Introduction to Botany. Lecture 3

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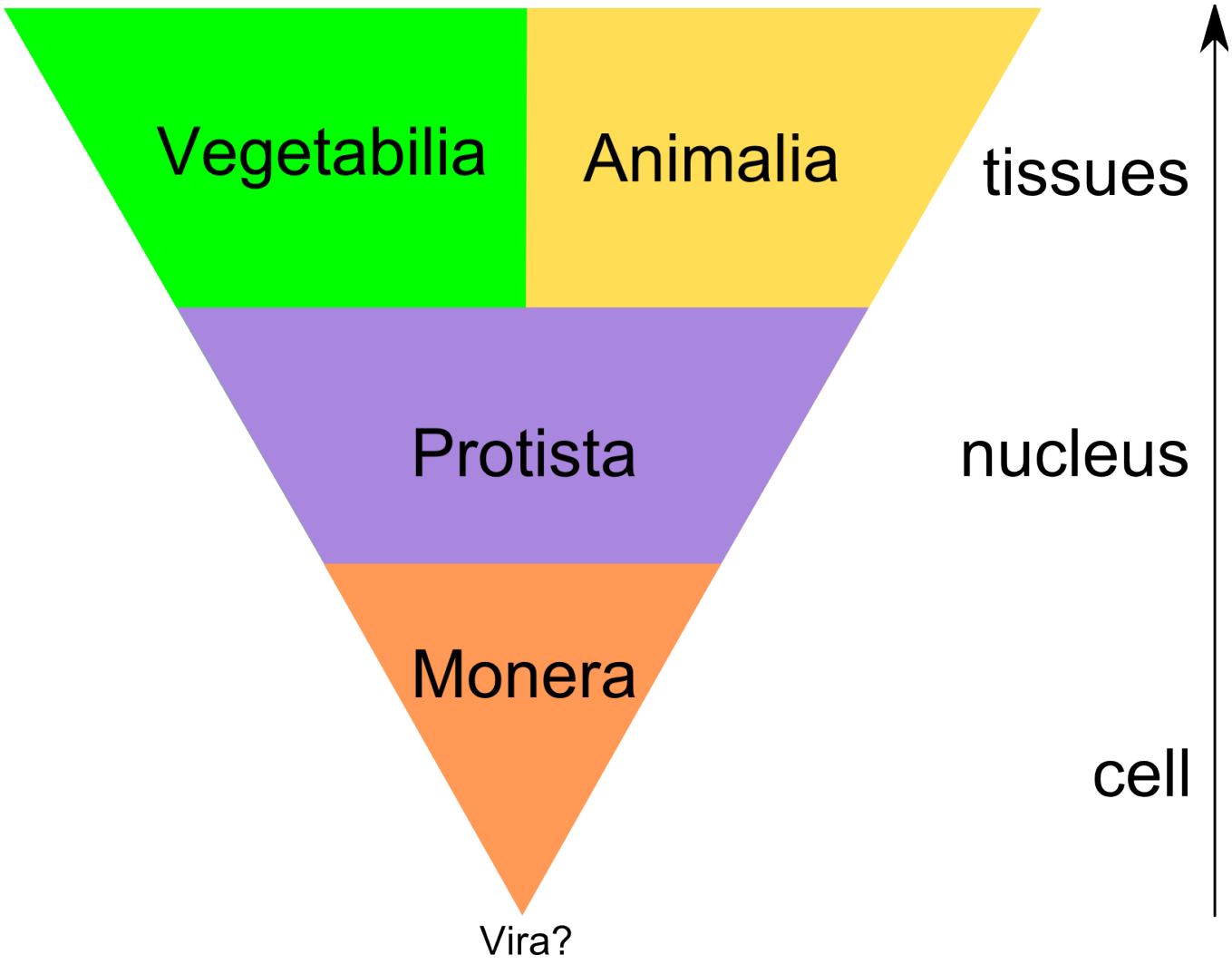
Taxonomic pyramid



Monday test

- Name at least one function of proteins in plasma membrane

Monday test

- What will happen if plant roots disappear from a soil?

Monday test

- Plants are ... (at least one definition)

Bonus question

These flowers belong to ...

Outline

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

Nucleus 1

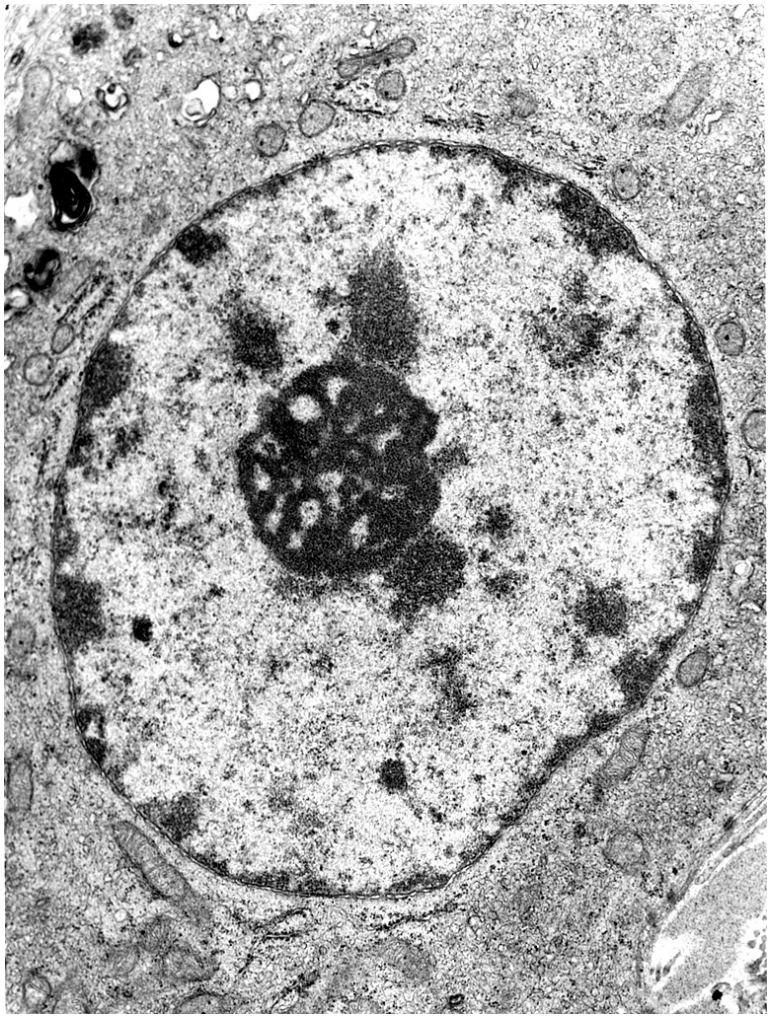
Nuclear envelope Double layered membrane, filaments of protein lamin line inner surface and stabilize structure, inner and outer membranes connect to form pores

Nucleoplasm Portion inside the nuclear envelope

Nucleoli Dark staining bodies within nucleus, site for ribosome synthesis

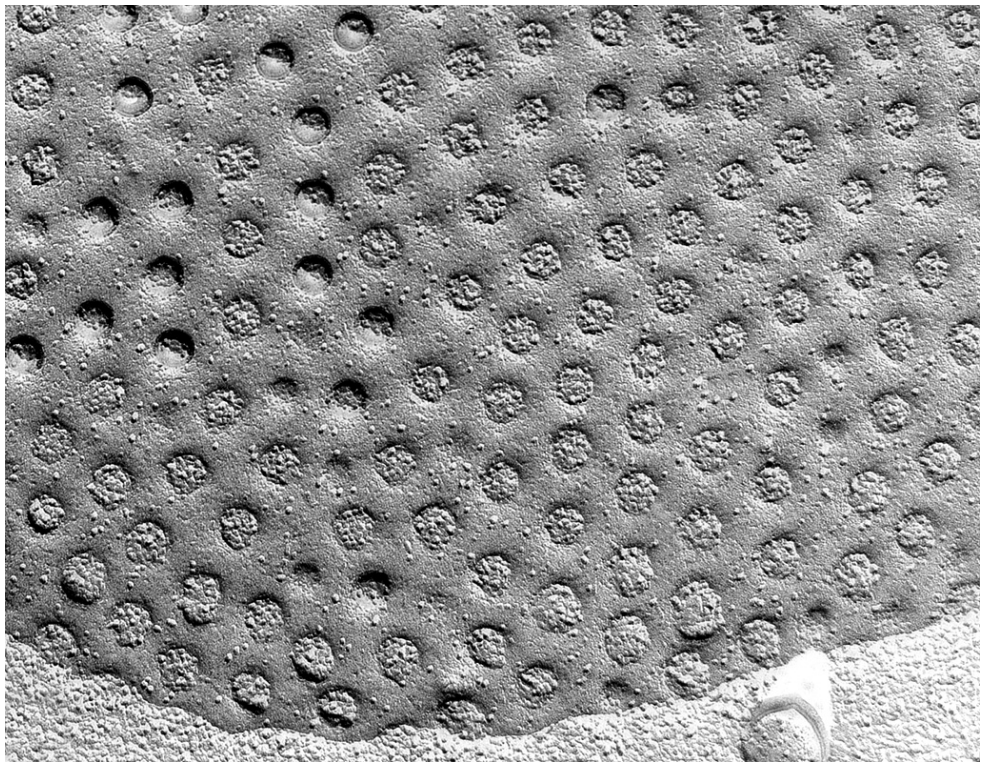
Chromosomes Store genetic information in nucleotide sequences, each chromosome consists of chain of nucleosomes (long DNA molecule and associated histone proteins)

Nucleus 2



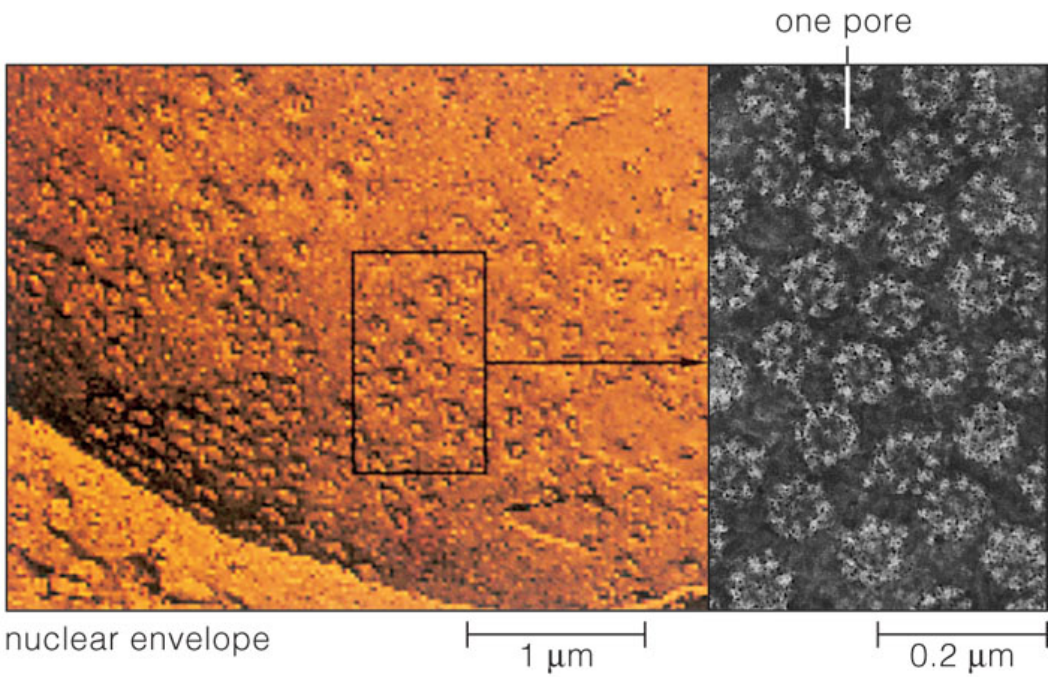
A typical nucleus with a prominent nucleolus (TEM).

Nucleus wall 1

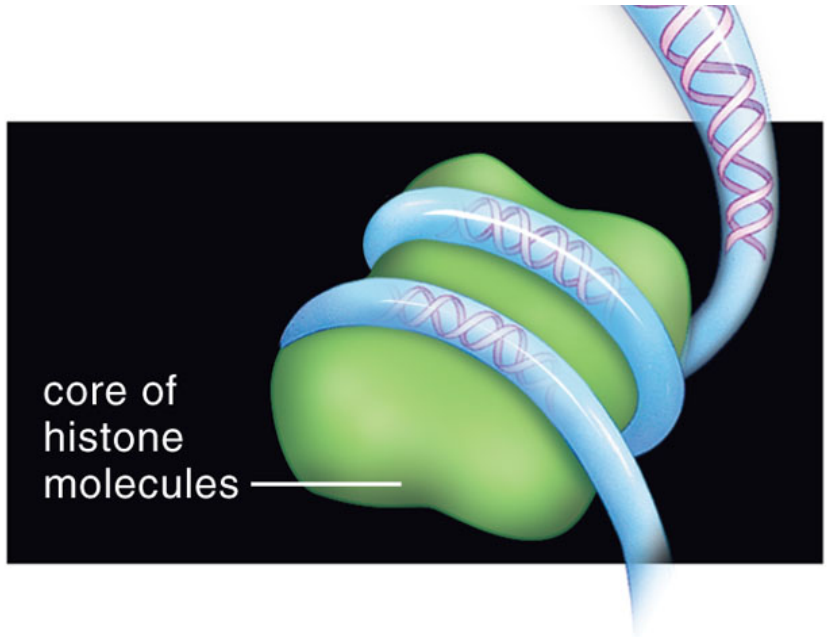


Freeze-fracture technique used to show nuclear pores. Nuclear pores are structures in the nuclear envelope that allow passage of certain materials between the cell nucleus and the cytoplasm (TEM $\times 100,000$)

Nucleus wall 2

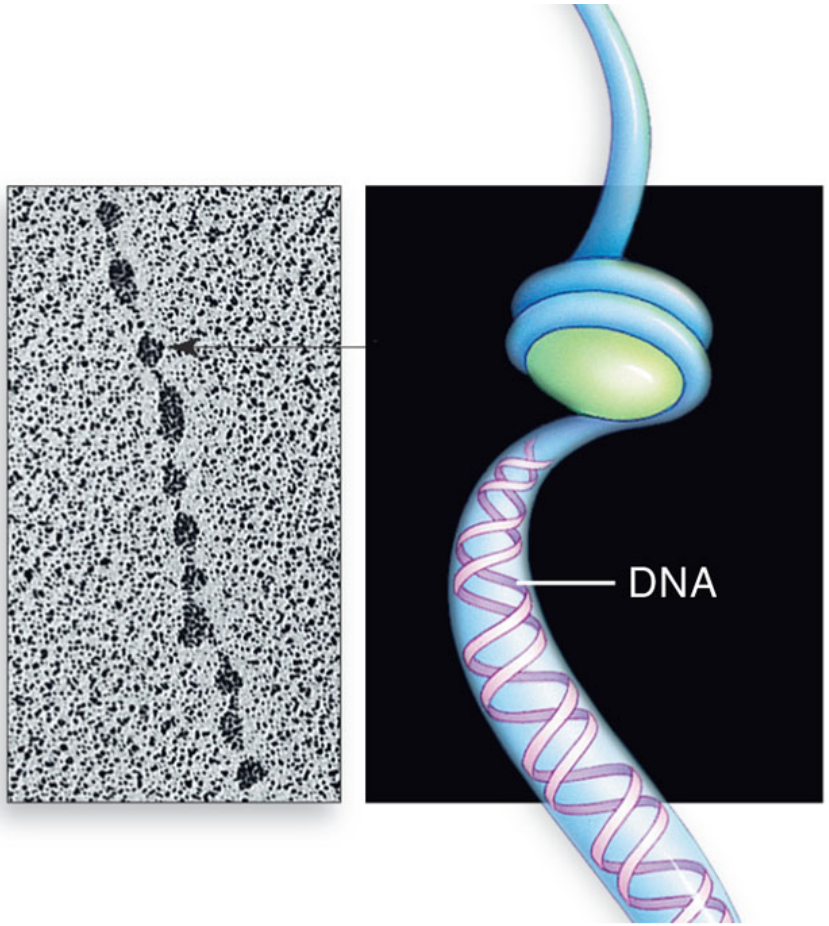


DNA wrapping 1



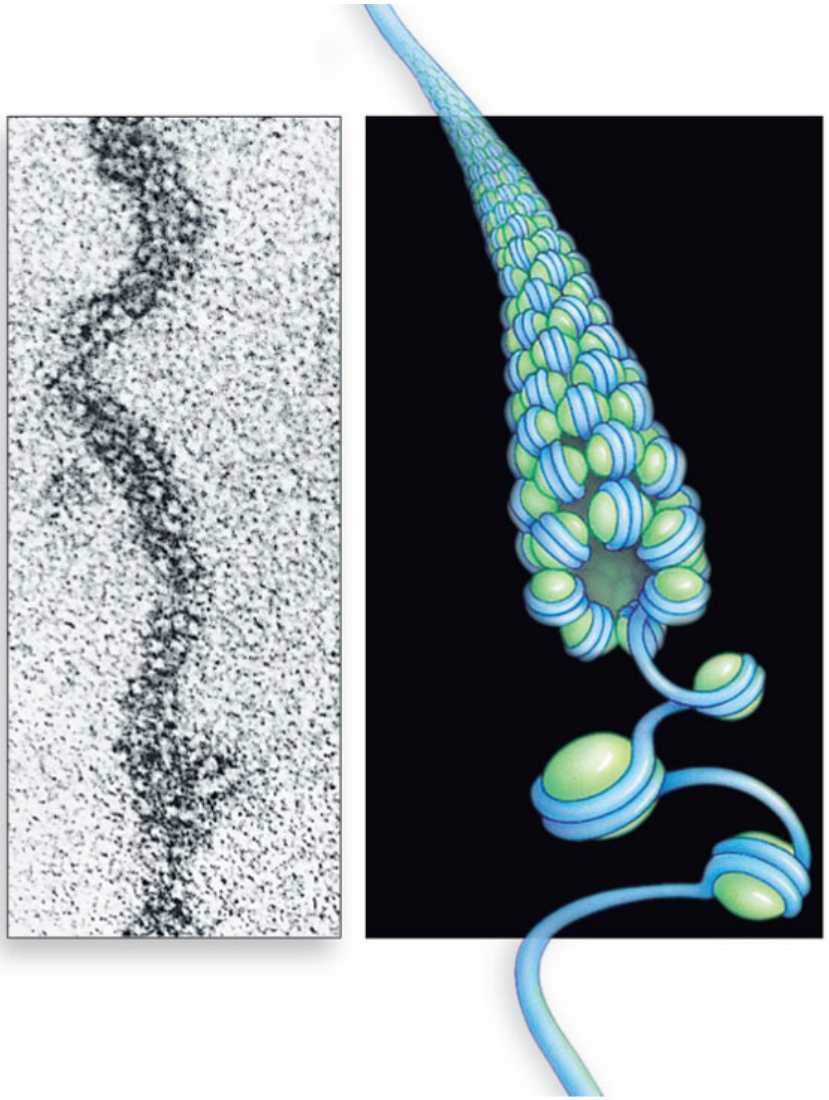
a A nucleosome consists of part of a DNA molecule looped twice around a core of histones.

DNA wrapping 2



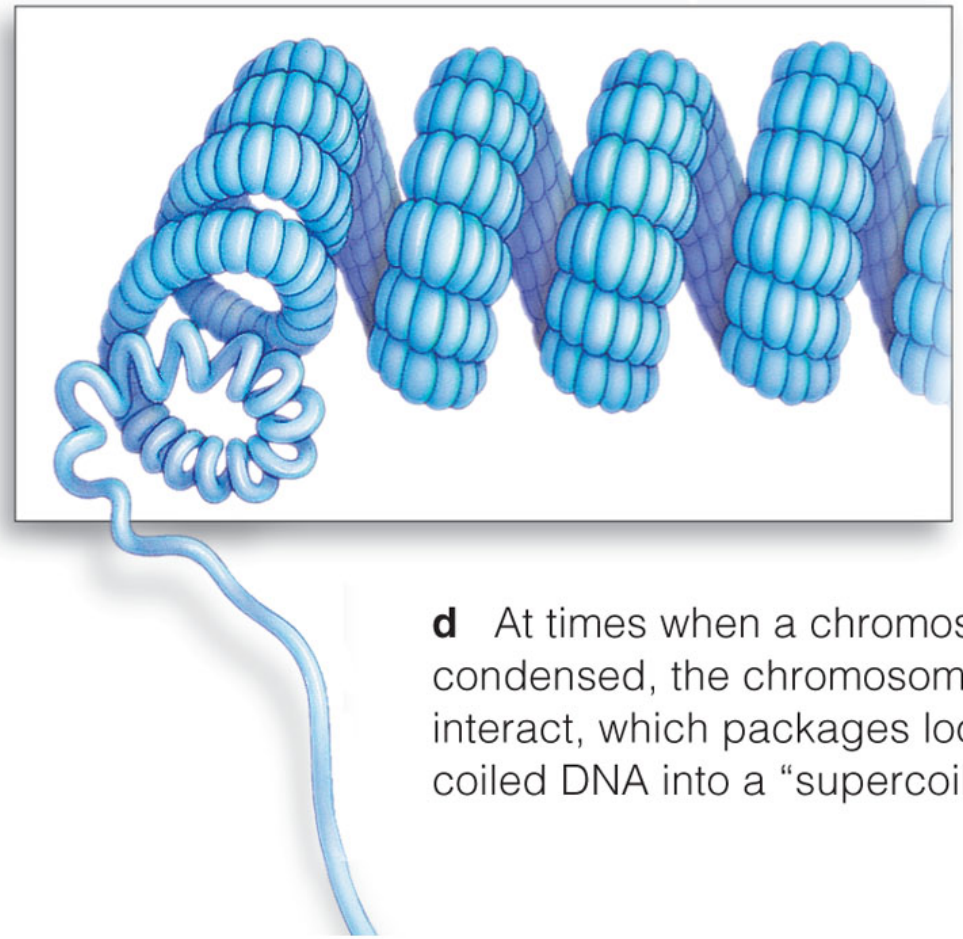
b Immerse a chromosome in saltwater and it loosens up to a beads-on-a-string organization. The "string" is one DNA molecule. Each "bead" is a nucleosome.

DNA wrapping 3



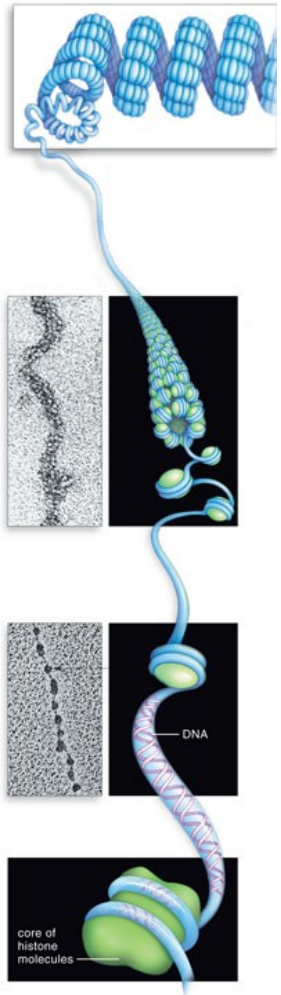
c At a deeper level of structural organization, the chromosomal proteins and DNA are organized as a cylindrical fiber.

DNA wrapping 4

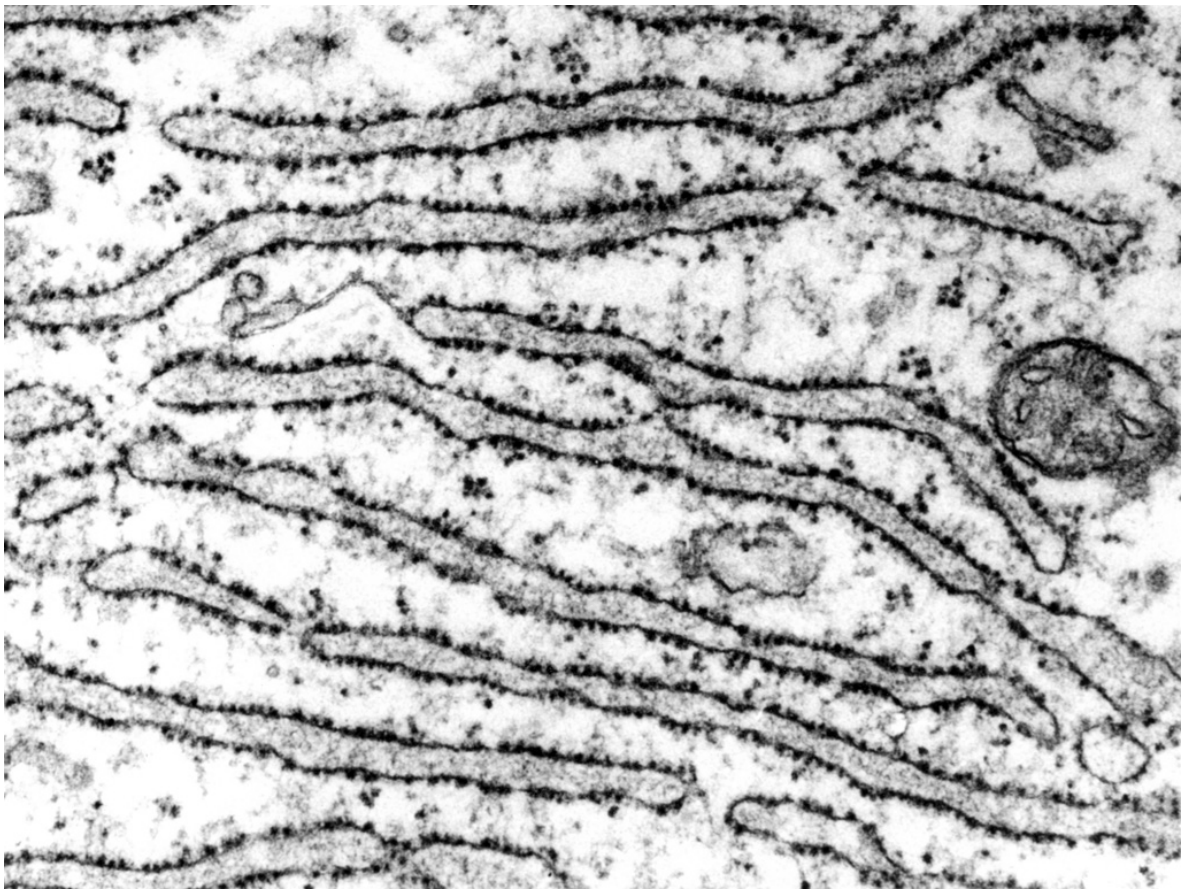


d At times when a chromosome is most condensed, the chromosomal proteins interact, which packages loops of already coiled DNA into a “supercoiled” array.

DNA wrapping: general view

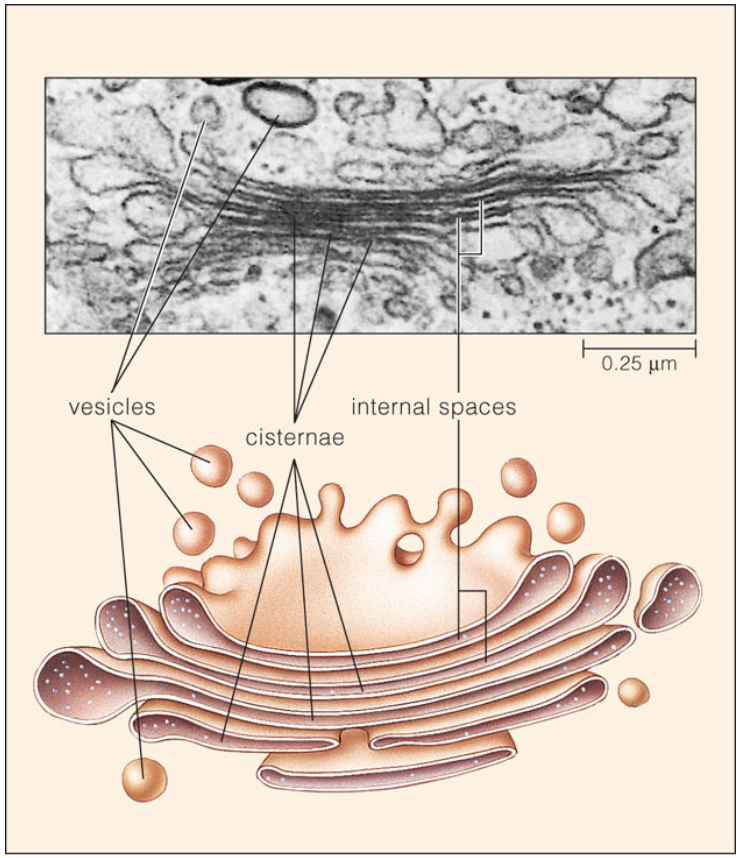


Endoplasmatic reticulum (network), ER



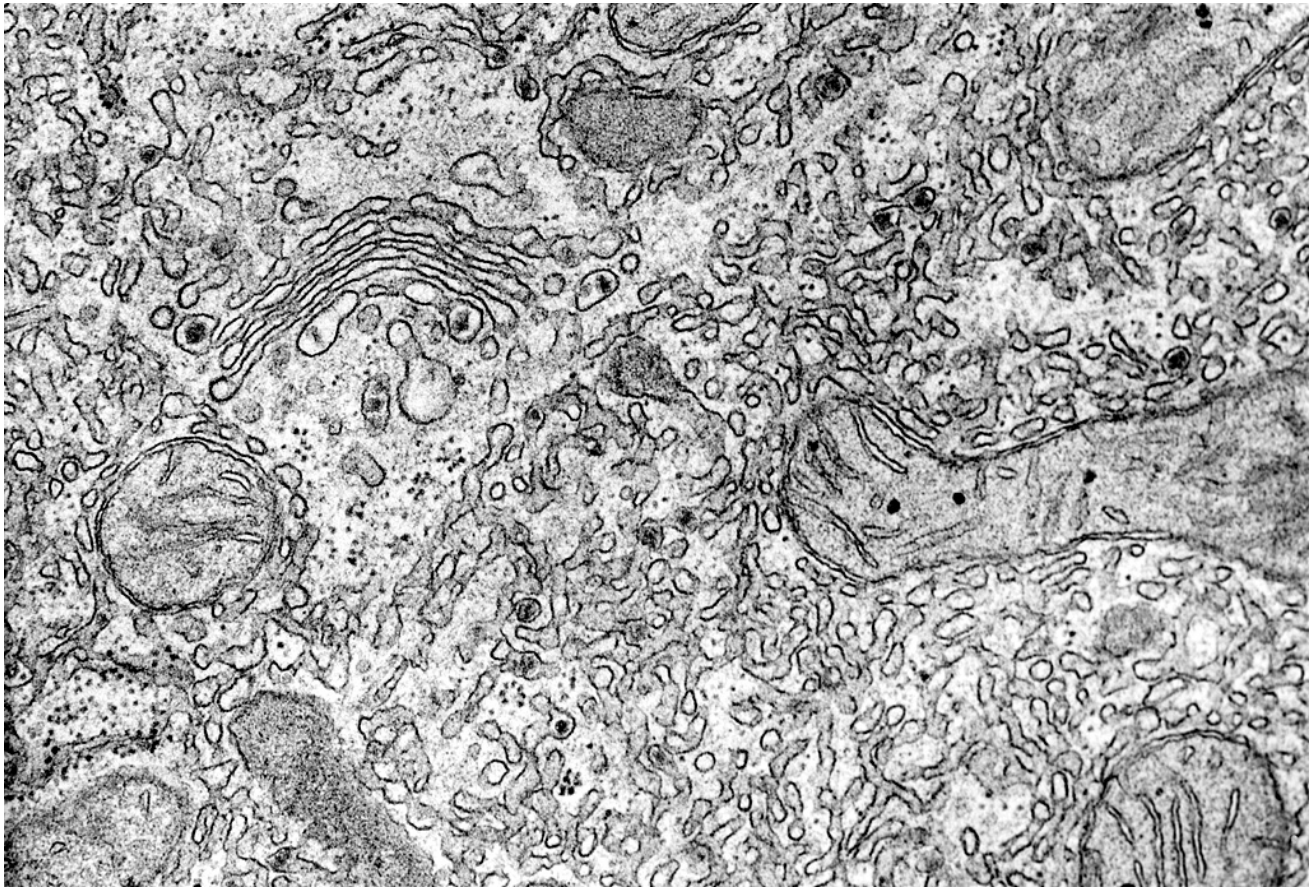
Rough endoplasmic reticulum with ribosomes along outer surface. Manufactures many proteins destined for secretion or for incorporation into membranes (TEM)

Goldgi apparatus (dictyosome) 1



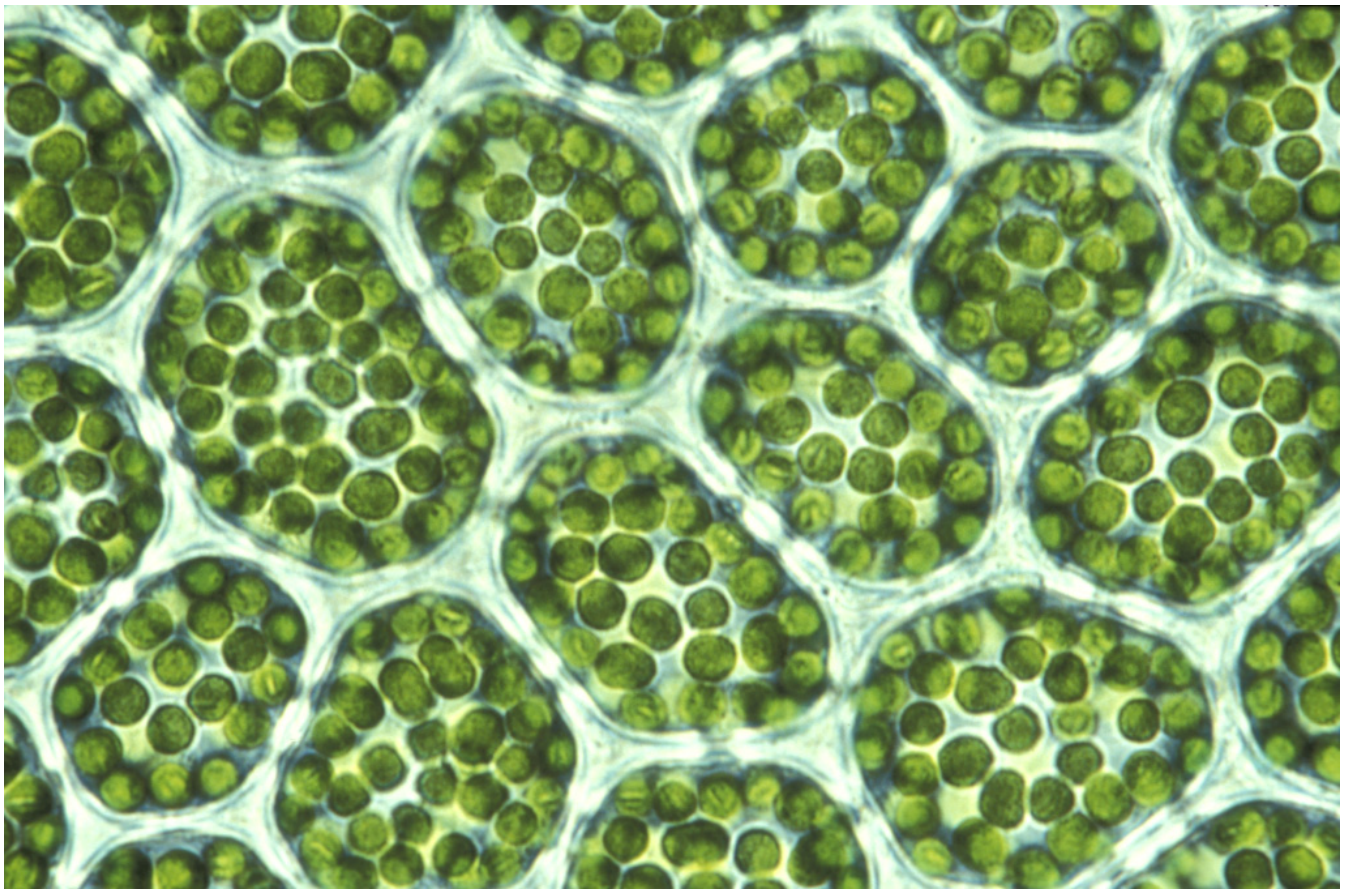
The Golgi is an organelle composed of stacks of flattened, membranous sacs mainly responsible for modifying, packaging, and sorting proteins that will be secreted or targeted to other organelles of the internal membrane system or to the plasma membrane*

Goldgi apparatus (dictyosome) 2



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

Plastids 1



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

Plastids 2

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

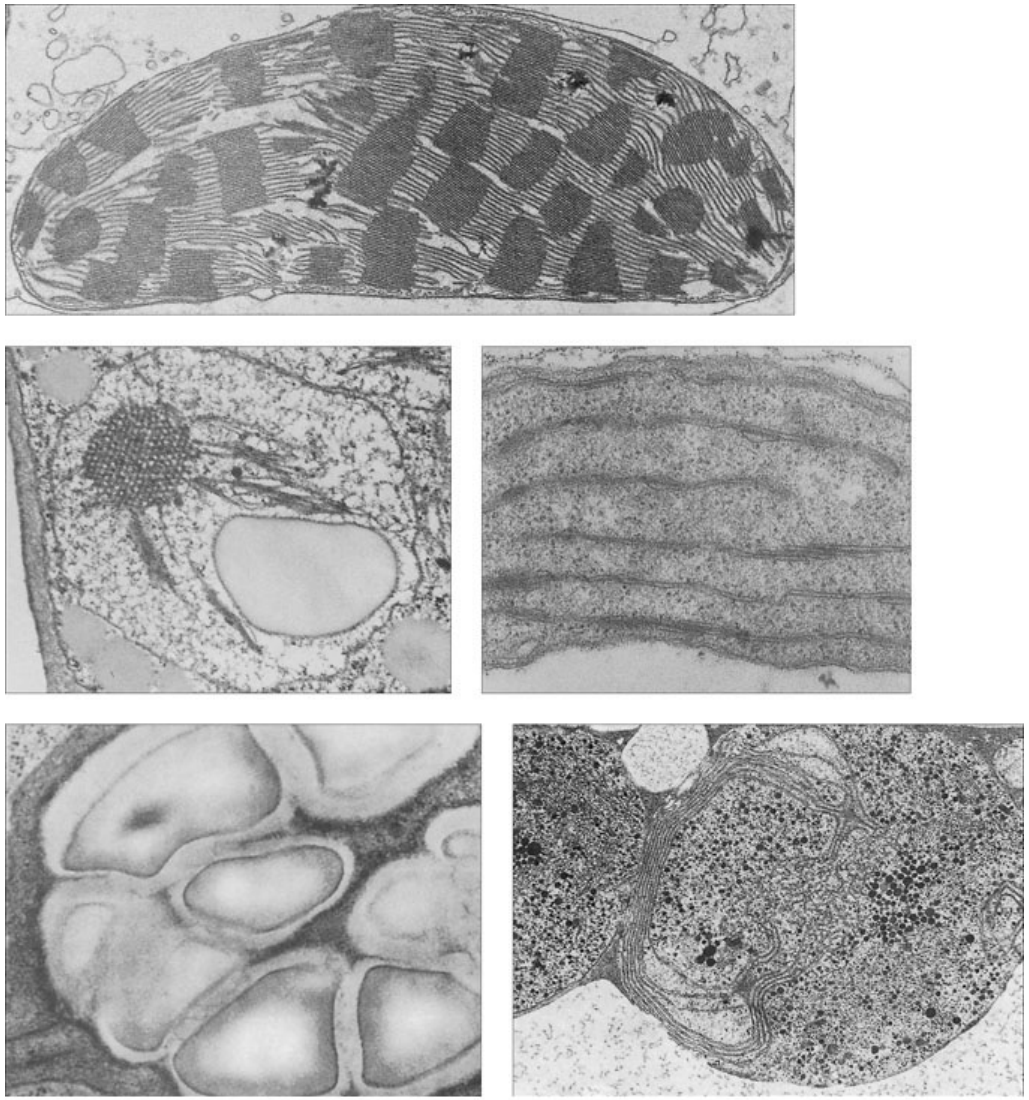
Pigments

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

Plastid types 1

- 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 2



Mitochondria

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

Summary

- There are **two ways** of moving things between plant cells: through symplast or through apoplast
- **Nucleus** stores and expresses genetic information
- **ER** handles ribosomes and packages proteins
- **Golgi apparatus** guides the movement of proteins
- **Plastids** convert energy of light to chemical energy and store starch
- **Mitochondria** make useful forms of chemical energy

For Further Reading

Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.
Plant Biology. 2nd edition.
Thomson Brooks/Cole, 2006.
Chapters 3.4–3.6.