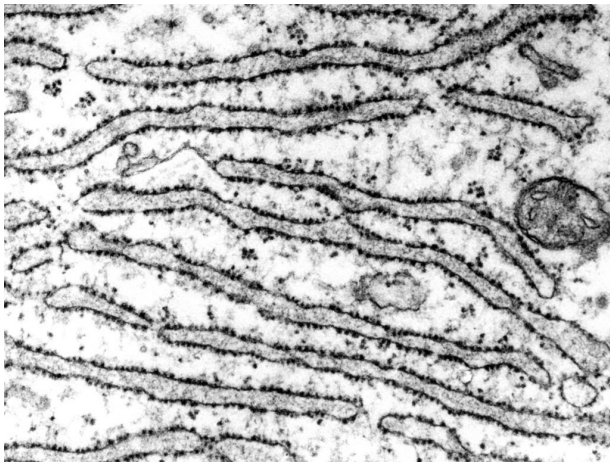
# Vacuoles, osmosis and turgor pressure

- If cell vacuoles contain more concentrated solution of salts then water surrounding cell (i.e., water outside is *hypotonic*), water will flow inside a cell. It is called **osmosis**
- Cell wall prevents cell from explosion due to high **turgor pressure**
- When water flows outside a cell, cell content will shrink: this is **plasmolysis**

# Symplast and apoplast

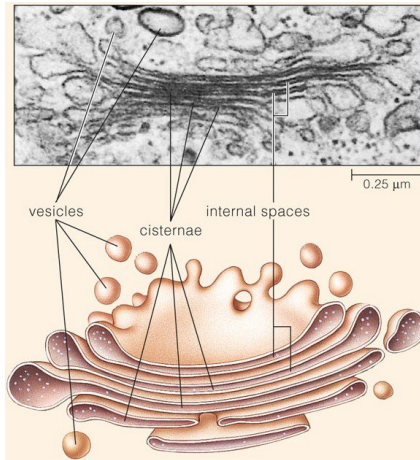
- **Symplast**—name for continuous cytoplasm in set of cells
- **Apoplast**—space outside cell; area of considerable metabolic activity

# Endoplasmic reticulum (network), ER



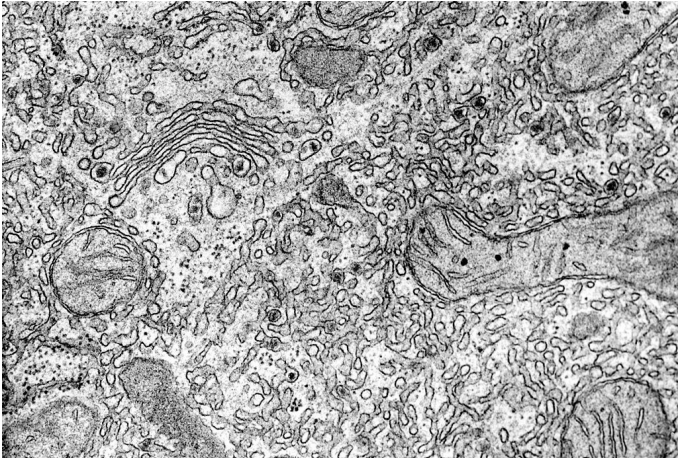
Rough endoplasmic reticulum with ribosomes along outer surface.  
Manufactures many proteins destined for secretion or for incorporation  
into membranes (TEM)

# Golgi apparatus (dictyosomes)



The Golgi is an organelle composed of stacks of flattened, membranous sacs mainly responsible for modifying, packaging, and sorting proteins that will be secreted or targeted to other organelles of the internal membrane system or to the plasma membrane

# Golgi apparatus on TEM



Golgi complex and smooth endoplasmic reticulum in a liver cell (TEM)

# Plant cell

## Protein synthesis

# Nucleus structure

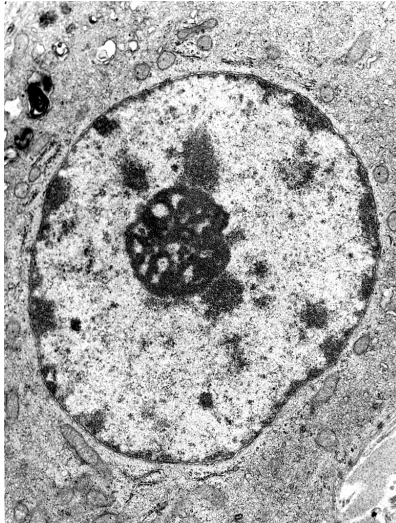
**Nuclear envelope** Double layered membrane, filaments of protein lamin line inner surface and stabilize structure, inner and outer membranes connect to form pores

**Nucleoplasm** Portion inside the nuclear envelope

**Nucleoli** Dark staining bodies within nucleus, site for ribosome synthesis

**Chromosomes** Store genetic information in nucleotide sequences, each chromosome consists of chain of nucleosomes (long DNA molecule and associated histone proteins). When cell is not dividing, chromosomes are frequently seen as **chromatin**.

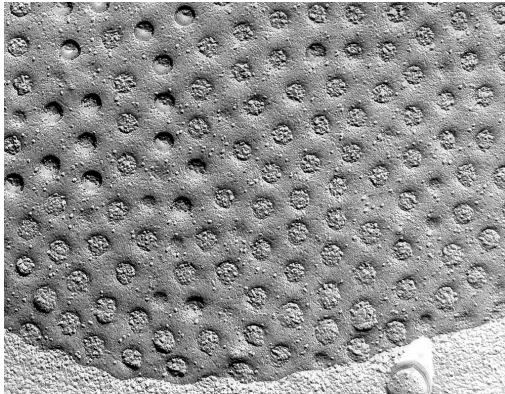
# Nucleus



A typical nucleus with a prominent nucleolus (TEM).

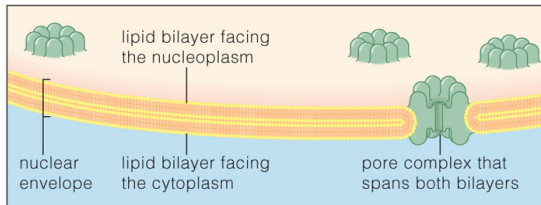
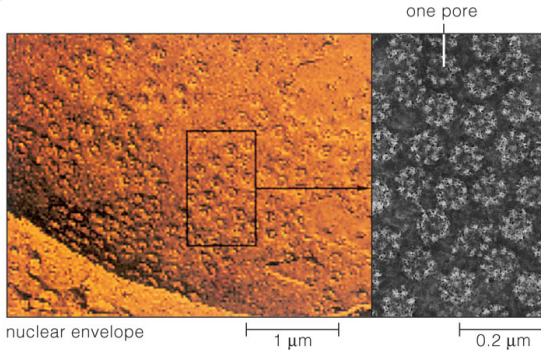


# Nuclear pores



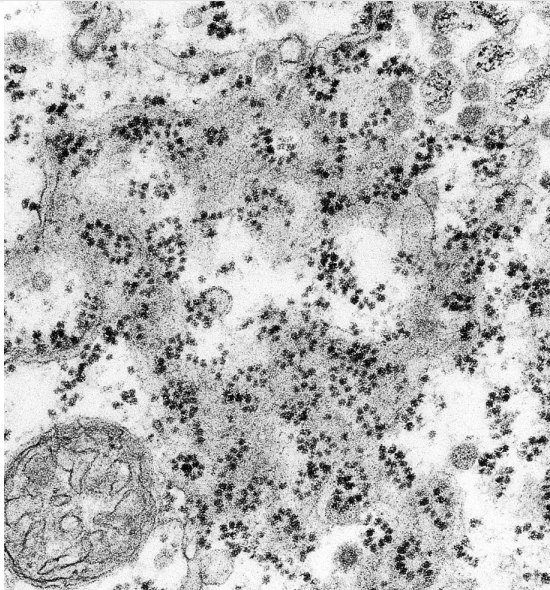
Freeze-fracture technique used to show nuclear pores. Nuclear pores are structures in the nuclear envelope that allow passage of certain materials between the cell nucleus and the cytoplasm (TEM  $\times 100,000$ )

# Nuclear pores and envelope



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# Ribosomes



# Plant cell

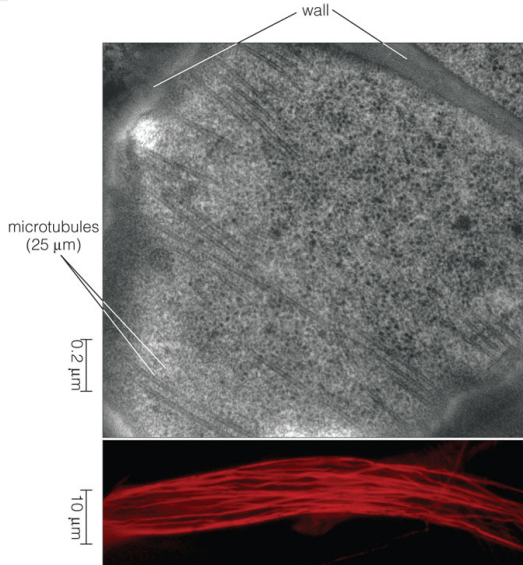
## Other cell structures

# Cellular skeleton

*Collection of long, filamentous structures within cytoplasm:*

- **Microtubules.** Movement based on tubulin-kinesins interactions. They are key organelles in cell division, form basis of cilia and flagella, serve as guides for the construction of cell wall
- **Microfilaments.** Movement based on actin-myosin interactions. Serve as guides for movement of organelles within cell

# Cytoskeleton



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# Mitosis and meiosis

## Mitosis

# Definition of mitosis

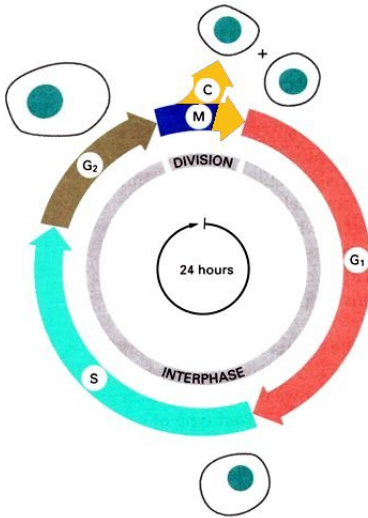
- *Equal cell division, where each of daughter cells receives the same number of chromosomes as a mother cell*
- Chromosome formula:  $X \longrightarrow I + I$
- **The goal of mitosis** is the equal distribution of pre-synthesized DNA
- Mitosis does not change genotype of cells



# Mitosis, karyokinesis and cytokinesis

- Mitosis is the kind of nucleus division, **karyokinesis**
- Cytokinesis is a different process, the part of **cell cycle**

# Cell cycle



- Interphase

- Pre-synthetic stage (G<sub>1</sub>)
- Synthetic stage (S): DNA duplicated
- Post-synthetic stage (G<sub>2</sub>)

- Mitosis

- Prophase
- Metaphase
- Anaphase
- Telophase

- Cytokinesis

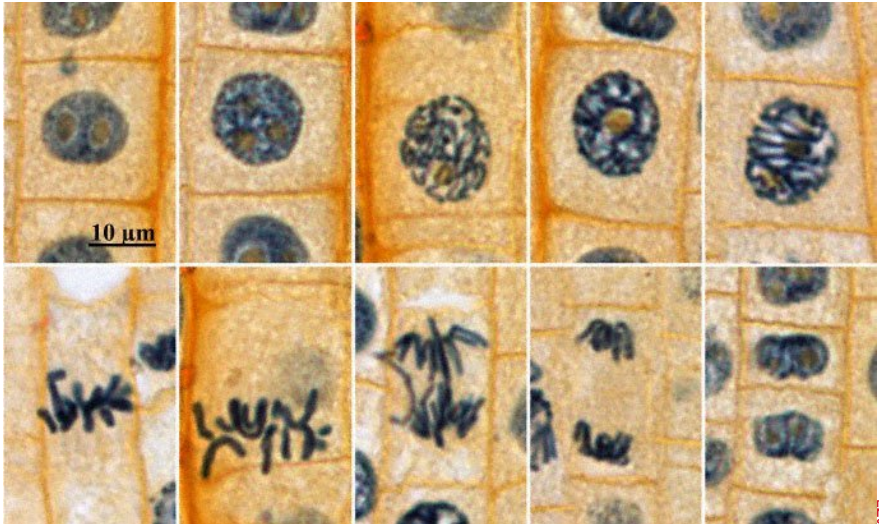
# Stages of mitosis

- Prophase
- Metaphase
- Anaphase
- Telophase

# Final question (2 points)

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Which stage?



# 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

# For Further Reading



A. Shipunov.

*Introduction to Botany* [Electronic resource].

Mode of access:

[http://ashipunov.info/shipunov/school/biol\\_154](http://ashipunov.info/shipunov/school/biol_154)