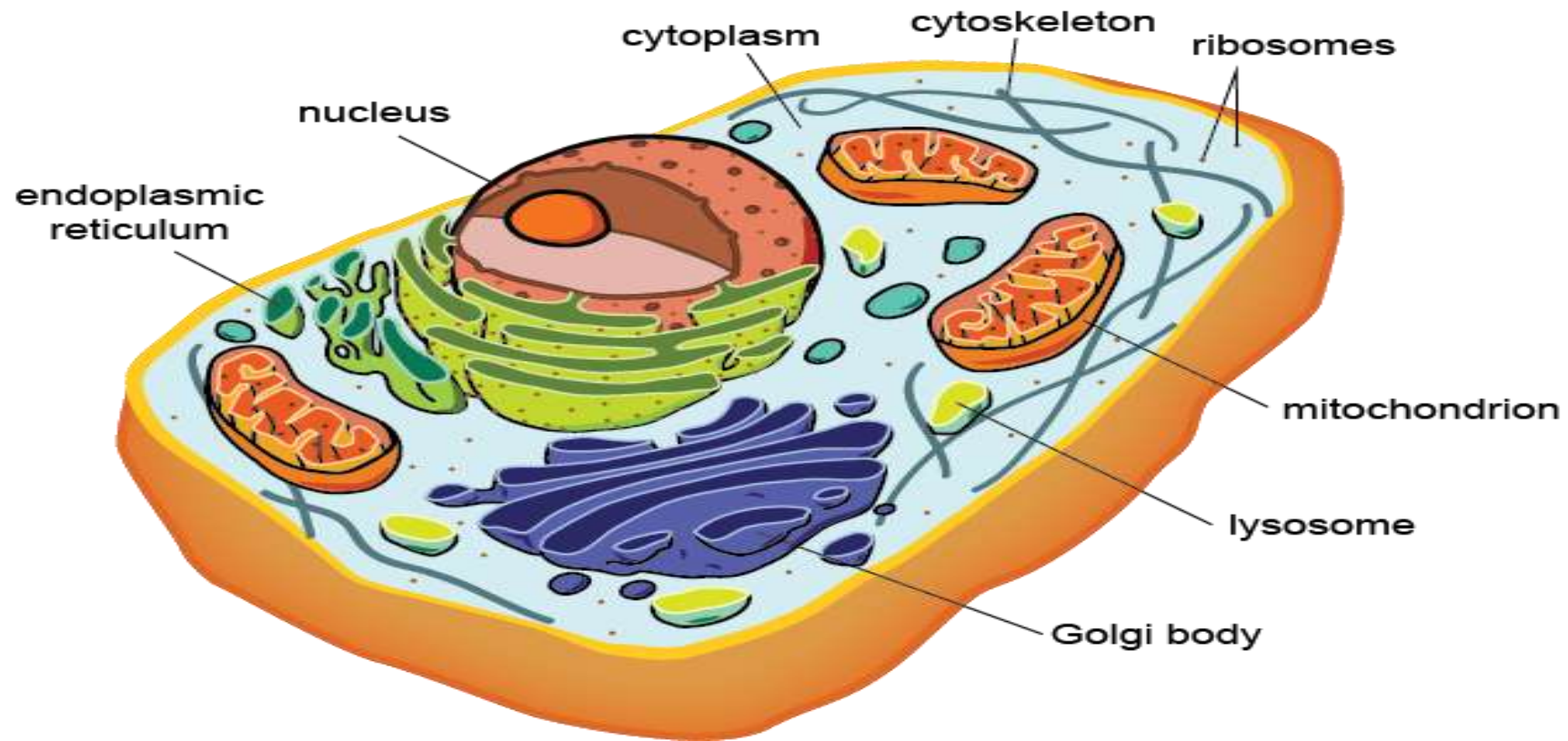


# THE CELL



Dr. Tamadher Mohammed

## What is the cell ?

A cell is the smallest unit that is capable of performing life functions . Its a chemical system that is able to maintain its structure and reproduce. Cells are the functional unit of life , and all living things are cells or composed of cells.

## Cell theory:-

Cell Theory was proposed by the German scientists, Theodor Schwann, Matthias Schleiden, and Rudolf Virchow. The cell theory states that:

1. All living organisms are composed of cells and product of cells
2. All cells arise from preexisting cells through the process of cell division
3. The body of living organisms is made up of one or more cells.

## **Cell structure**

The cell is the basic structural and functional unit of all forms of life. Every cell consists of cytoplasm enclosed within a membrane, and contains many macromolecules such as proteins, DNA and RNA, as well as many small molecules of nutrients and metabolites. The term comes from the Latin word *cellula* meaning 'small room'.

### **What are the functions of the cell?**

The essential functions of the cell include:

- The cell provides support and structure to the body.
- It facilitates growth by mitosis.
- It helps in reproduction.
- Provides energy and allows the transport of substances.

## **Cell number and shape :-**

### **A- Types of cells according to cell number**

**1- Unicellular organism** :- Organisms with single cell, capable of independent existence and carries all functions like digestion, excretion, respiration, growth & reproduction (Acellular). Examples, Amoeba, Euglena and prokaryotic like bacteria.

**2- Multicellular organisms** –Organisms with more than one cell

Cells in multicellular organisms vary in size & shape depending on function.

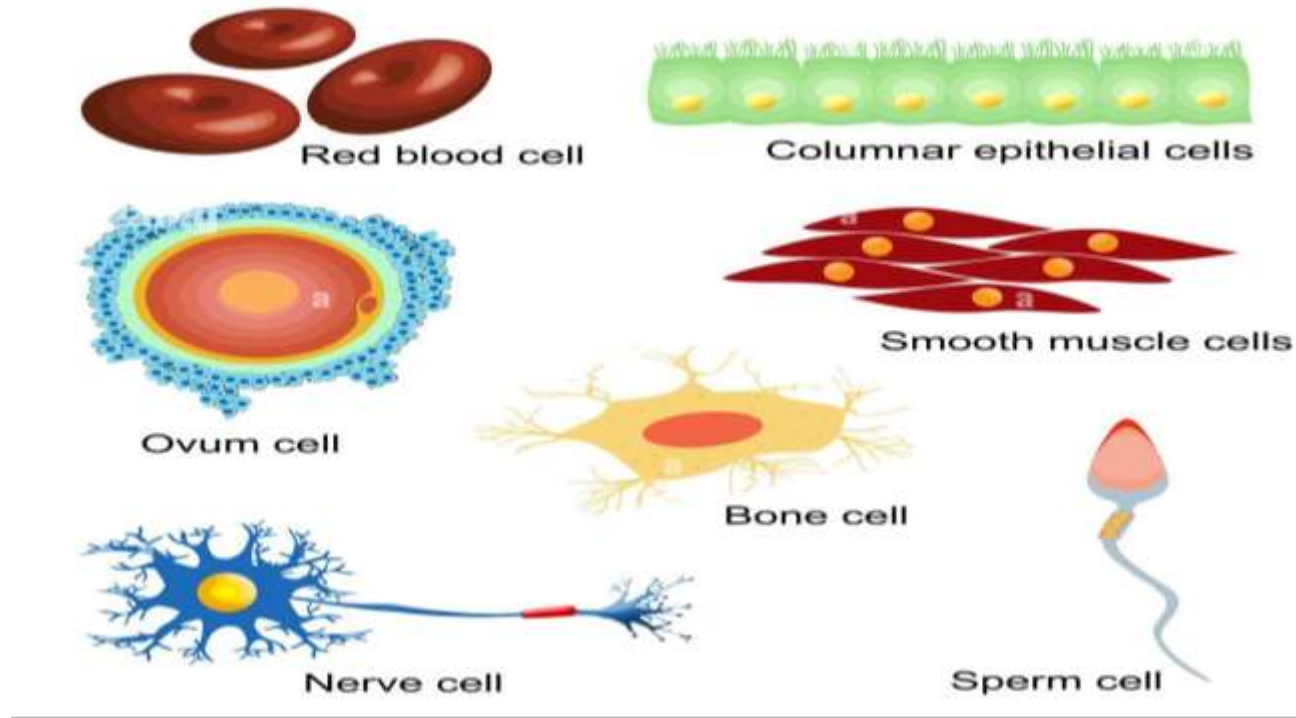
## B- Types of the cells according to the cell shape :-

1-Spindle shaped cells & provides mechanical support,

2-Nerve cells-long and branched cells conducting nerve impulses

3-RBC & helps in carrying oxygen

4-Muscle cells-cylindrical or spindle shaped concerned with the movement of body parts.



## Cells can be Eukaryotic or Prokaryotic

• **Prokaryotes** :do not have a nucleus ,its lack a membrane bound nucleus and organelles. Genetic material is free in the cytoplasm , Ribosomes are only other cell structure.(bacteria). **Eukaryotes**: have a nucleus and organelles (plants, fungi, animals, protists) .

### The difference between prokaryotic and eukaryotic

	Prokaryotic	Eukaryotic
1	There is no Organelles within the cell	There are membrane bound organelles
2	The nuclear material spread in the cytoplasm	Have a nucleus
3	Mostly single cells	Multicellular
4	Simple	Complex Specific in functions
5	Archaea and bacteria	Plants, Animals, fungi

**The cell structure** comprises several individual components which perform specific functions essential to carry out life processes.

The components of the cell are as follows:

- Cell wall
- Cell membrane
- Cell organelles
  - Nucleolus
  - Nuclear membrane
  - Endoplasmic reticulum
  - Golgi Bodies
  - Ribosome
  - Mitochondria
  - Lysosomes
  - Vacuoles

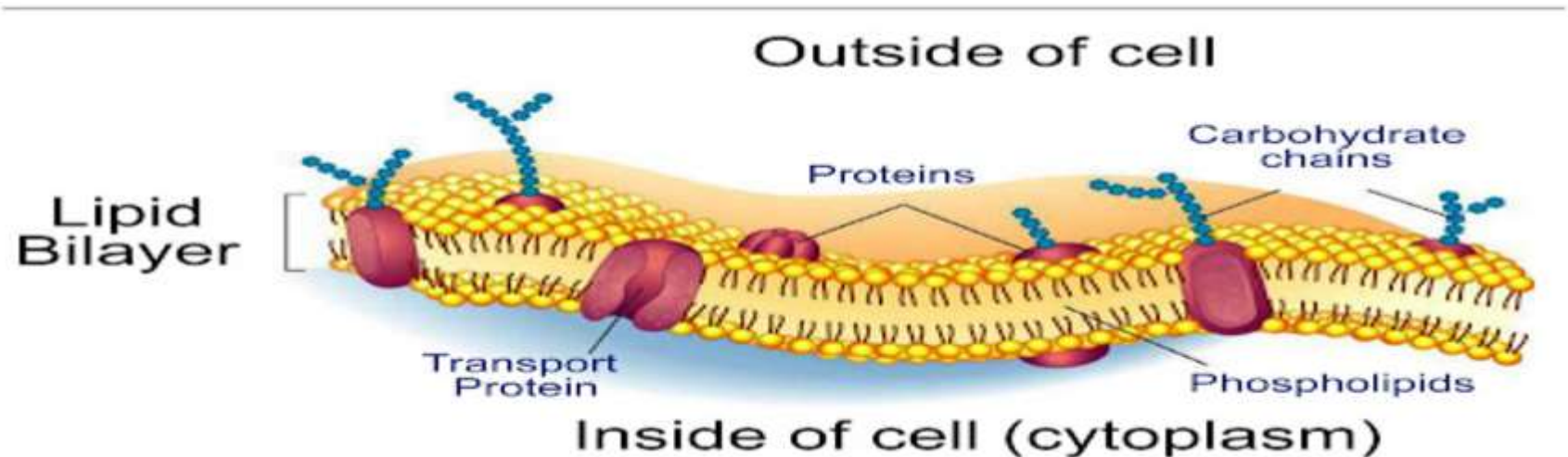
## Eukaryotic Cell Structures & Functions:-

Cell has **non living** outer layer called **cell wall** found only in plant cells .

Below cell wall is **cell membrane**. In **animals Cell** there is no cell wall and the cell membrane encloses protoplasm

**Plasma Membrane or cell membrane** :- Outer membrane of cells that controls movement of substances in and out of the cell . Double layer (bi-layer) .

**FUNCTION:** It allows outward and inward movement of molecules across it like diffusion, osmosis, active transport, phagocytosis.





## Cytoplasm

Gel-like mixture inside cells surrounded by cell membrane , Contains cell structures that carry out specific jobs ex. Mitochondrion, nucleus .....etc and Provides a medium for chemical reactions to take place.

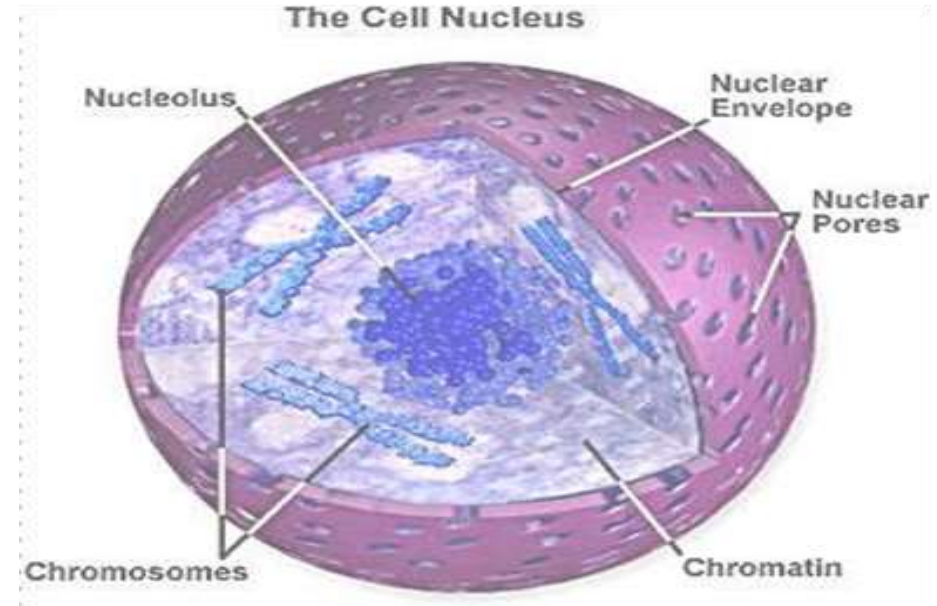
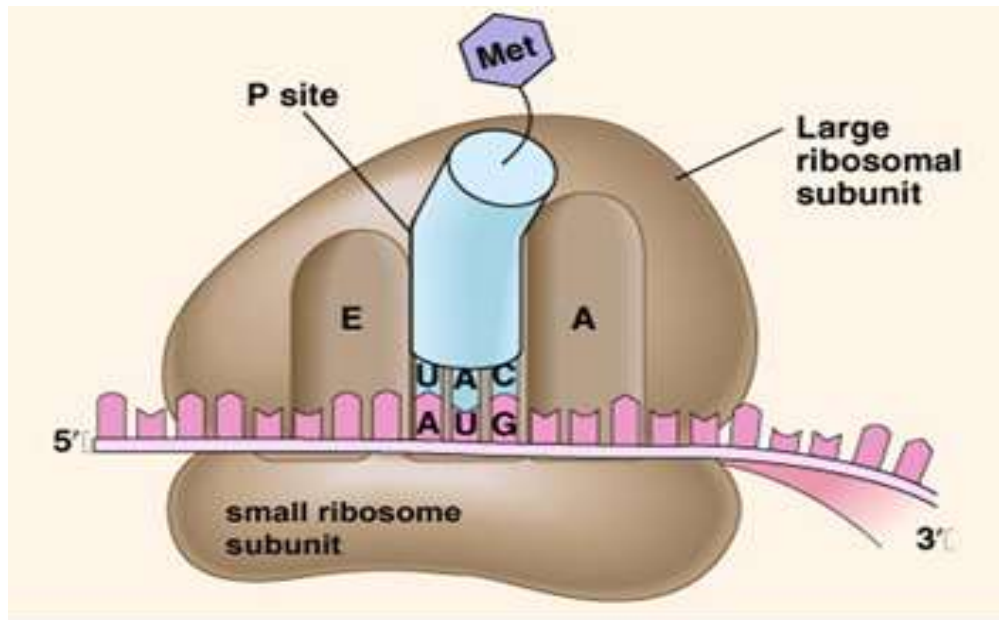
## Nucleus

Largest cell organelle present in eukaryotic cells .It is usually spherical

It has double layer nuclear membrane with nuclear pores .It has transparent granular matrix called nucleoplasm, chromatin network composed of DNA and histone proteins It also has a spherical body called Nucleolus

**FUNCTION of nucleus** : It is the control centre of the cell. It contains genetic material DNA which regulates all metabolic activities of the body.

**nucleolus** :- a darkened region where ribosomal RNA is synthesized



## Ribosomes

Ribosomes are small particles, composed of approximately 60 percent RNA and 40 percent protein. Ribosomes are composed of two subunits, large subunit and small subunit. It is the storage and synthesis of proteins. Ribosomes are found in both eukaryotes and prokaryotes.

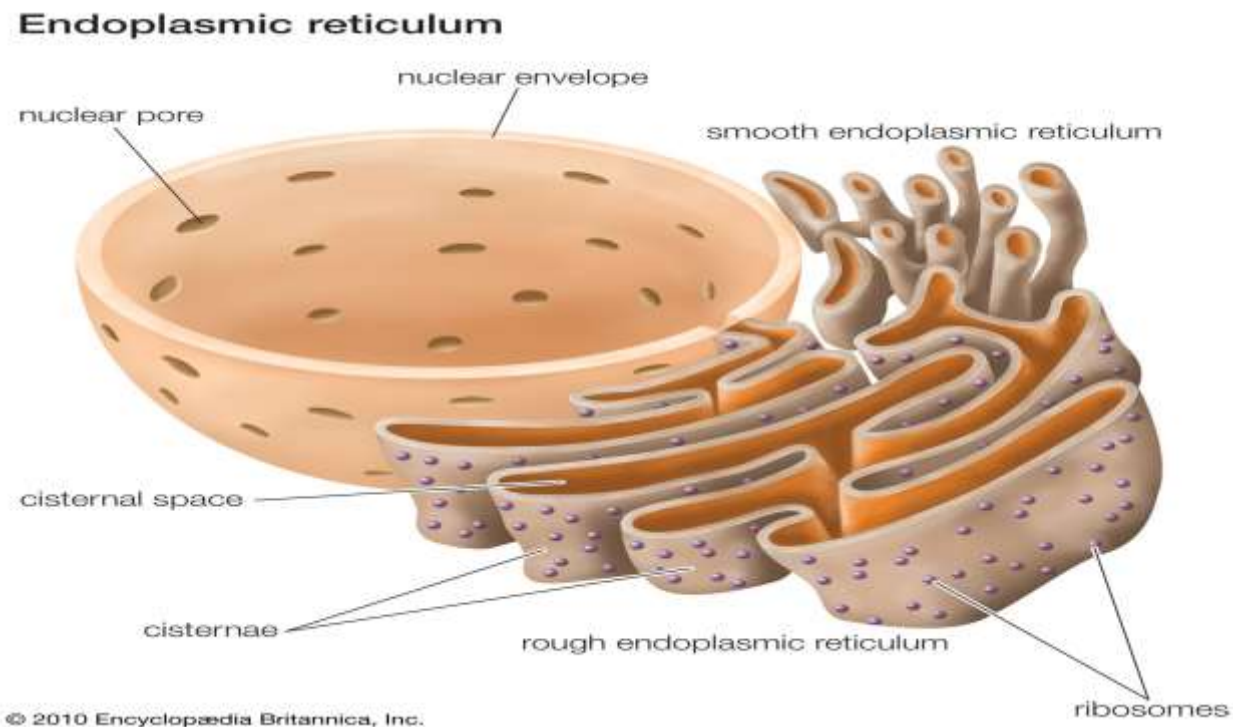
Some ribosomes remain free-floating in the cytoplasm, creating proteins for the cell's use. Others will attach to the endoplasmic reticulum (Rough ER) and produce the proteins that will be "exported" from the cell.

**Endoplasmic Reticulum**:- There are two types

**Rough Endoplasmic Reticulum** :- Network of continuous sacs, studded with ribosomes. Internal delivery system of the cell. Manufactures, processes, and transports proteins for export from cell. Continuous with nuclear envelope.

**Smooth Endoplasmic Reticulum**

Similar in appearance to rough ER, but without the ribosomes. Produces lipids, involved in carbohydrate metabolism, and detoxification of drugs and poisons.



**The Golgi apparatus (GA)**, also called Golgi body or Golgi complex, is a series of three to twenty cup-shaped, membrane-covered sacs.

**The GA functions are**,

1. processes, packages, storage, and distributes molecules about or from the cell.
2. It is also said to be involved in secretion.
3. It modifies proteins and lipids (fats) that have been built in the ER and prepares them for export as outside of the cell.
4. They also build lysosomes.
5. The number of GAs in each cell varies according to its function, but animal cells generally contain between ten and twenty per cell.

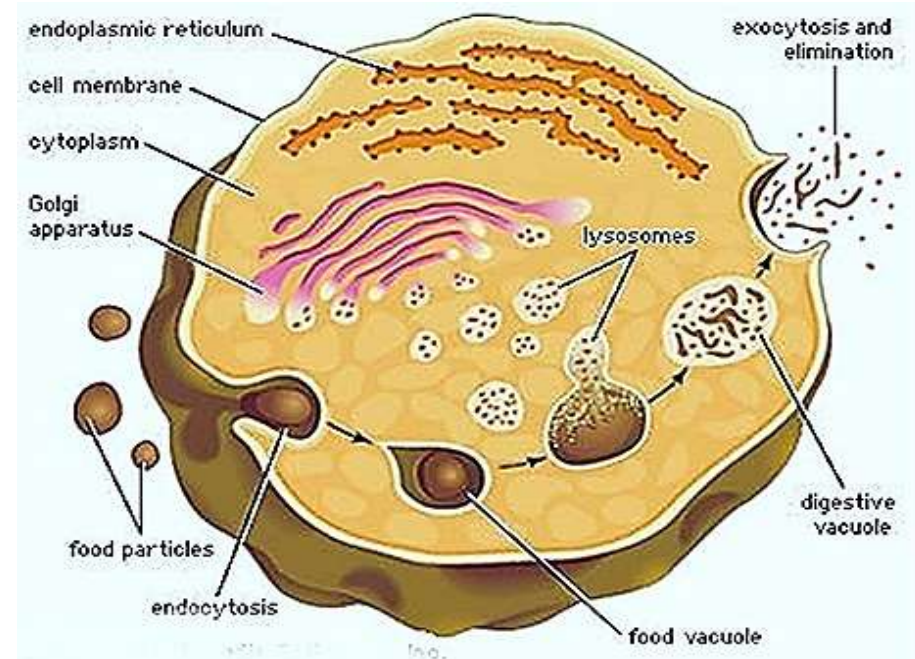
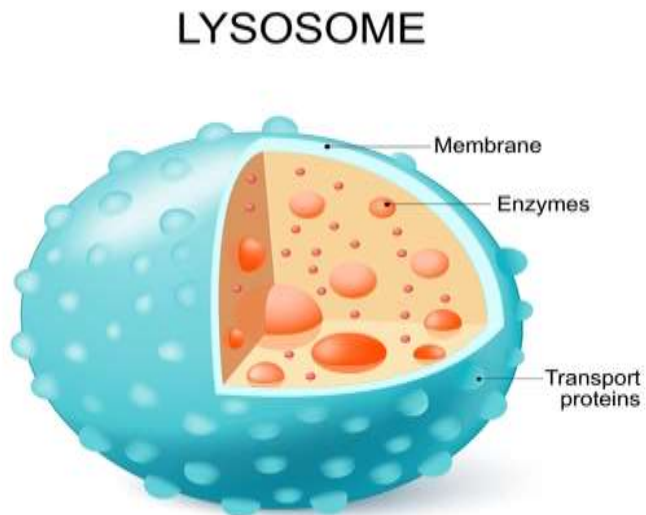




## Lysosomes:

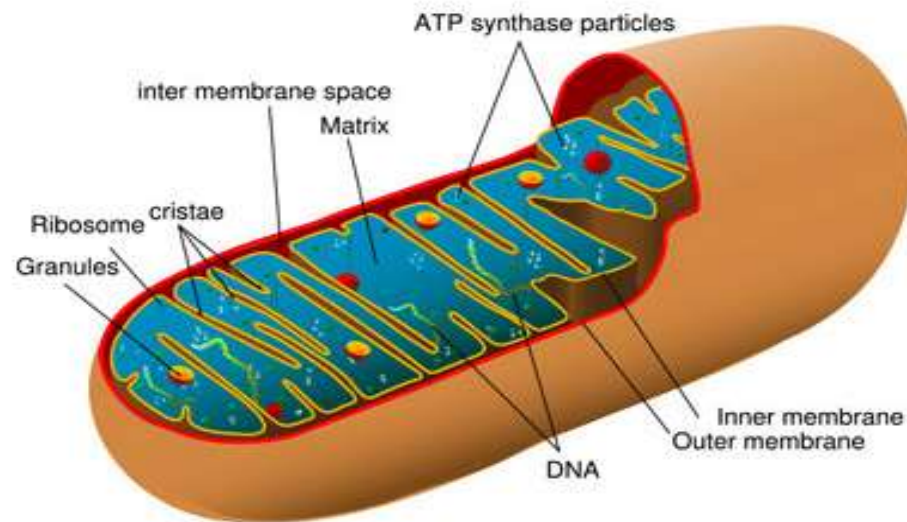
A membrane-bounded organelle, produced by the golgi apparatus, found in the cytoplasm of eukaryotic cells, Lysosomes contain hydrolytic digestive enzymes.

It acts as the "garbage disposal" of the cell by breaking down cell components (proteins, lipids, carbohydrates and other macromolecules into simple compounds) which are then returned to the cytoplasm as new cell-building materials.



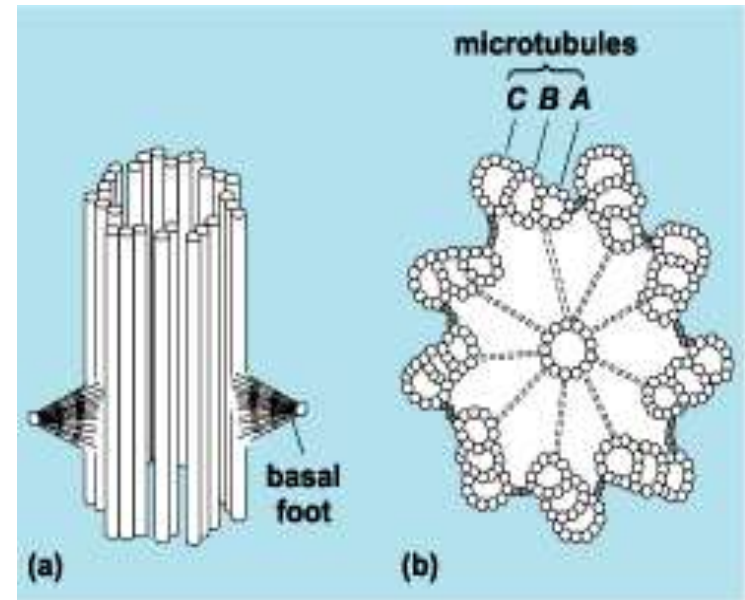
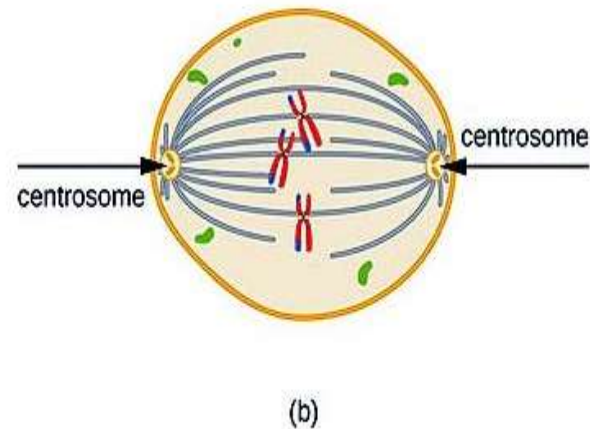
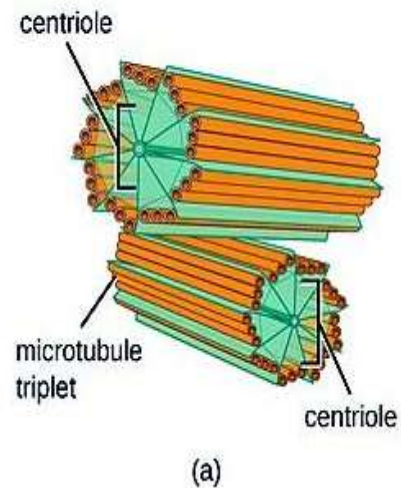
## Mitochondria:

- The mitochondria are specialized, oval-shaped cellular compartments. Mitochondria have a double membrane, the outer membrane is smooth, the inner membrane called cristae contains numerous folding to increase surface area.. The mitochondria are responsible for the aerobic (oxygen dependent) metabolism of the cell. There is also some DNA present in the mitochondria which is probably responsible for the synthesis of messenger RNA necessary to produce protein enzymes. The fluid inside of the mitochondria is called the matrix.
- acts like a digestive system that helps break down nutrients and other materials creating energy.



## Centrioles:

- Centrioles are short cylinders with pattern of microtubules triplets. May be involved in microtubules organization and in the formation of cilia and flagella.
- microtubules (three per bundle) arranged in a ring.
- Centrioles play notable roles in cell division. During interphase of an animal cell, also separate chromosome pairs during mitosis



# Cilia and Flagella:

- Cilia are tail-like projections extending approximately 5–10  $\mu\text{m}$  from the cell body. There are two types of cilia: motile cilia, and non-motile or primary cilia, which typically serve as sensory organelles.

