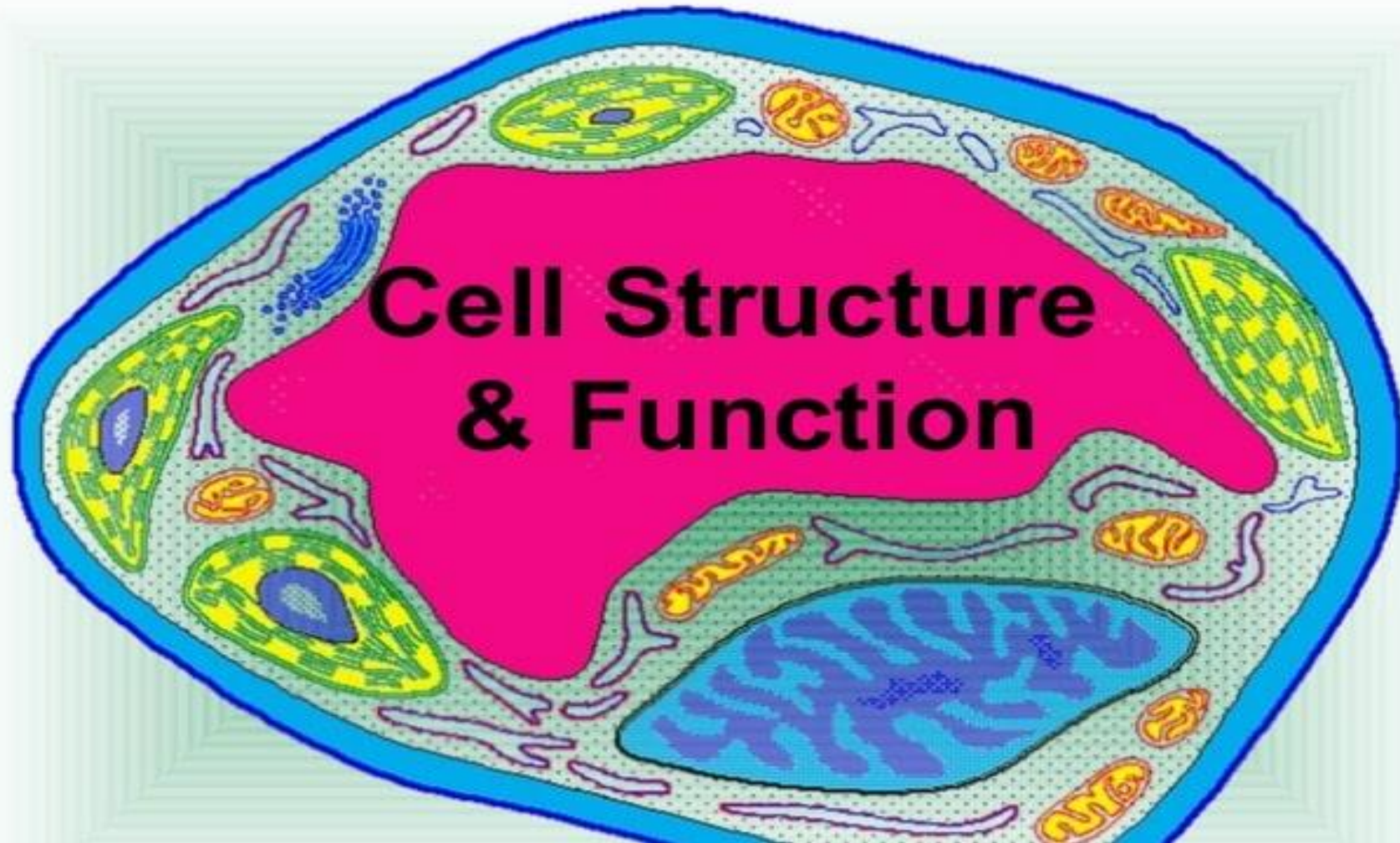




By lecturer:
Ms. Sarmad Sirag
M.sc Biochemistry and Molecular Biology

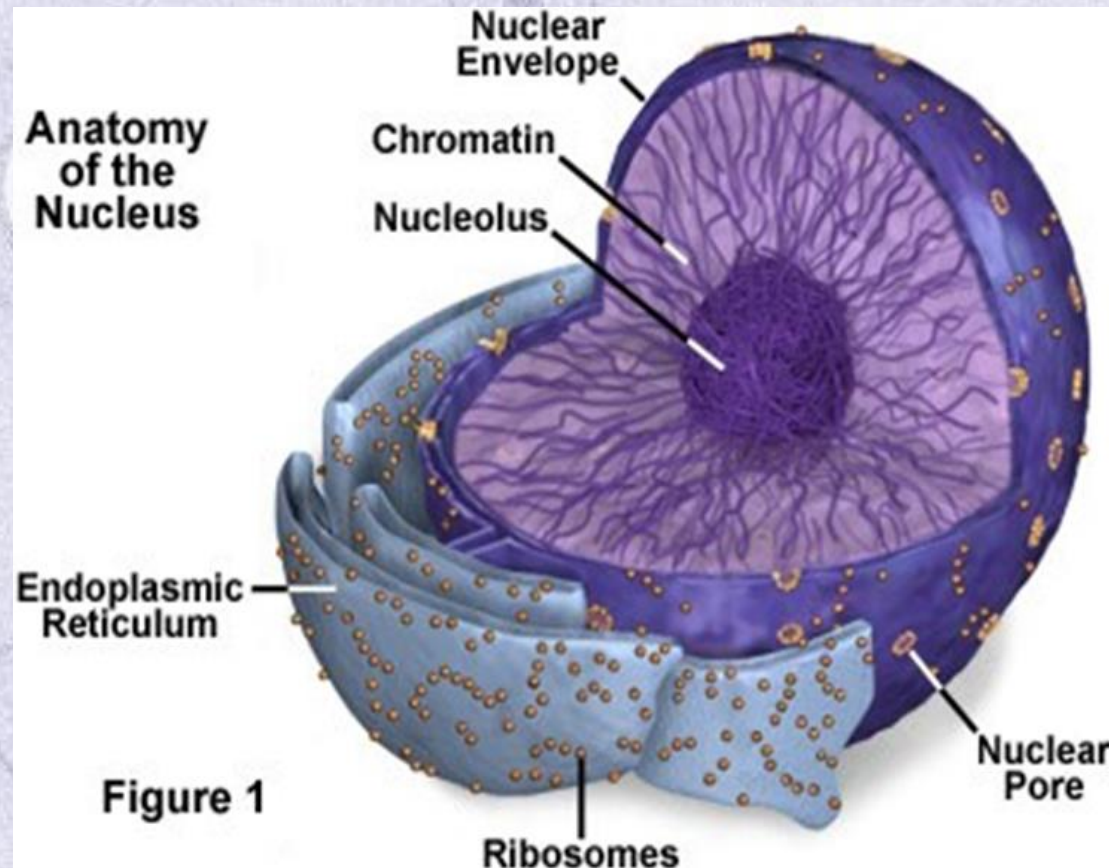
Structure of the cell

Typical cell as seen by light microscope has **2 major parts**, a **nucleus** & a **cytoplasm**.

The nucleus is separated from the cytoplasm by a **nuclear membrane** and the cytoplasm is separated from the surrounding by a **cell membrane**.

Nucleus

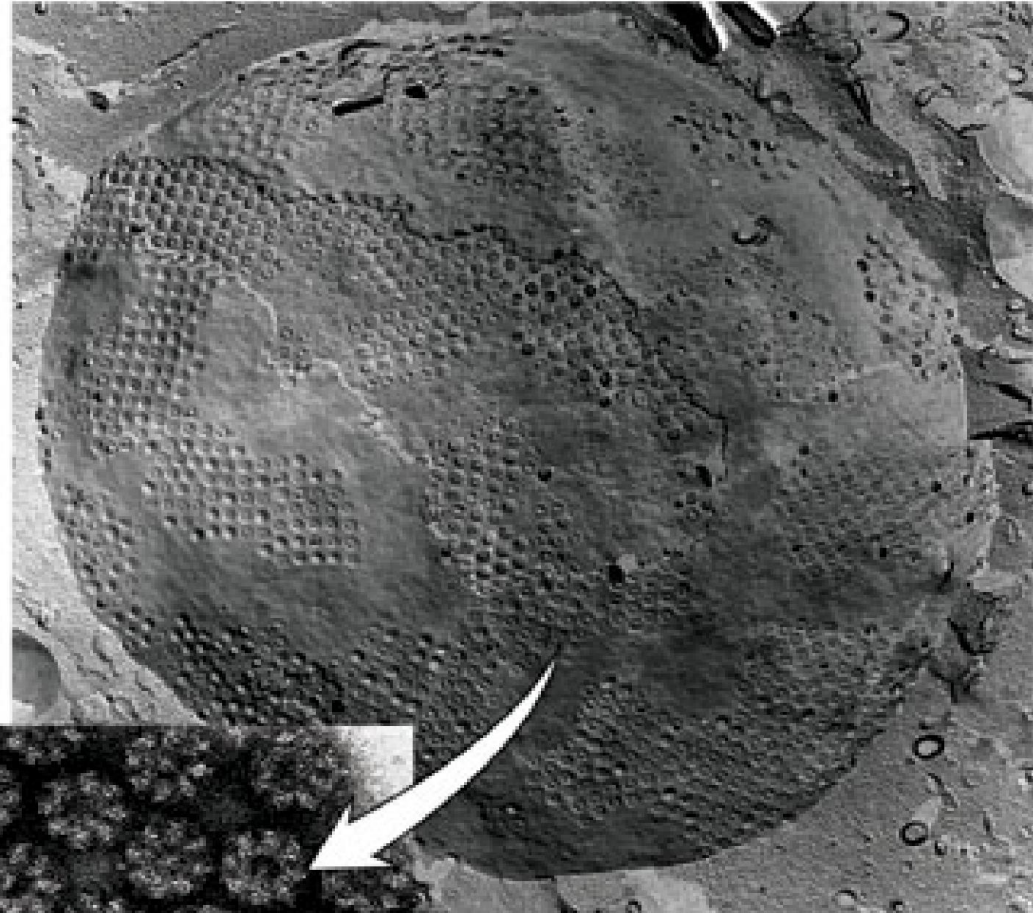
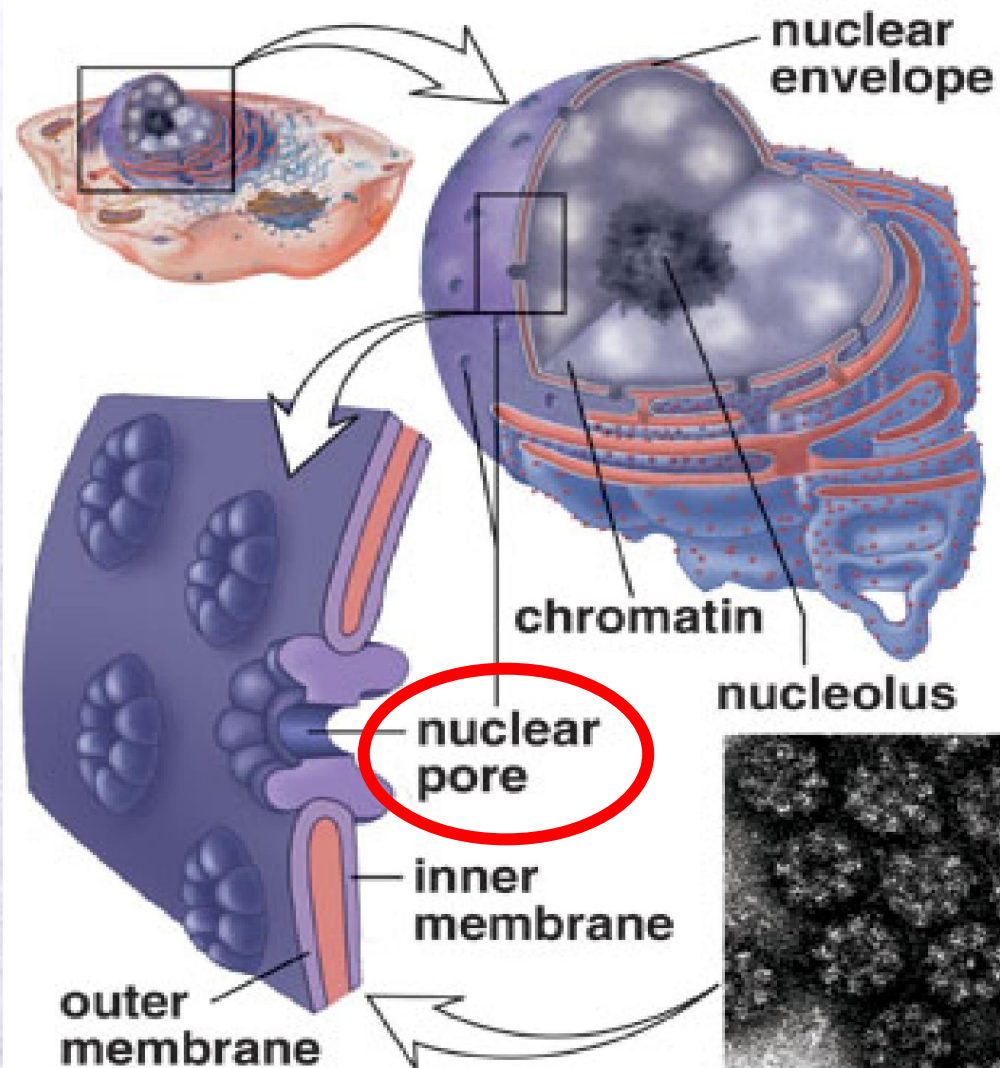
Organelle that controls the cell's activities & contains DNA



Parts of Nucleus

- 1. Nuclear envelope:** 2 membranes that surround nucleus of a cell
- 2. Nucleolus:** cell structure that contains rRNA & proteins; where ribosomes synthesis occur.
- 3. Chromatin:** DNA + histone protein

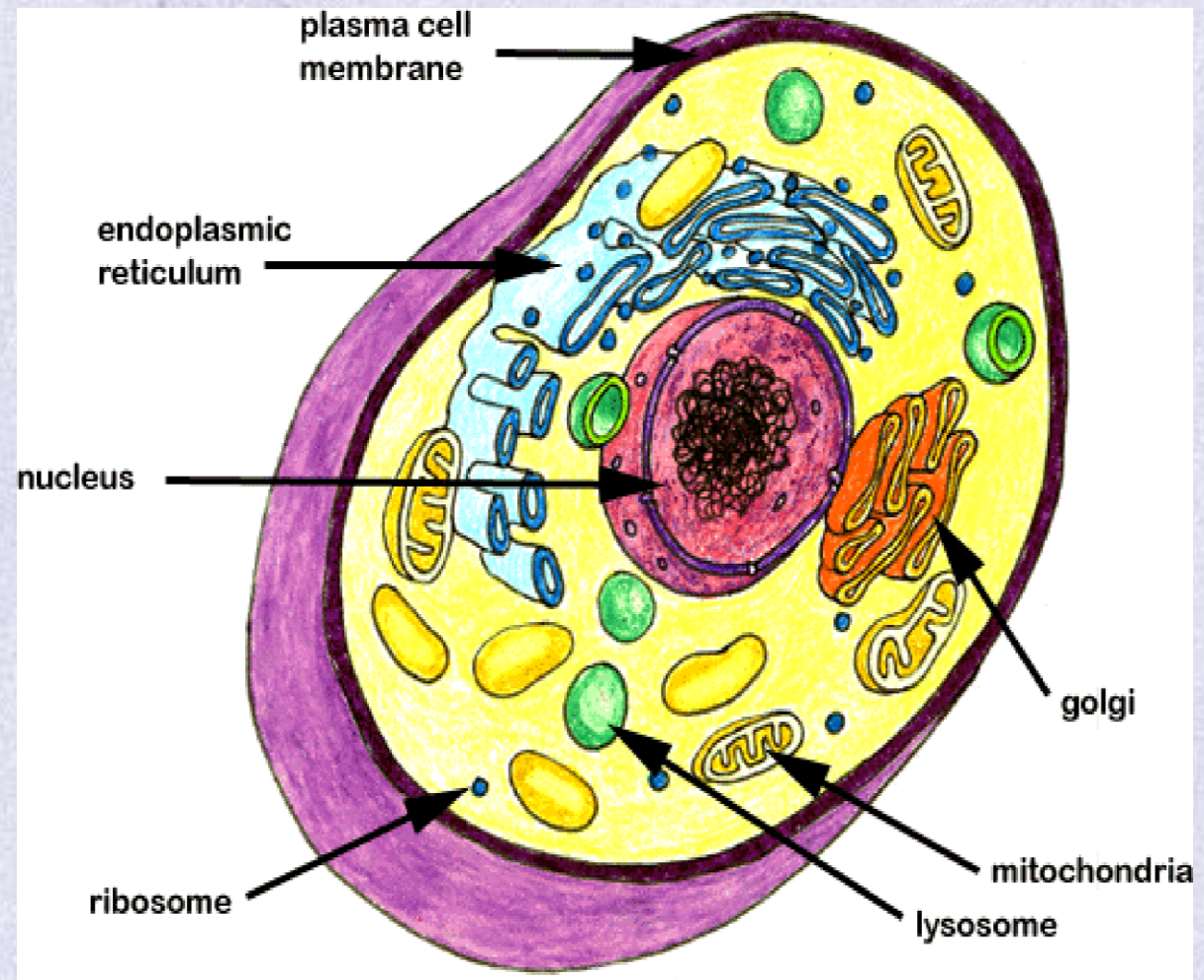
Parts of Nucleus



Electron micrographs of nuclear envelope showing pores.

Cytoplasm

Cytoplasm : (jelly-like) area between nucleus & cell membrane of a cell surrounds organelles.





MITOCHONDRIA
THE CELL'S POWER HOUSE

Cytoplasmic organelles

1. Mitochondria

Is an Organelle that changes chemical energy stored in food into compounds that can be used by the cell (ATP).

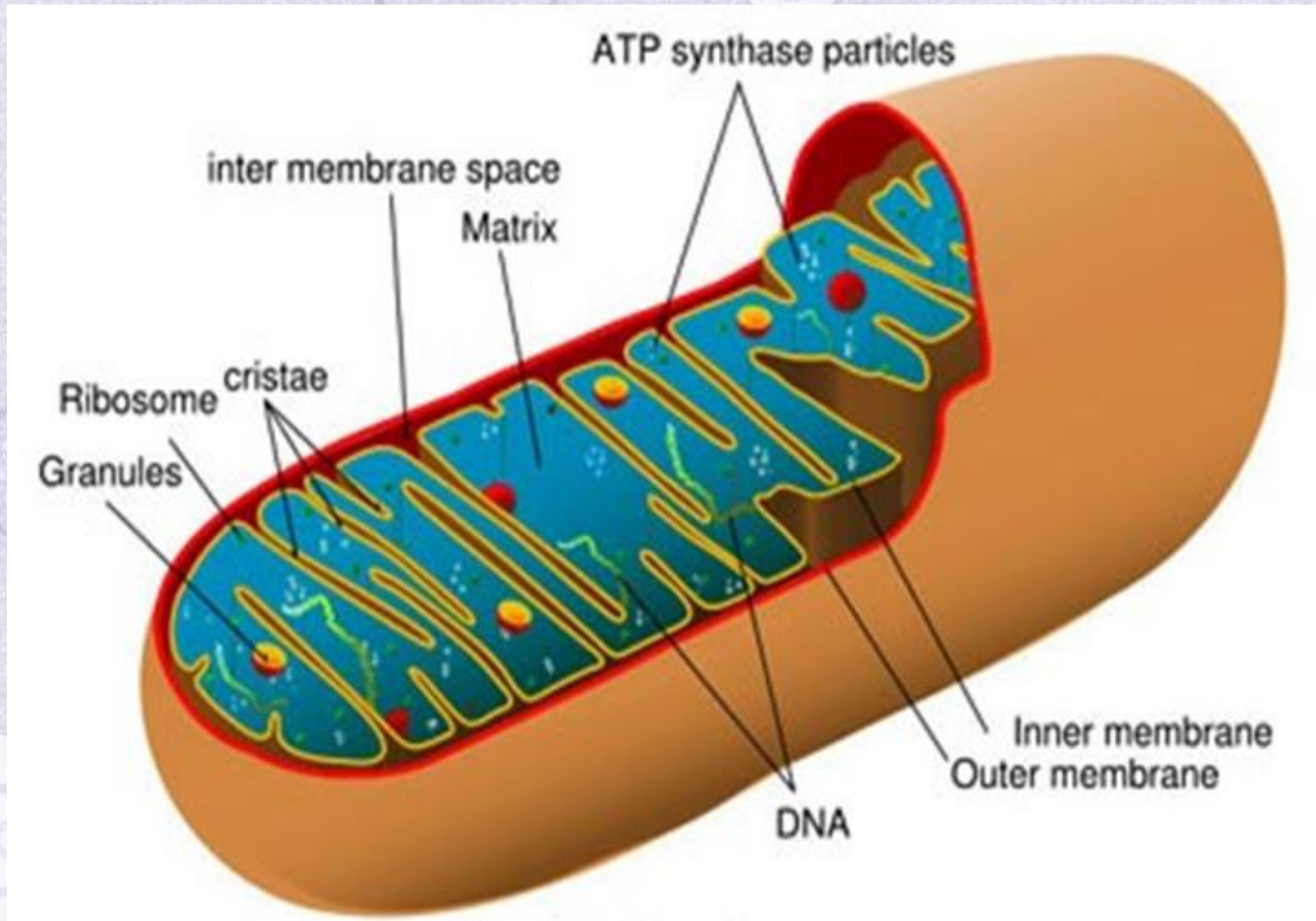
Functions:

- **ATP synthesis**
- **Metabolic reactions occur in mitochondria**

Parts of Mitochondria

- **Outer membrane**
- **Intermembrane space**
- **Inner membrane**
- **Cristae**
- **Matrix**

Mitochondria



2.Ribosomes

Protein Factories

Ribosomes : organelles in which proteins are made

- **Smallest of organelles**
- **Assembled in nucleolus**
- **Composed of RNA & protein**
- **Some attached to membranes while others free in cytoplasm**
- **Free in cytoplasm(cytosolic):** makes proteins for use within cell
- **Attached to RER:** makes proteins for export out of cell



3. Endoplasmic reticulum

Endoplasmic reticulum: complex network of membranes that transports materials inside the cell

Functions of Smooth & rough endoplasmic reticulum

- **Smooth:** lipid synthesis, storage of special enzymes, calcium, detoxification in liver
- **Rough:** synthesis of proteins (ribosomes stuck to it)
- Protein folding and glycosylation

Endoplasmic Reticulum

We need to get these molecules out YESTERDAY people!

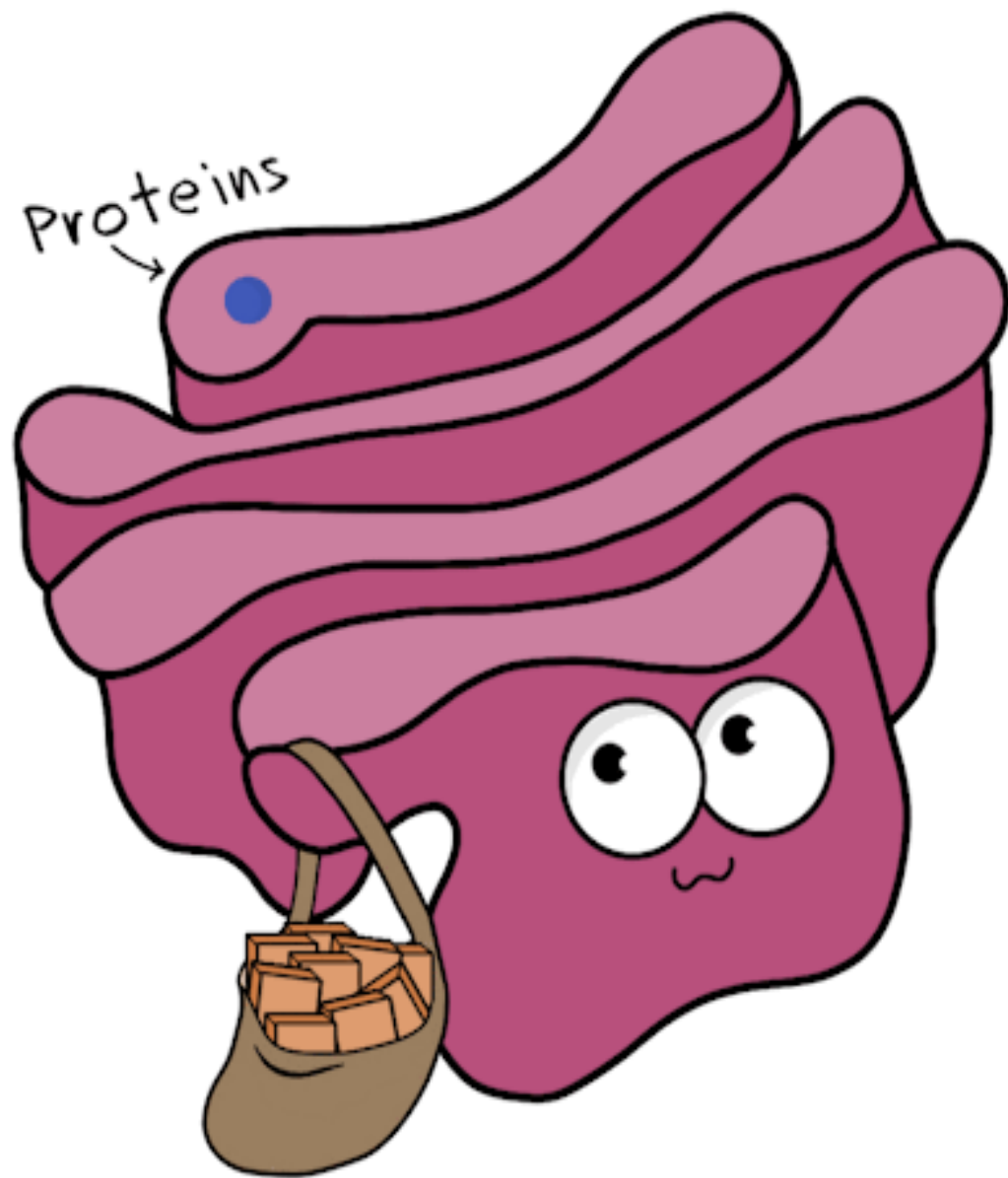


GOLGI



FOR ALL YOUR PACKING NEEDS

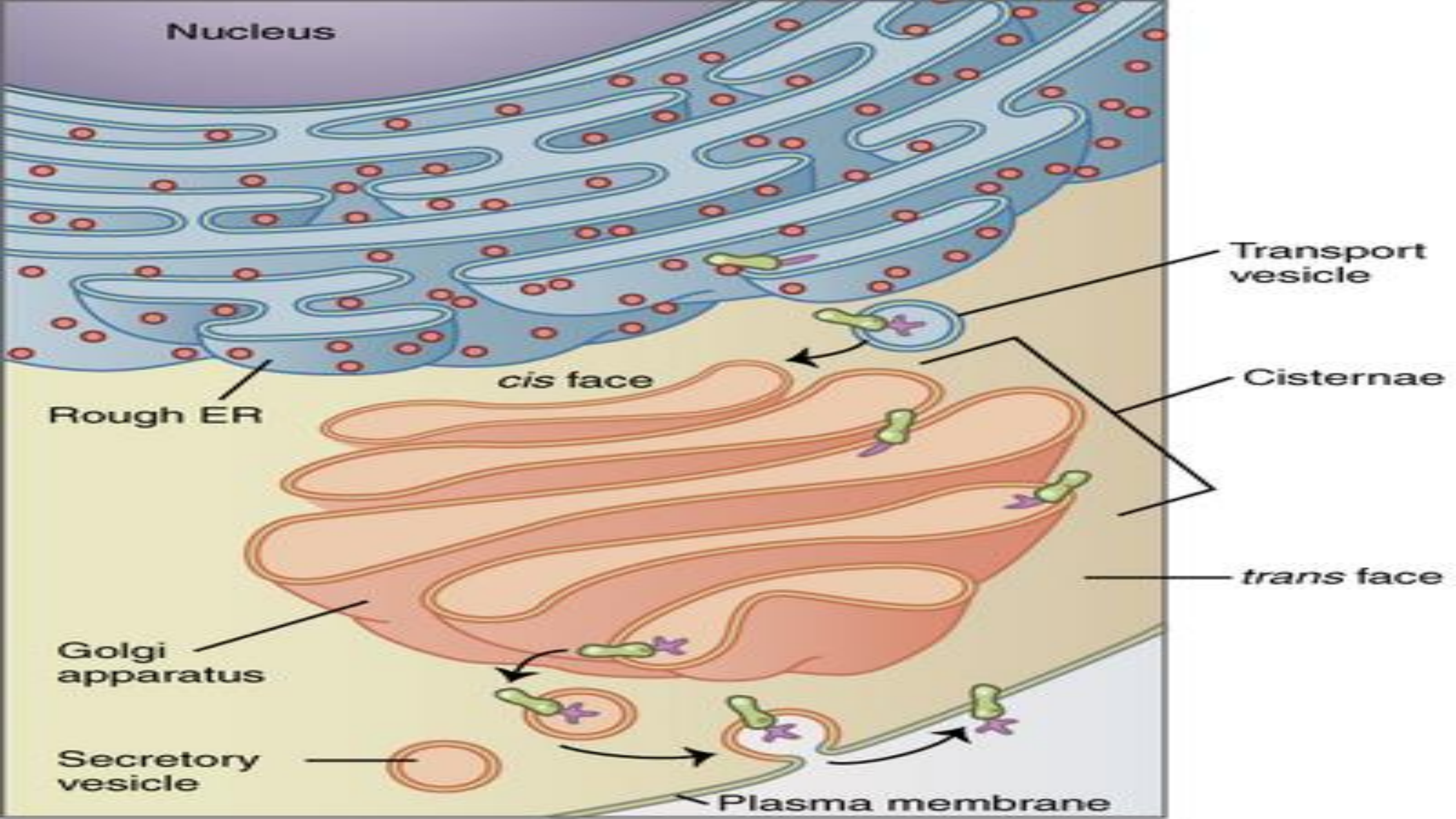
Proteins



Post office of the cell

4. Golgi apparatus

- **Golgi apparatus:** organelle that modifies, collects, packages, & distributes molecules made at one location of the cell & used at another
- **Functions:**
 - Receive vesicles from RER & SER
 - Modifications (glycosylation, phosphorylation)
 - Packaging of molecules
 - Direct them inside or outside the cell



5. Lysosome Recycling center

Lysosome: organelle that contains hydrolytic enzymes

Functions:

- Digesting of certain macromolecules in the cell.
- Autophagy (self digestion) of organelles
- Autolysis of damaged cells

Amoeba Sisters

Lysosome

#AmoebaGIFs

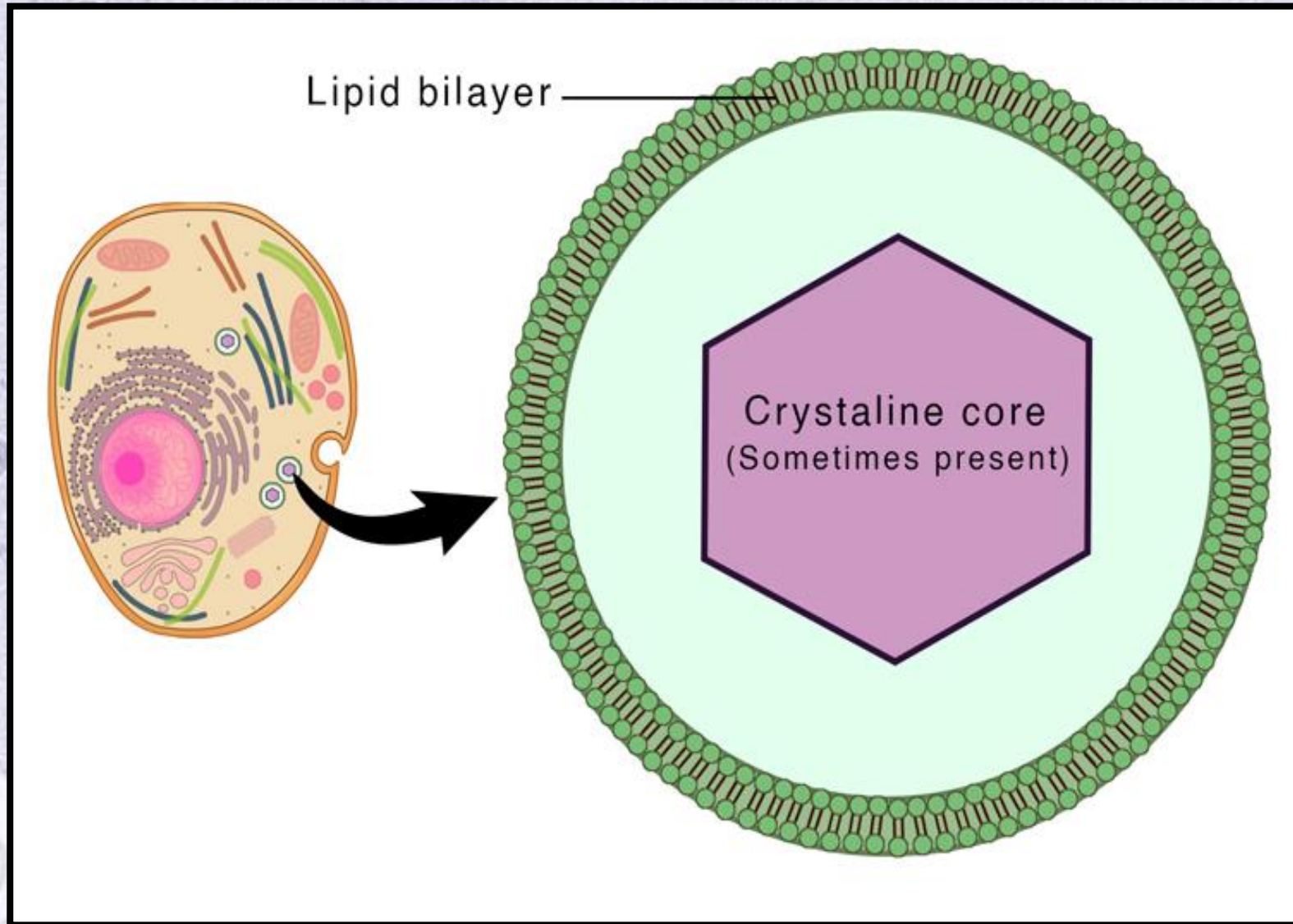


Enzyme-packed wrecking balls of the cell

6. peroxisome

- Is an organelle that contain oxidative enzymes
- **Functions:**
 - Detoxification of harmful substances
 - Lipid metabolism

6. peroxisome

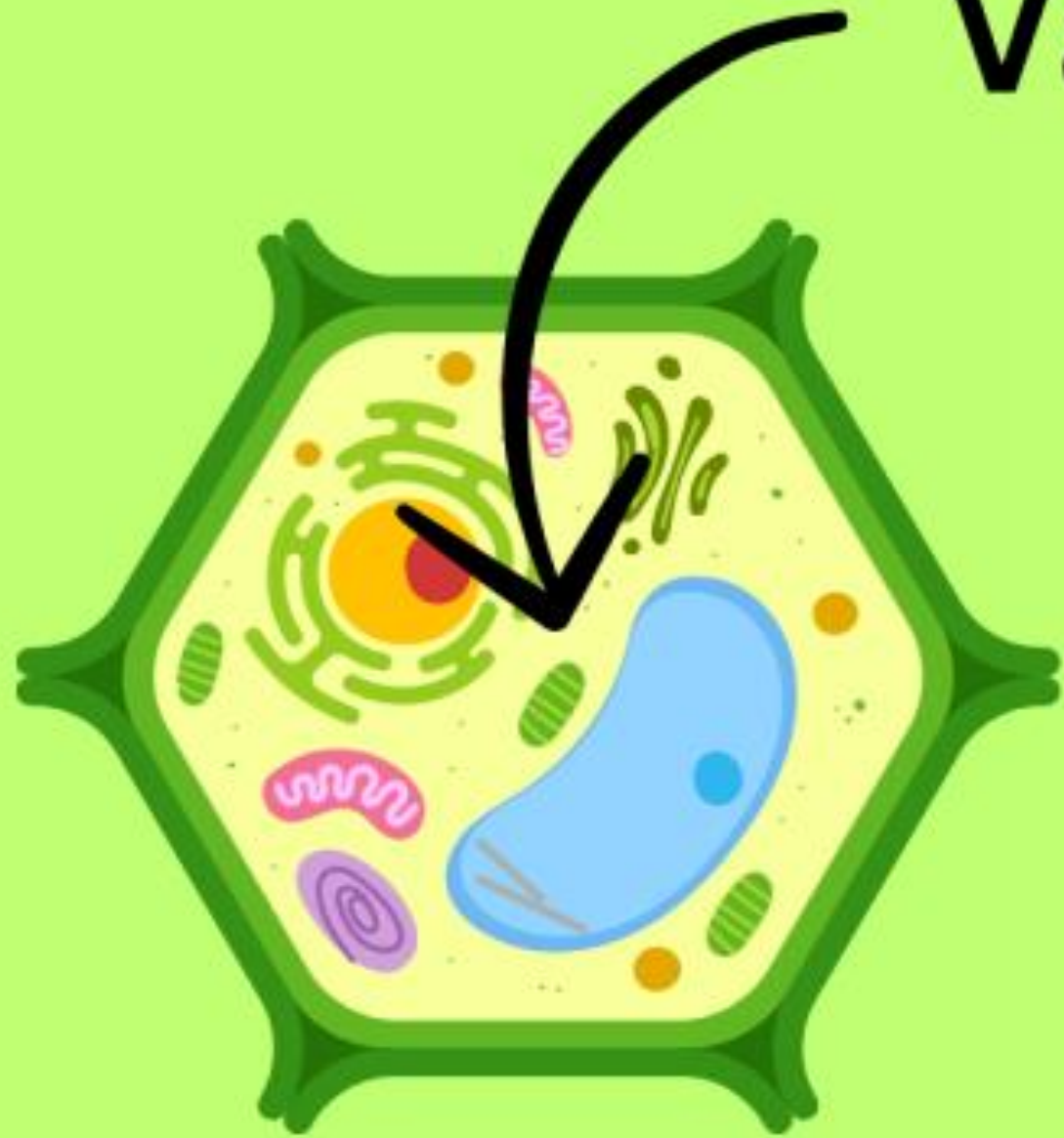


7. Vacuole Storage Tanks

Vacuole : organelle that stores materials such as water, salts, proteins, and carbohydrates.

- **Stores food, fluid, waste products**
- **Plants have a large central vacuole for water storage**
- **Unicellular animals can use contractile vacuoles for movement**

Vacuole



8. Cytoskeleton

Cytoskeleton: framework of the cell composed of a network of filaments, fibers and motor proteins that support cell structure and help in cell movement.

Components of Cytoskeleton

- 1. Microtubules**
- 2. Intermediate Filaments**
- 3. Microfilaments**
- 4. Motor proteins**

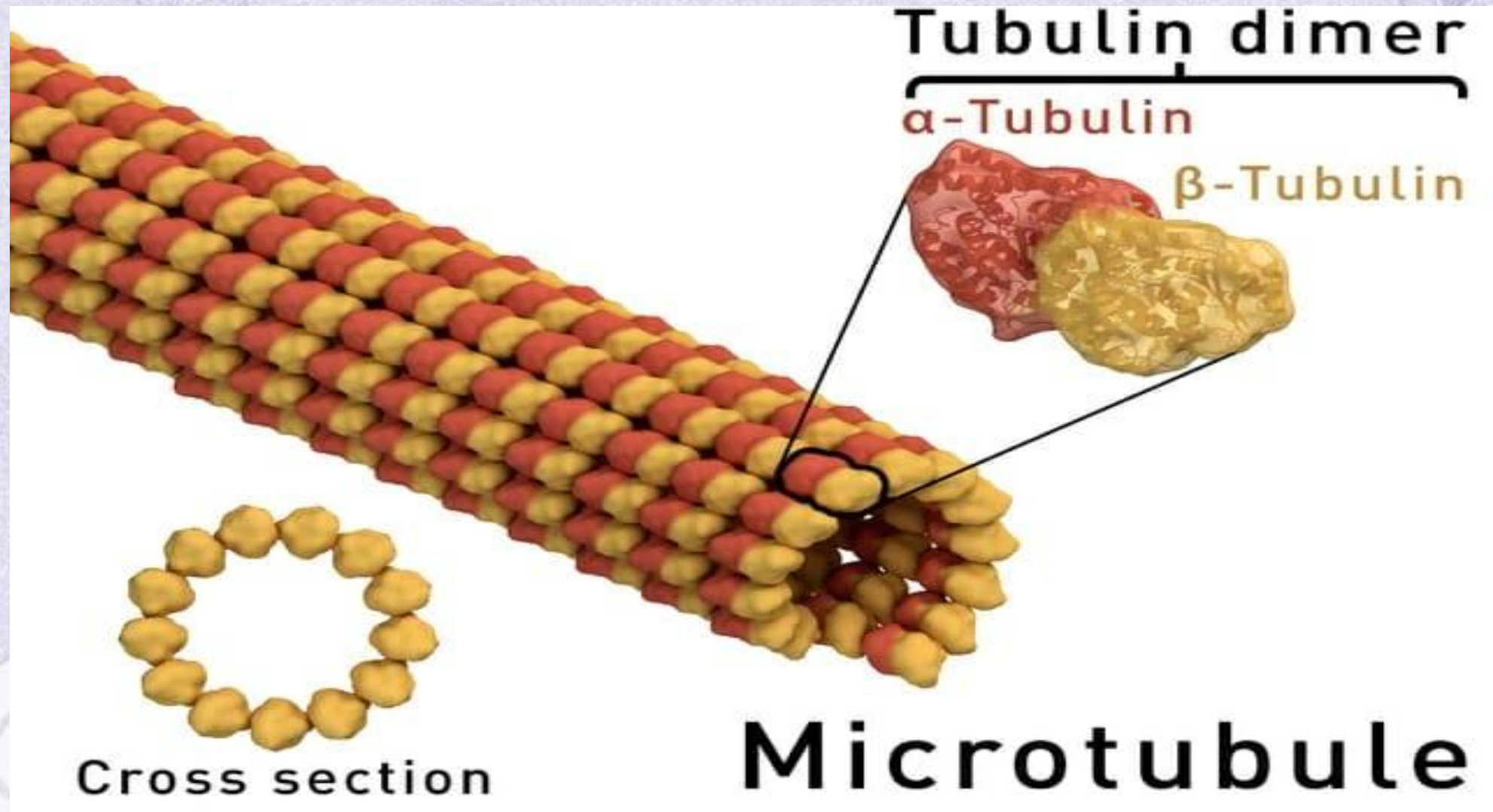
1. Microtubules

- Microtubules are small, hollow, round tubes with a diameter of about 24 nanometres.
- They are made up of α and β tubulin.
- Microtubules are very dynamic structures (can change quickly).

Function:

- Transport of cellular materials
- Dividing chromosomes during cell division
- Formation of cilia & flagella

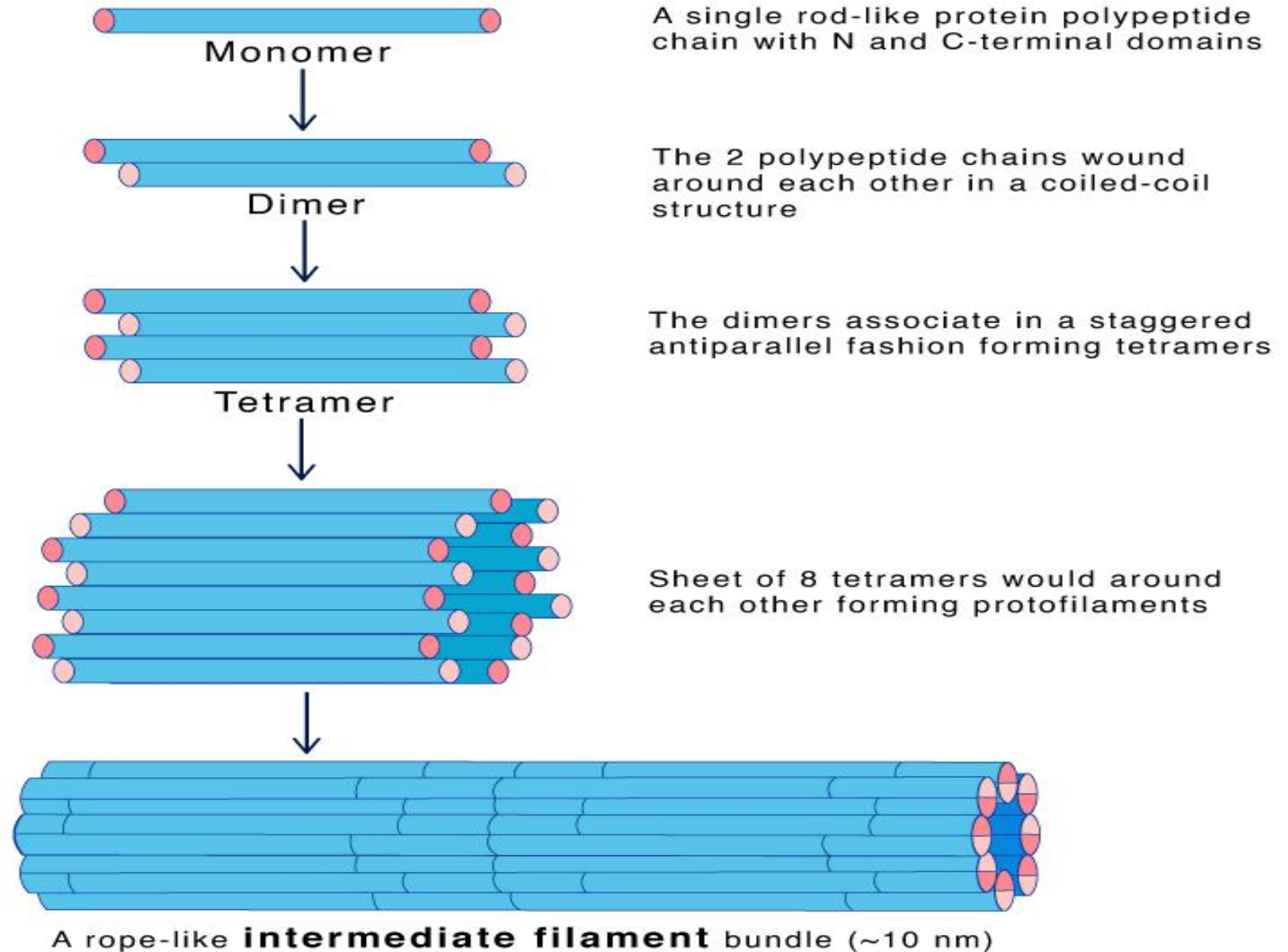
1. Microtubules



2. Intermediate Filaments

- The intermediate filaments are about 10 nm in diameter .
- **Function:**
- **Anchors:** cell- cell, cell- ECM, cell- organelles
- provide strength to the cell

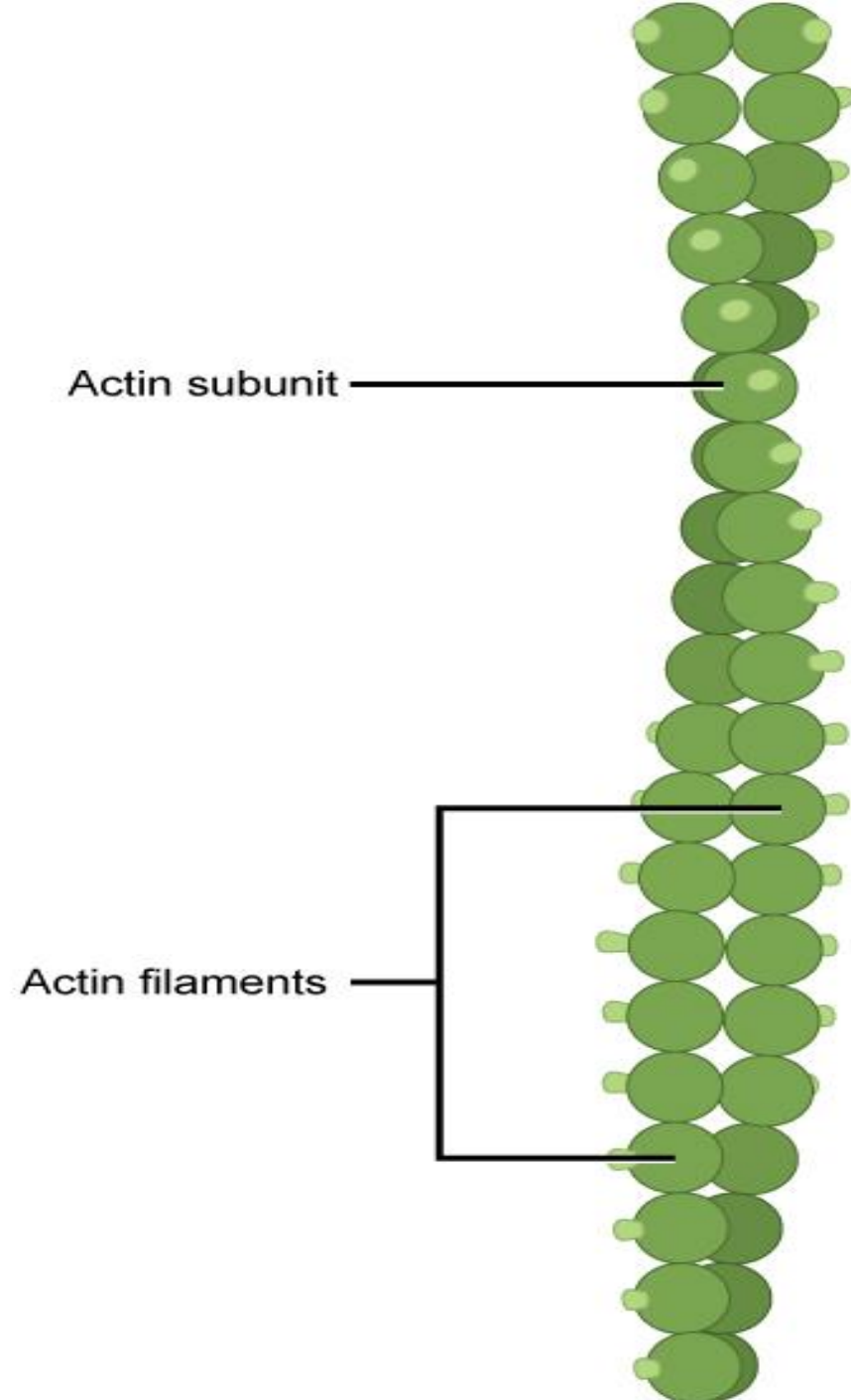
2. Intermediate Filaments



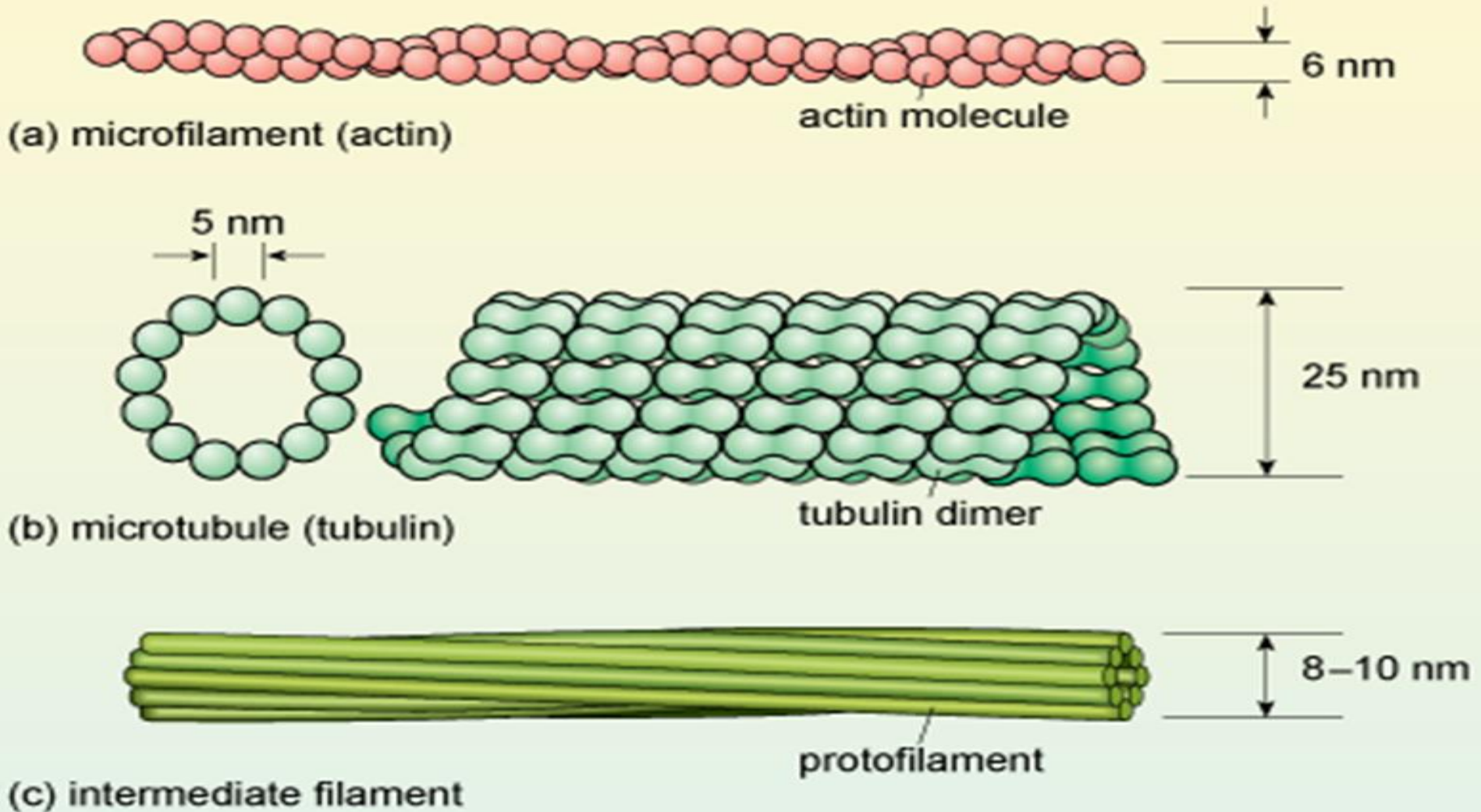
3. Microfilaments

- **Microfilaments are: thread-like protein fibres, 3-6 nm in diameter.**
- **They consist of the protein **actin****
- **Functions:**
 - **Responsible for cellular movements**
 - **Cytokinesis, muscle contraction (actin+ myosin)**
 - **Phagocytosis of WBCs**

3. Microfilaments



Components of Cytoskeleton



4. Motor proteins

- **Kinesin**

- Pull the organelles along the cell membrane.

- **Dynein**

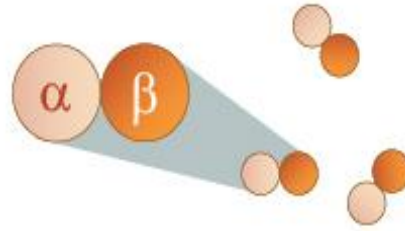
- Pull the cell organelles towards the nucleus.

- **Myosin**

- Interact with actin protein and are responsible for muscle contractions.
- Cytokinesis, exocytosis, and endocytosis.

4. Motor proteins

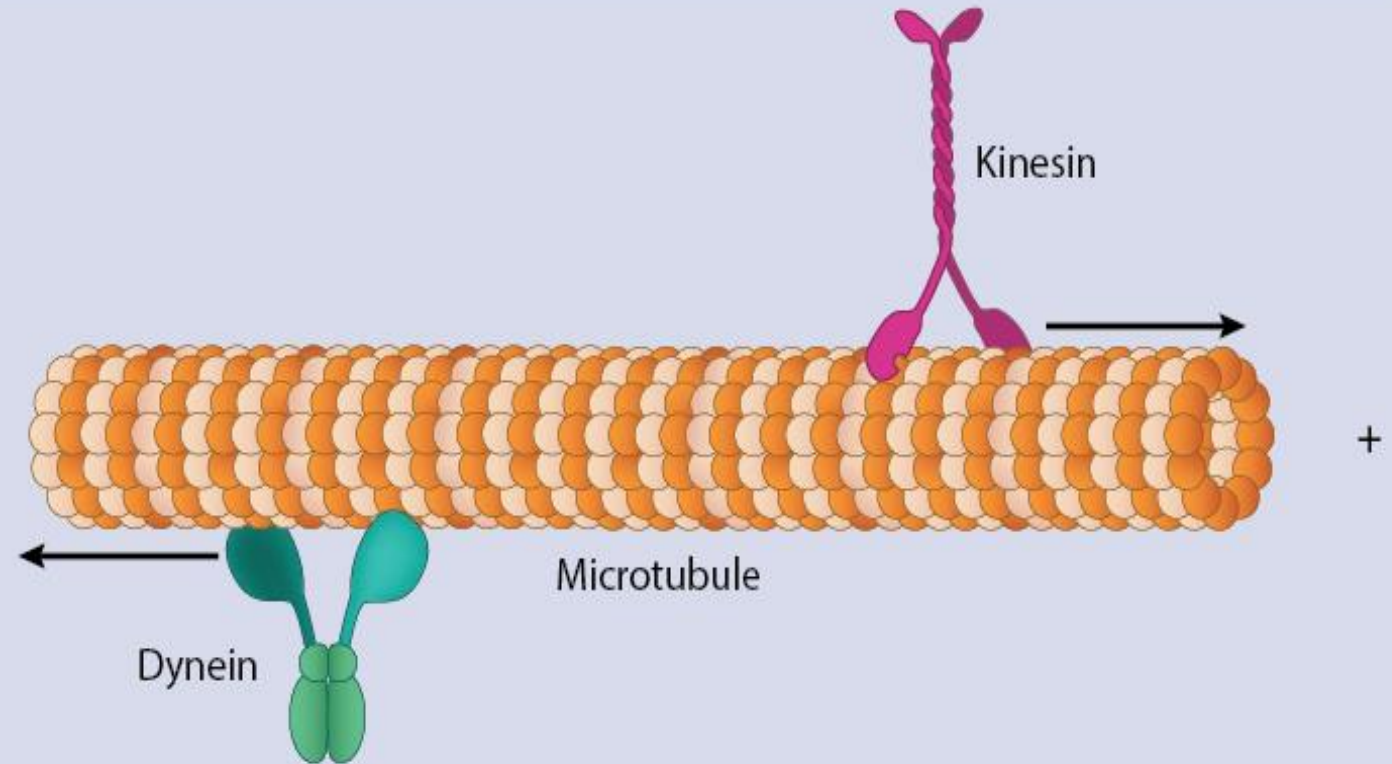
1 Tubulin heterodimers



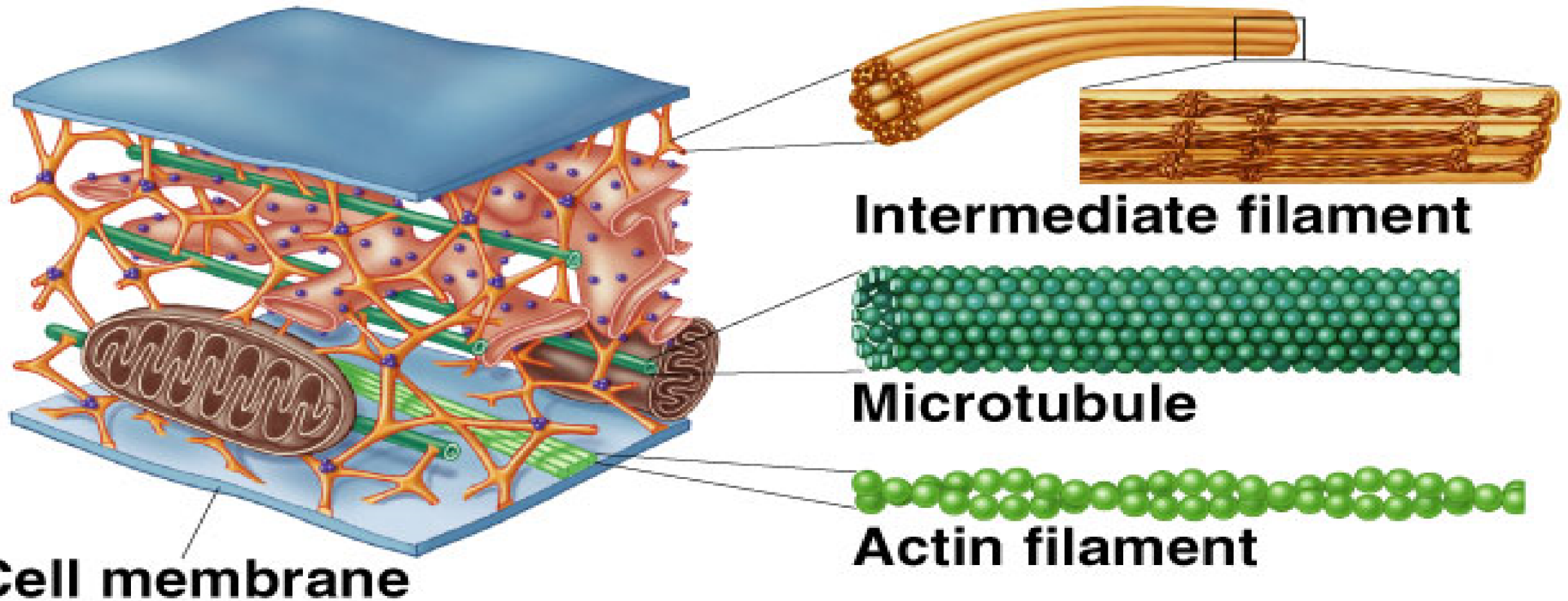
2 Protofilament



3



Components of Cytoskeleton

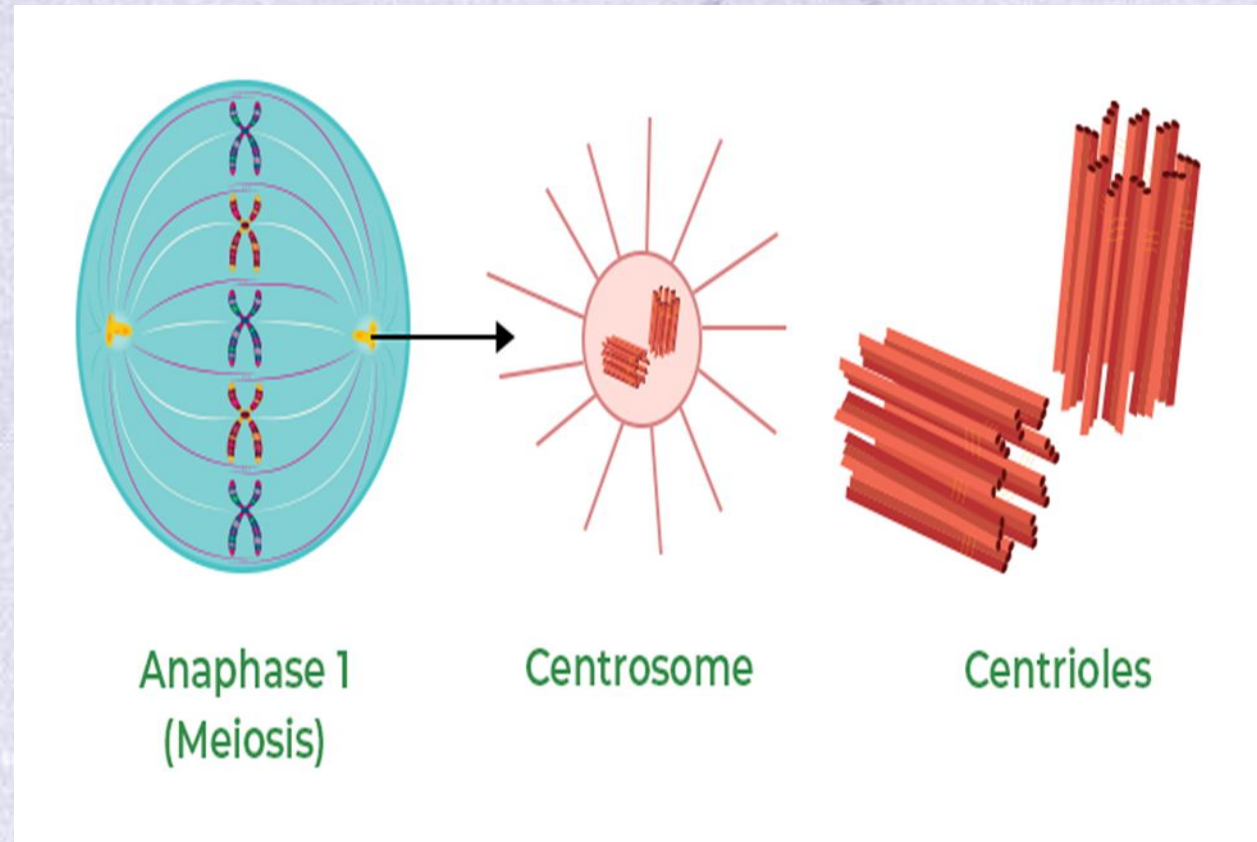


9. Centrioles

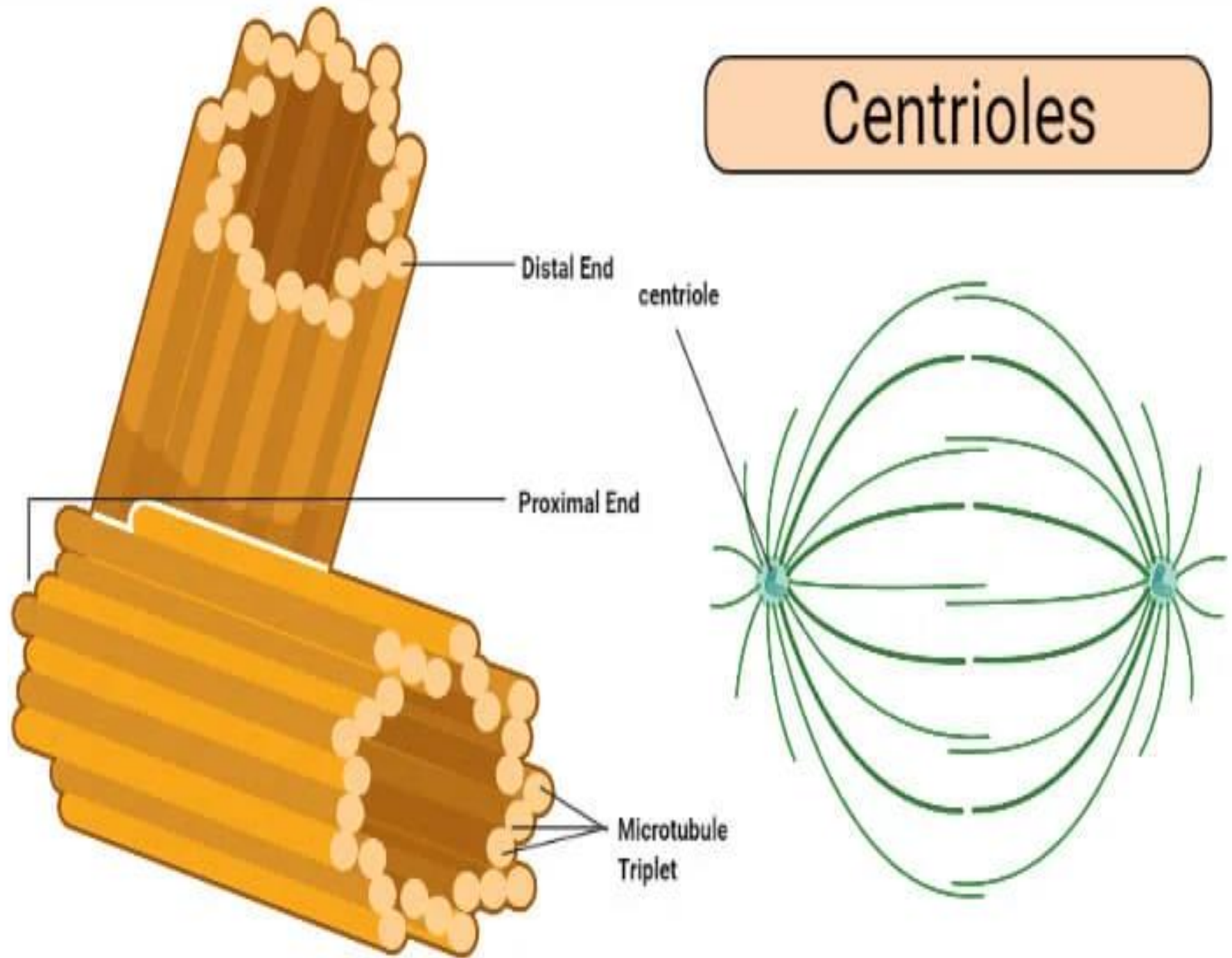
- Are barrel-shaped cell organelles composed of nine sets of microtubule triplets arranged in a cylinder + Proteins (tubulin, centrin, cenexin, and tektin)

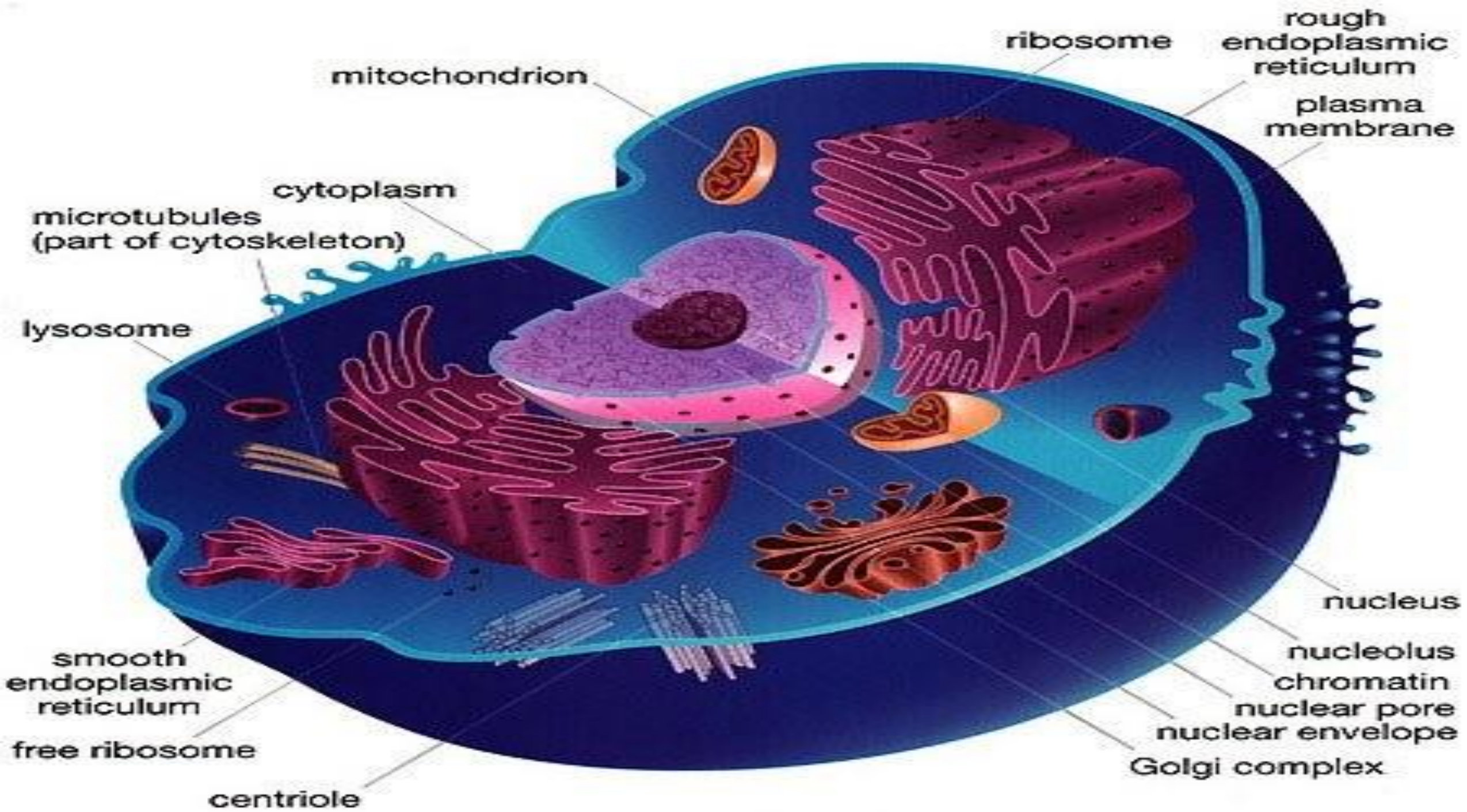
Functions:

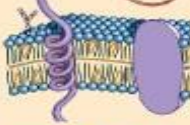
- Cell Division
- Cilia and Flagella Formation
- Centrosome Formation



Centrioles





Structure		Description	Function
Cell wall		Outer layer of cellulose or chitin; or absent	Protection; support
Cytoskeleton		Network of protein filaments	Structural support; cell movement
Flagella (cilia)		Cellular extensions with 9 + 2 arrangement of pairs of microtubules	Motility or moving fluids over surfaces
Plasma membrane		Lipid bilayer with embedded proteins	Regulates what passes into and out of cell; cell-to-cell recognition
Endoplasmic reticulum (ER)		Network of internal membranes	Forms compartments and vesicles; participates in protein and lipid synthesis
Nucleus		Structure (usually spherical) that contains chromosomes and is surrounded by double membrane	Control center of cell; directs protein synthesis and cell reproduction
Golgi apparatus		Stacks of flattened vesicles	Packages proteins for export from cell; forms secretory vesicles
Lysosomes		Vesicles derived from Golgi apparatus that contain hydrolytic digestive enzymes	Digest worn-out organelles and cell debris; play role in cell death
Microbodies		Vesicles that are formed from incorporation of lipids and proteins and that contain oxidative and other enzymes	Isolate particular chemical activities from rest of cell
Mitochondria		Bacteria-like elements with double membrane	"Power plants" of the cell; sites of oxidative metabolism
Chloroplasts		Bacteria-like elements with membranes containing chlorophyll, a photosynthetic pigment	Sites of photosynthesis
Chromosomes		Long threads of DNA that form a complex with protein	Contain hereditary information
Nucleolus		Site of genes for rRNA synthesis	Assembles ribosomes
Ribosomes		Small, complex assemblies of protein and RNA, often bound to endoplasmic reticulum	Sites of protein synthesis

THE
END