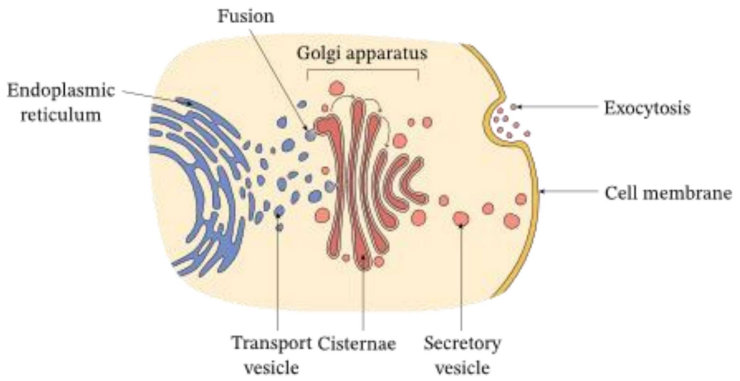
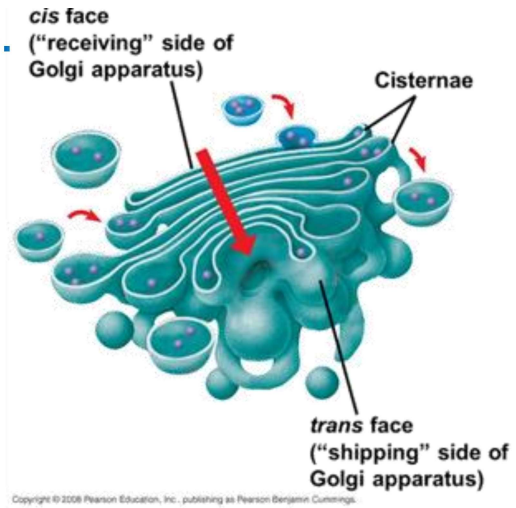
The Endoplasmic Reticulum function

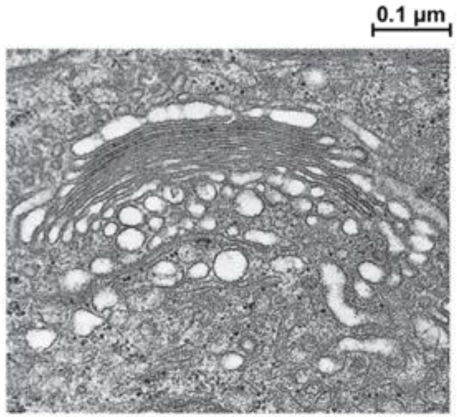
The Function	The smooth ER	The rough ER
1-	Synthesizes lipids	Distributes **transport vesicles,** proteins surrounded by membranes
2-	Metabolizes carbohydrates	secrete **glycoproteins** (proteins covalently bonded to carbohydrates)
3-	Detoxifies poison	Is a membrane factory for the cell
4-	Stores calcium	

The Golgi Apparatus: Shipping and Receiving Center

- The **Golgi apparatus** consists of flattened membranous sacs called cisternae.
- Functions of the Golgi apparatus:
  - Modifies products of the ER.
  - Manufactures certain macromolecules.
  - Sorts and packages materials into transport vesicles.





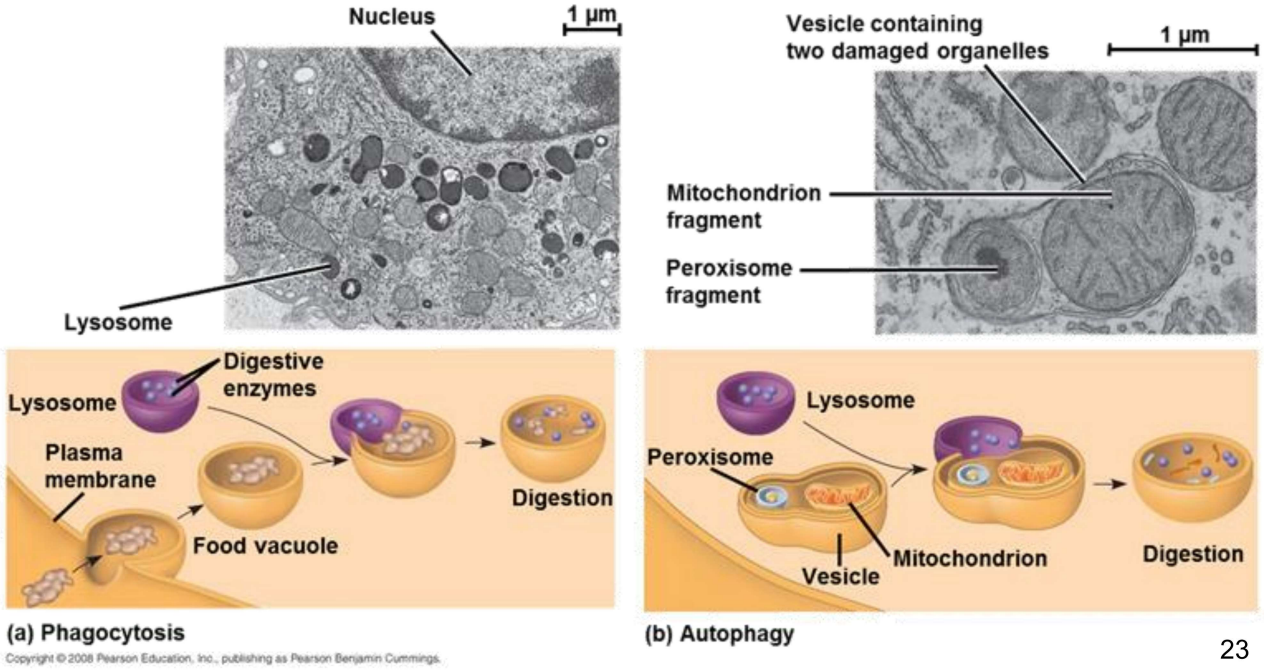


TEM of Golgi apparatus

Lysosomes: Digestive Compartments

- A **lysosome** is a membranous sac of hydrolytic enzymes that can digest macromolecules.

- The main function is digestion.
- Lysosomal enzymes can hydrolyze proteins, fats, polysaccharides, and nucleic acids.



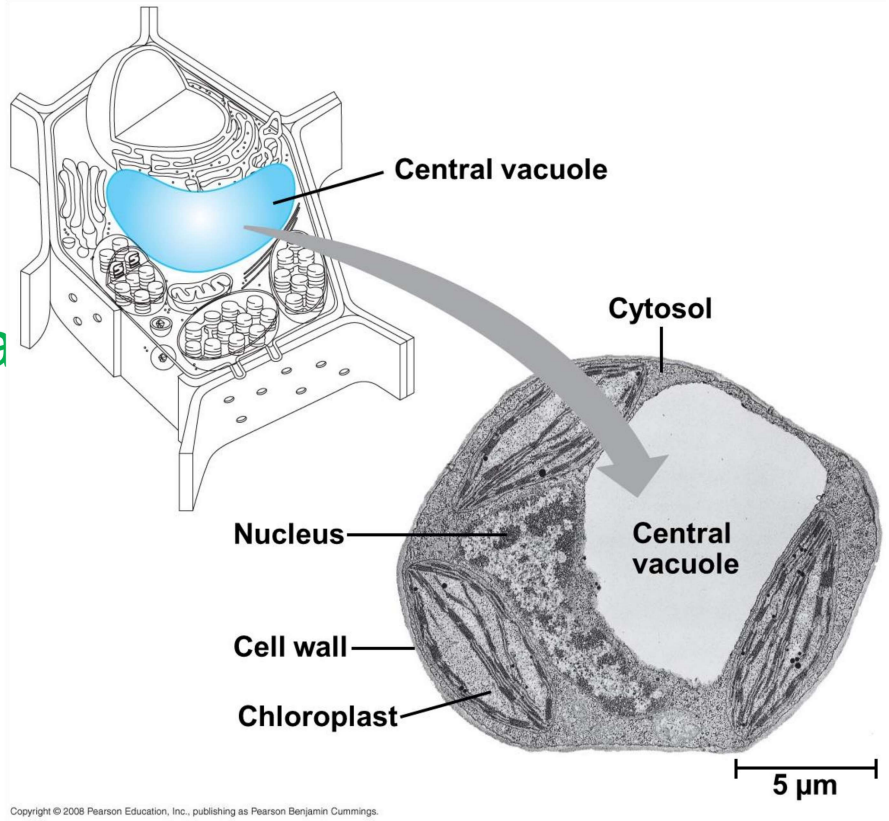
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Vacuoles: Diverse Maintenance Compartments

- A plant cell or fungal cell may have one or several vacuoles.
- The functions of the vacuole include:

- Storage, digestion, and waste removal

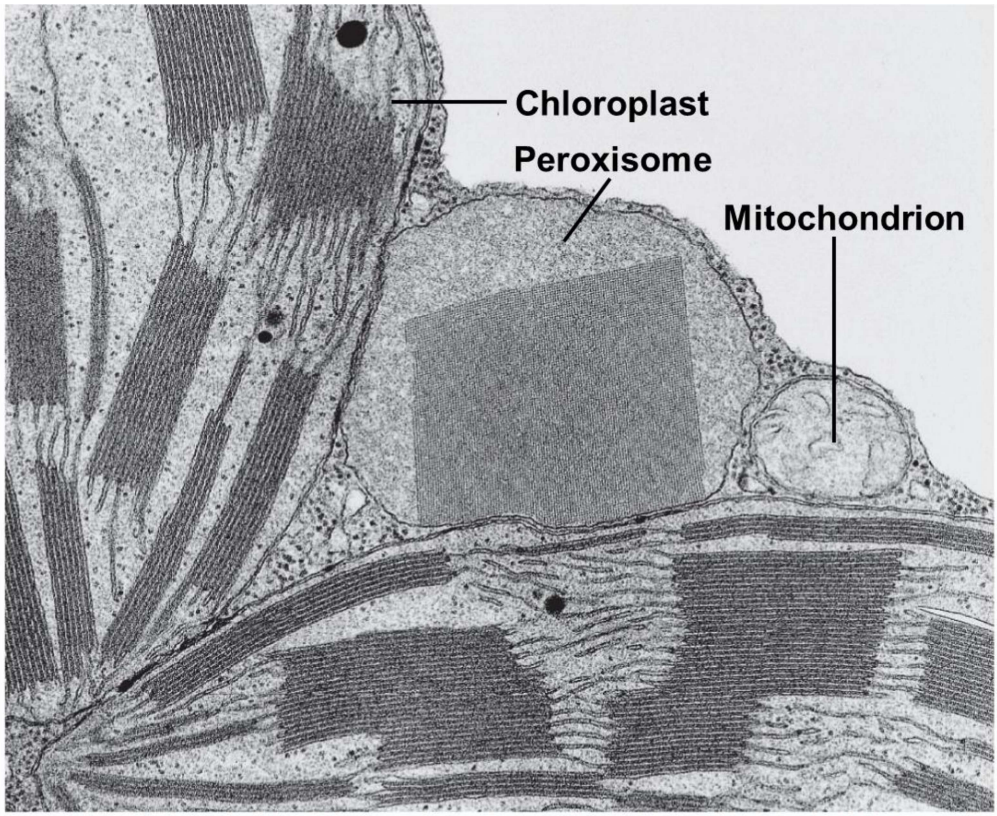
Fig. 6-15



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Mitochondria and chloroplasts change energy from one form to another

- **Mitochondria** are the sites of cellular respiration, a metabolic process that generates ATP.
- **Chloroplasts**, found in plants and algae, are the sites of photosynthesis
- **Peroxisomes** are oxidative organelles, produce hydrogen peroxide and convert it to water.

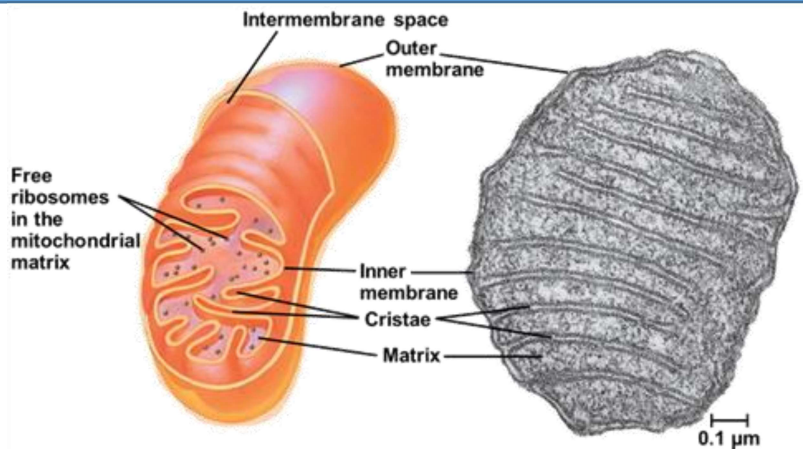


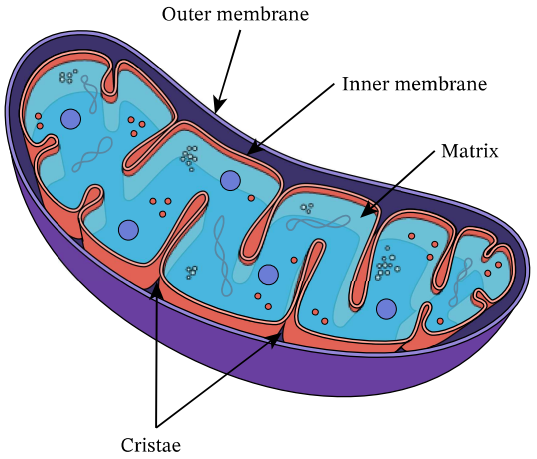
Mitochondria and chloroplasts Structures

- Mitochondria and chloroplasts Both have:
  - Have a double membrane.
  - Have proteins made by free ribosomes.
  - Contain their own DNA.

Mitochondria: Chemical Energy Conversion

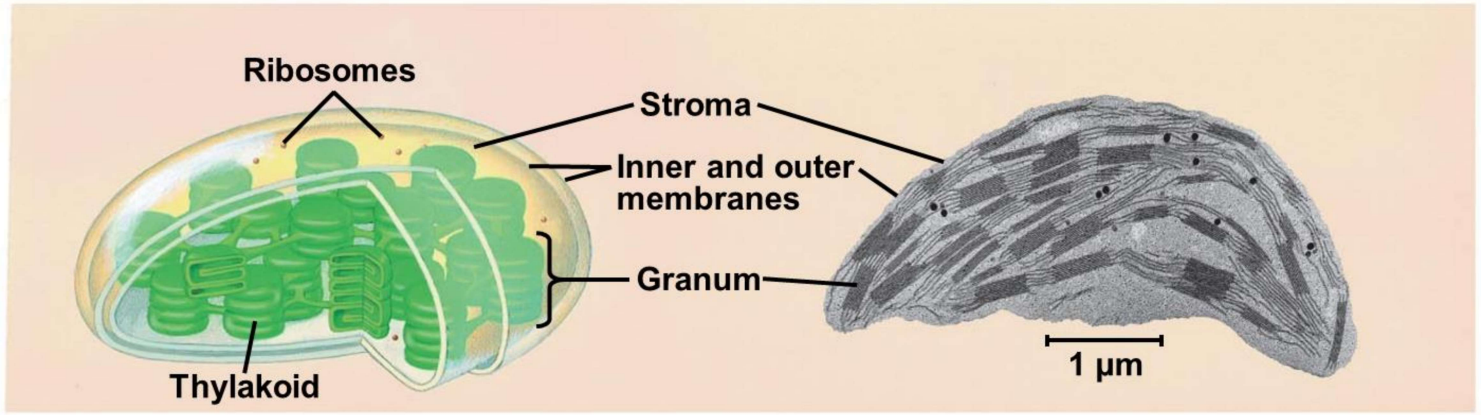
- Mitochondria are in nearly all eukaryotic cells.
- They have a smooth outer membrane and an inner membrane folded into **cristae.**
- The inner membrane creates two compartments: intermembrane space and **mitochondrial matrix.**
- Some metabolic steps of cellular respiration are catalyzed in the mitochondrial matrix.
- Cristae present a large surface area for enzymes that synthesize ATP.





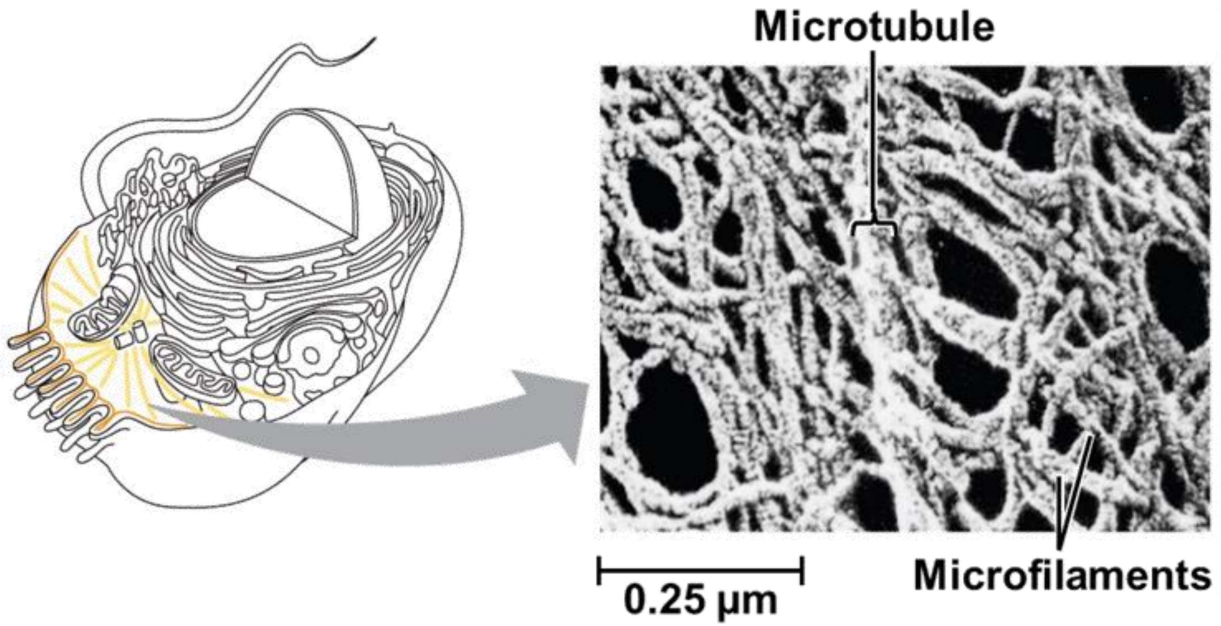
Chloroplasts: Capture of Light Energy

- The chloroplast is a member of a family of organelles called **plastids**.
- Chloroplasts contain the green pigment chlorophyll, as well as enzymes and other molecules that function in photosynthesis.
- Chloroplasts are found in leaves and other green organs of plants and in algae.



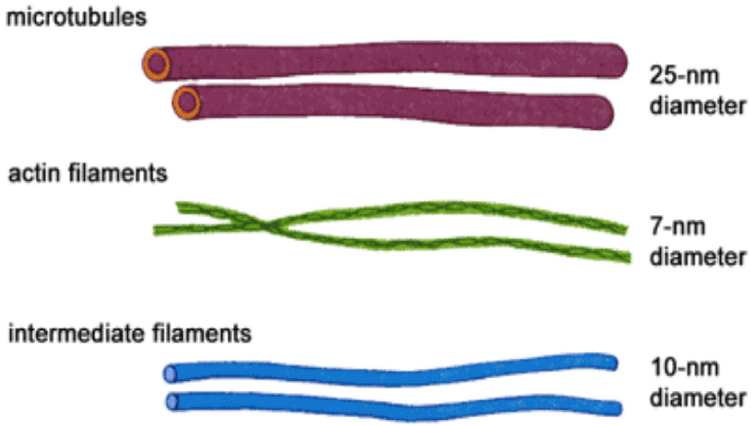
The cytoskeleton

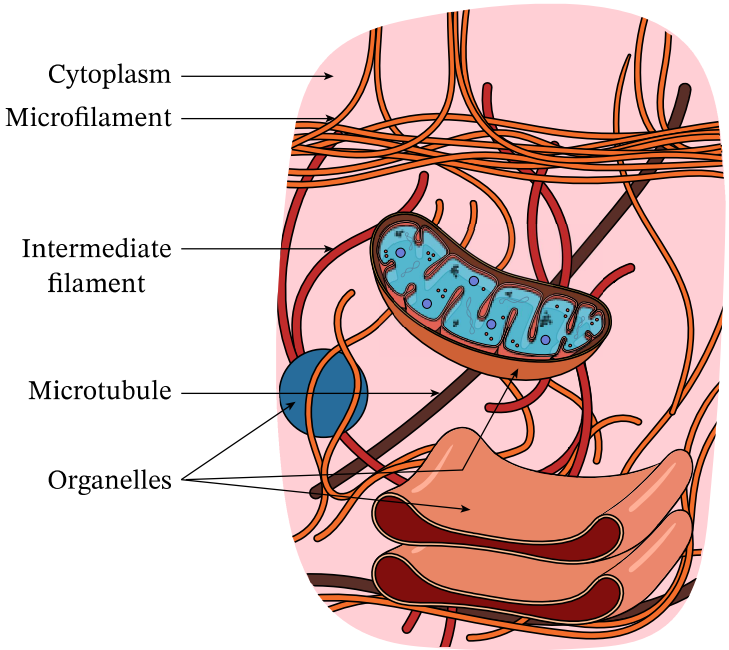
- The **cytoskeleton** is a network of fibers extending throughout the cytoplasm.
- It organizes the cell's structures and activities, anchoring many organelles.
- The roles of Cytoskeleton are Support, Motility, and Regulation.



The cytoskeleton

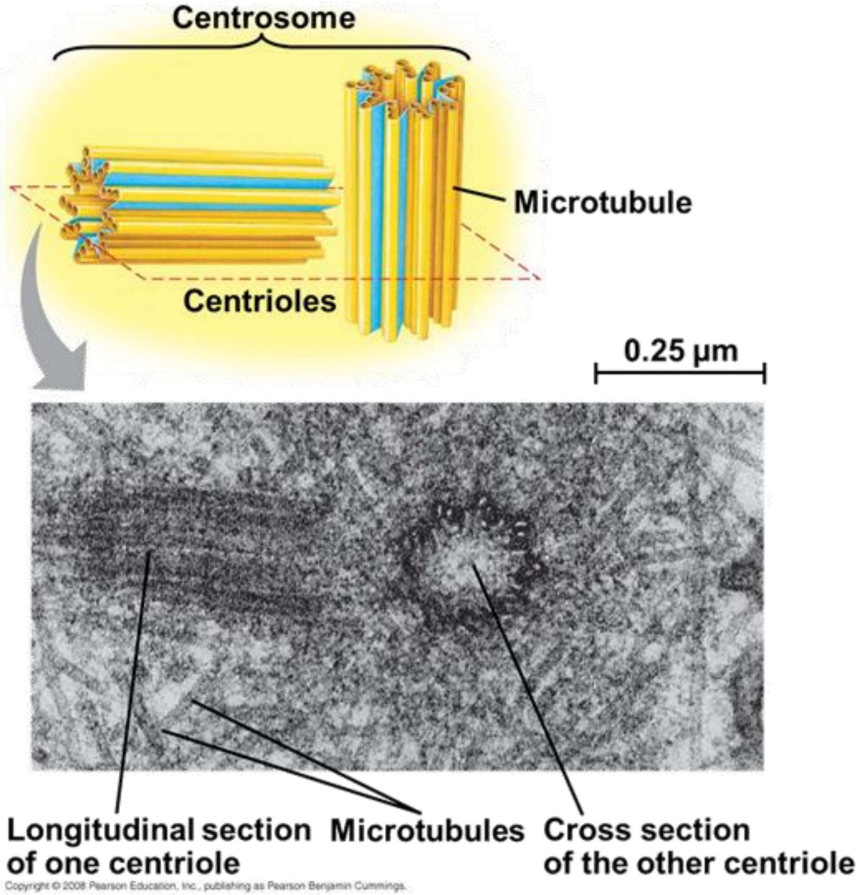
- It is composed of three types of molecular structures:
  - Microtubules are the thickest of the three components of the cytoskeleton.
  - Microfilaments also called actin filaments, are the thinnest components.
  - Intermediate filaments are fibers with diameters in a middle range .





Centrosomes and Centrioles

- In many cells, microtubules grow out from a **centrosome** near the nucleus.
- The centrosome is a microtubule-organizing center → it regulates cell motility, adhesion and polarity in interphase, and facilitates the organization of the spindle poles during mitosis.
- In animal cells, the centrosome has a pair of **centrioles**, each with nine triplets of microtubules arranged in a ring.

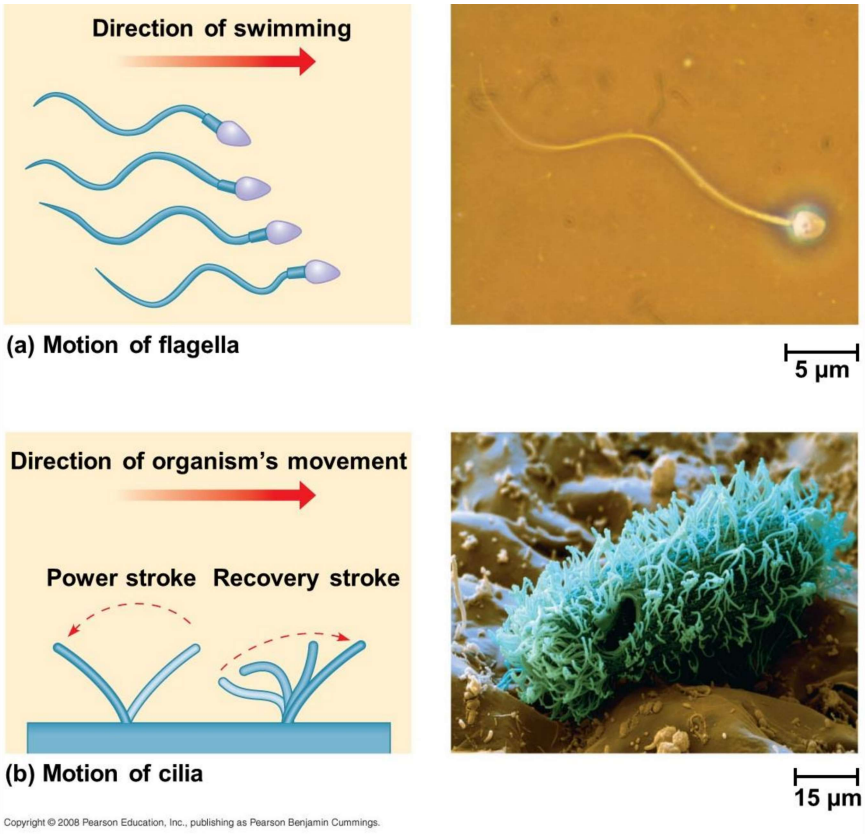


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Cilia and Flagella

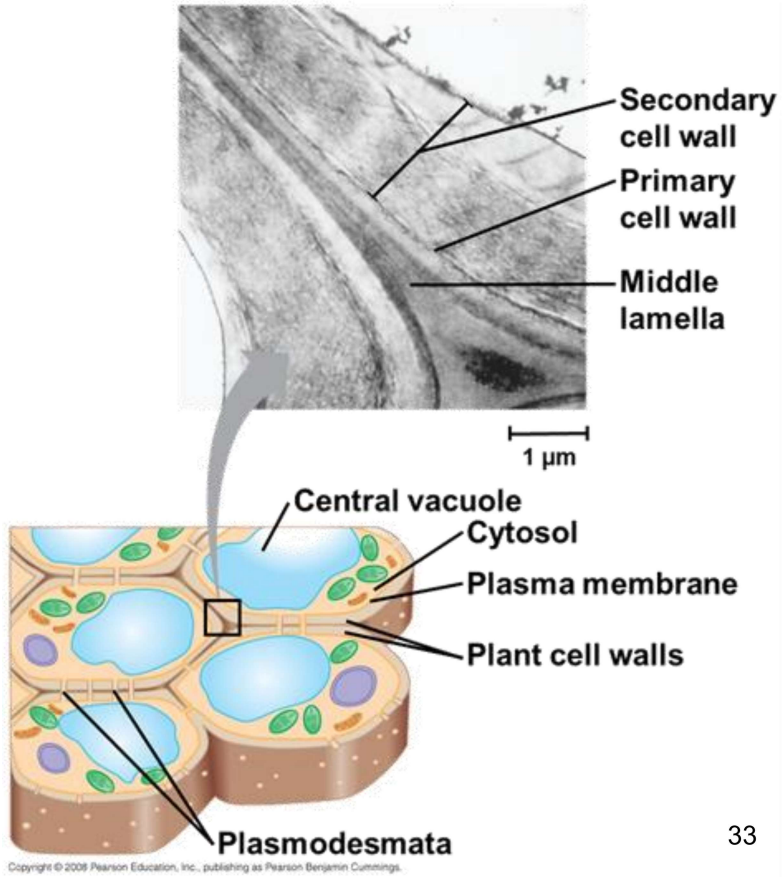
- Microtubules control the beating of **cilia** and **flagella**, locomotor appendages of some cells.

- Cilia and flagella differ in their beating patterns.

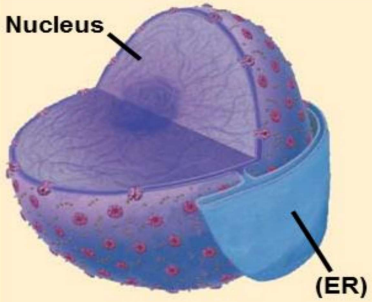
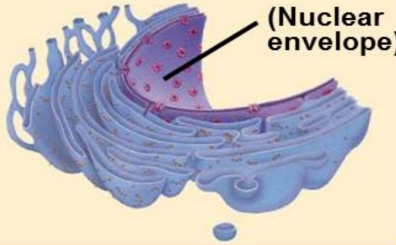
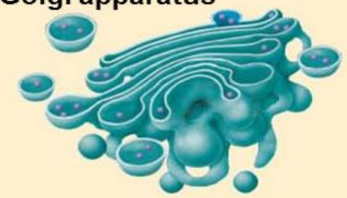


Extracellular components and connections between cells help coordinate cellular activities

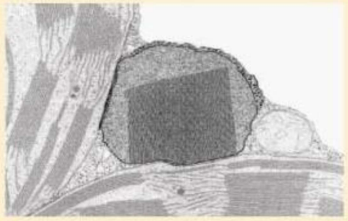
- Most cells synthesize and secrete materials that are external to the plasma membrane.
- These extracellular structures include:
  - Cell walls of plants: It protects the plant cell, maintains its shape, and prevents excessive uptake of water.
  - The extracellular matrix (ECM) of animal cells: it helps in supporting, movement, and regulation of the cells
  - Intercellular junctions: it helps in the adherence, interaction, and communication between neighboring cells



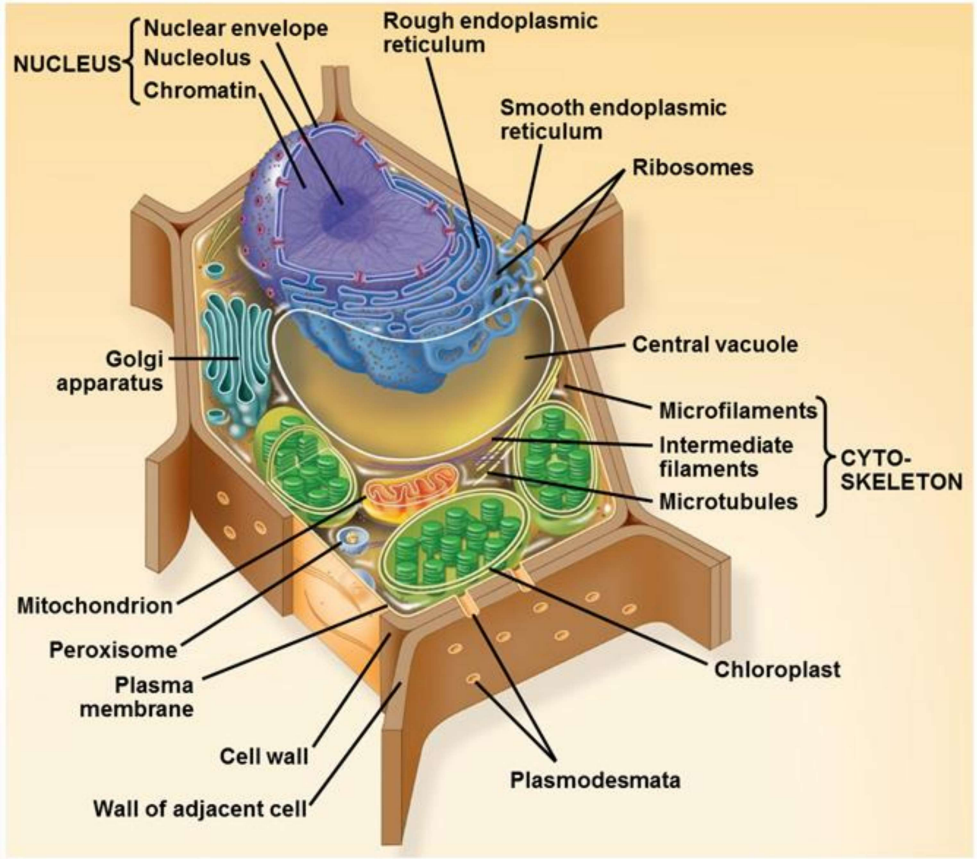
Summary of the Cell organelle

	Cell Component	Structure	Function
Concept 6.3 The eukaryotic cell's genetic instructions are housed in the nucleus and carried out by the ribosomes	Nucleus  (ER)	Surrounded by nuclear envelope (double membrane) perforated by nuclear pores. The nuclear envelope is continuous with the endoplasmic reticulum (ER).	Houses chromosomes, made of chromatin (DNA, the genetic material, and proteins); contains nucleoli, where ribosomal subunits are made. Pores regulate entry and exit os materials.
	Ribosome 	Two subunits made of ribosomal RNA and proteins; can be free in cytosol or bound to ER	Protein synthesis
Concept 6.4 The endomembrane system regulates protein traffic and performs metabolic functions in the cell	Endoplasmic reticulum  (Nuclear envelope)	Extensive network of membrane-bound tubules and sacs; membrane separates lumen from cytosol; continuous with the nuclear envelope.	Smooth ER: synthesis of lipids, metabolism of carbohydrates, Ca^{2+} storage, detoxification of drugs and poisons Rough ER: Aids in sythesis of secretory and other proteins from bound ribosomes; adds carbohydrates to glycoproteins; produces new membrane
	Golgi apparatus 	Stacks of flattened membranous sacs; has polarity (*cis* and *trans* faces)	Modification of proteins, carbohydrates on proteins, and phospholipids; synthesis of many polysaccharides; sorting of Golgi products, which are then released in vesicles.

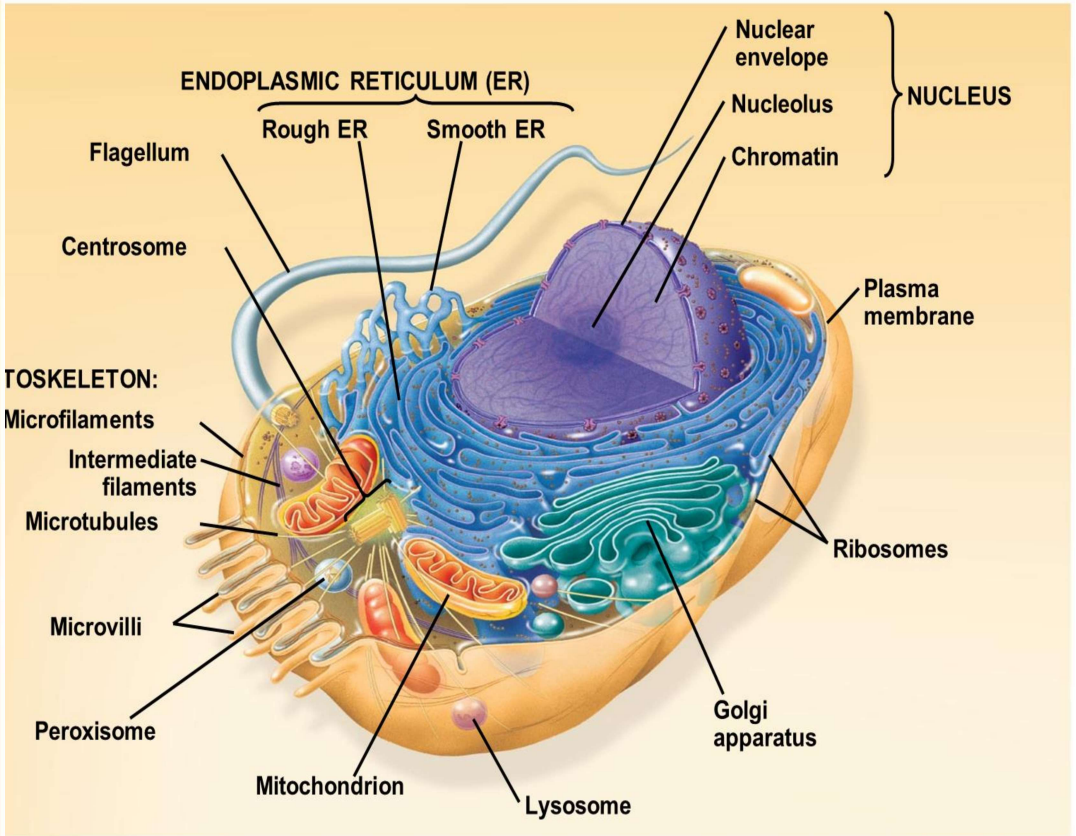
Summary of the Cell organelle

	Cell Component	Structure	Function
	Lysosome 	Membranous sac of hydrolytic enzymes (in animal cells)	Breakdown of ingested sub-stances cell macromolecules, and damaged organelles for recycling
	Vacuole 	Large membrane-bounded vesicle in plants	Digestion, storage, waste disposal, water balance, cell growth, and protection
Concept 6.5 Mitochondria and chloro-plasts change energy from one form to another	Mitochondrion 	Bounded by double membrane; inner membrane has infoldings (cristae)	Cellular respiration
	Chloroplast 	Typically two membranes around fluid stroma, which contains membranous thylakoids stacked into grana (in plants)	Photosynthesis
	Peroxisome 	Specialized metabolic compartment bounded by a single membrane	Contains enzymes that transfer hydrogen to water, producing hydrogen peroxide (H_2O_2) as a by-product, which is converted to water by other enzymes in the peroxisome

Plant and Animal Cells



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Plant Cell VS Animal cell

CELL Organelles	Plant Cell	Animal Cell
Cell Wall	Made of cellulose is present in almost all cells.	absent.
Plastids	Plastids like leucoplasts, chloroplast and chromoplasts are present.	No plastids found.
Chloroplasts	Plants cells have chloroplasts to prepare their own food.	Chloroplasts completely absent.
Vacuoles	Cell sap containing vacuoles are present.	usually absent or one or more small vacuoles are seen.
Lysosomes	Lysosomes not evident.	Lysosomes occur in cytoplasm.
Nucleus	nucleus may be located at the edge of the cell.	Usually located centrally.
Golgi bodies	Plant cells have many simpler units of golgi complex, called dictyosomes.	Animal cells have a single highly elaborate golgi complex.

Plant Cell VS Animal cell

CELL ORGANELLES	Plant Cell	Animal Cell
Centrioles	Present only in lower plant forms.	Present
Flagella	May be found in some cells.	May be found in some cells.
Cilia	Very rare	Present
Cell shape and structure	Rigid, fixes rectangular shape.	Lack rigidity, are round and irregular shape.
Starch grains	Present	Are not present.

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- a A. Urry, Micheal L.Cain, Steven A. Wasserman, Peter V. Minorsky, Rebecca B. Orr, Neil A. Campbell, Publisher: Pearson, Year: 2020, ISBN: 9780135988046; 0135988047