

## **PUC 1<sup>ST</sup> YEAR –SEMESTER-2**

### **UNIT I: Cell Biology**

#### **Module No 5: Other Cell organelles and Inclusions**

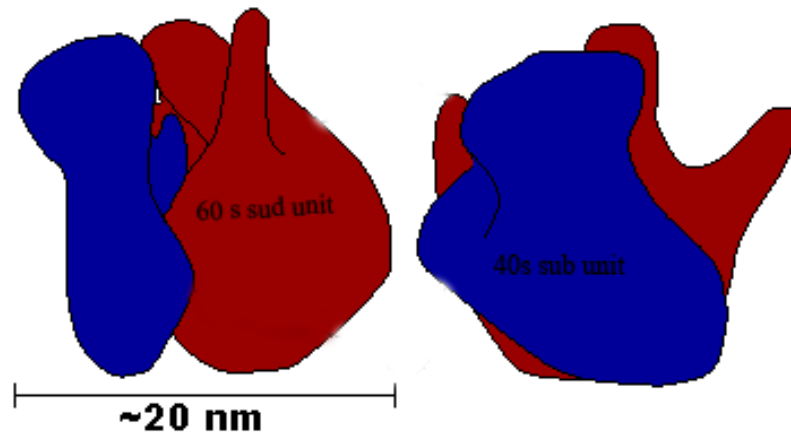
All eukaryotic cells are typically made of outer cell or plasma membrane, cytoplasm and nucleus. The cytoplasm contains certain non-living and living structures. The non-living structures are called inclusions or paraplast or deutoplasm. The living structures are called as organelles. Organelles are membrane bound structures. They carry out several important metabolic activities such as transport, secretion, storage, respiration, reproduction etc. They are endoplasmic reticulum, Ribosomes, mitochondria, Golgi complex, lysosomes, centrioles, microtubules, basal granules, plastids, cytoplasmic vacuoles, micro bodies, cilia and flagella. Of these Golgi complex and mitochondria are double unit membranes while endoplasmic reticulum and lysosomes are single unit membranes. Ribosomes do not follow the membrane concept. Centrosomes are devoid of any limiting membrane.

**Structure and functions of Nucleus, Plastids, and Mitochondria are covered in earlier modules. This module is mainly deals with the rest of the cell organelles.**

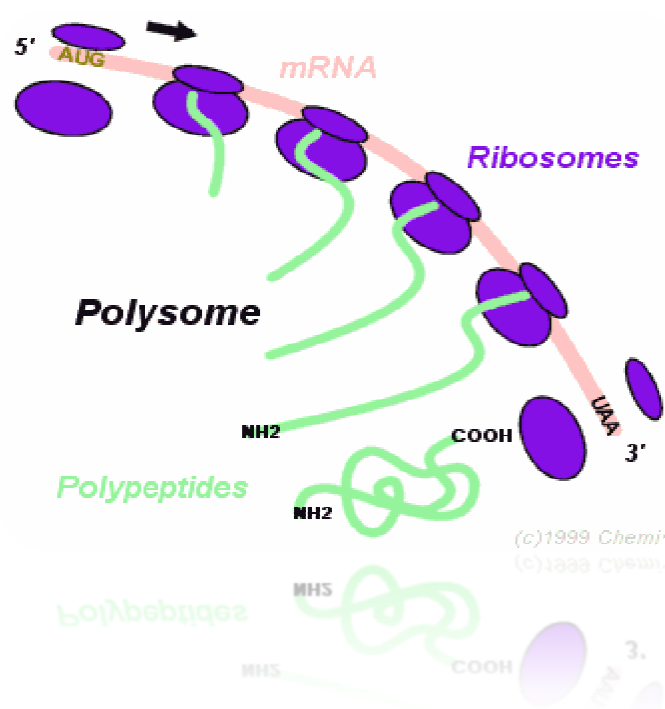
#### **1. Ribosomes:**

Ribosomes are present in all organisms but absent in mature RBC. These ribosomes composed by RNA and proteins. Eukaryotic ribosomes belongs to '80 S' type (sedimentation coefficient). In eukaryotes the ribosomes are present either attached to the endoplasmic reticulum or freely scattered in the cytoplasm. Each ribosome is composed of a larger and a smaller subunit. The two subunits come

together only during protein synthesis. Association and dissociation of the two subunits depend on magnesium concentration.

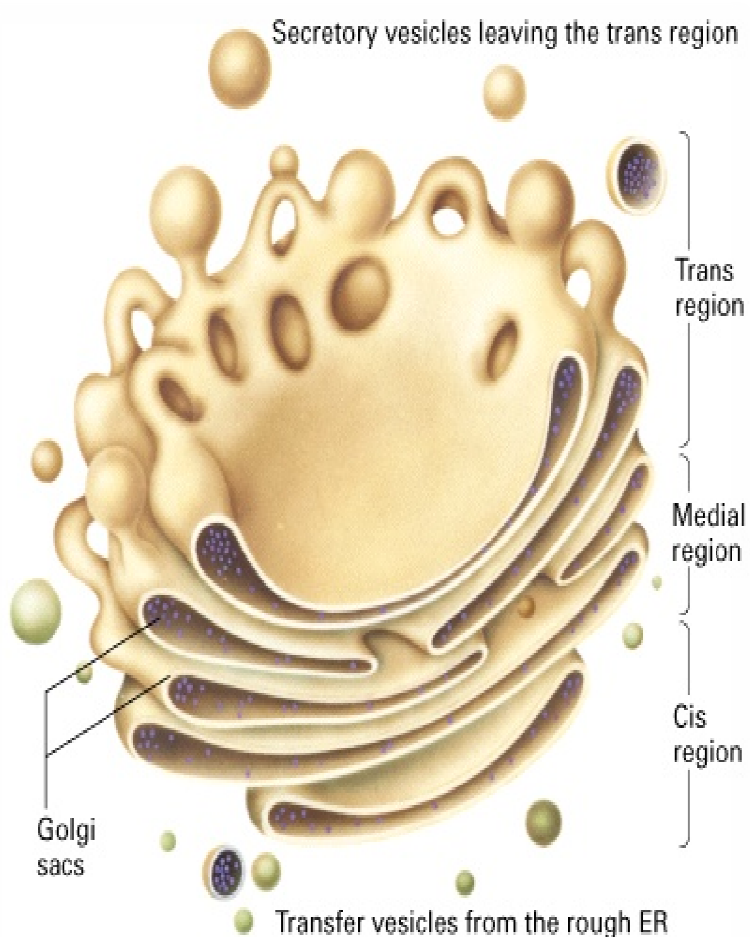


The main function of ribosomes is protein synthesis. So they are most abundant in cells that are active in protein synthesis, such as pancreas and brain cells. During protein synthesis several ribosomes form into long chains called 'Polysomes or Poly ribosomes'. They translate the genetic message present in messenger RNA to form proteins.



## 2. Golgi Complex (Dictyosomes)

It is found in all eukaryotic cells except in mature RBC. It occurs between the nucleus and the plasma membrane. Golgi complexes are double unit membranes made of lipoproteins. Golgi complex consists of flattened cisternae, Tubules, vesicles and large vacuoles. They are abundant in secretory cells.



### Functions:

1. Golgi synthesize carbohydrates, lipids hormones and enzymes with the help of several enzymes present in the membrane.
2. Break down of the golgi cisternae which contain the lytic enzymes results in the formation of lysosomes.

3. Acrosome of the sperm head is formed by golgi membrane.

### 3. Micro bodies:

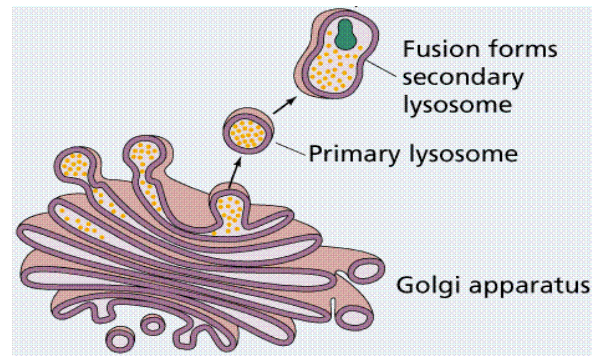
Various small spherical, single membraned organelles found in the cytoplasm associated with the mitochondria, Endoplasmic reticulum and chloroplast. They are two types.

**a) Peroxisomes:** They are found in animal cells and also in the leaves of higher plants. They cause break down of hydrogen peroxide ( $H_2O_2$ ) and protect the cells from toxic effects. They cause oxidation of fatty acids and play important role in the synthesis of phospholipids. In plant leaves they are involved in a process called photo respiration.

**b) Glyoxysomes:** They are found only in plant cells. Particularly in seeds. They have enzymes for the oxidation of fatty acids. They are involved in gluconeogenesis (convert fats to carbohydrates).

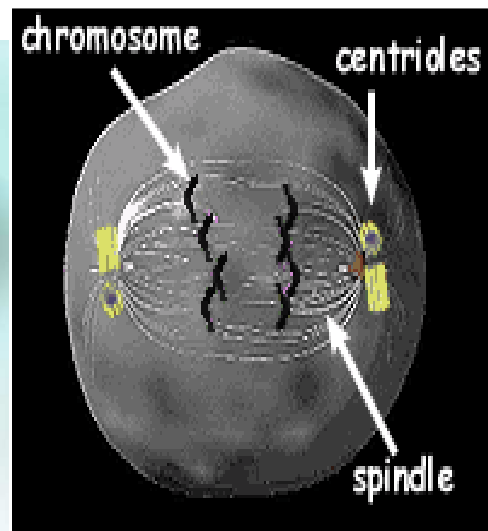
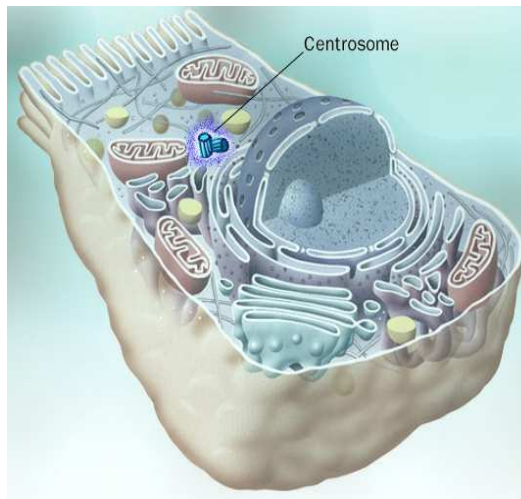
### 4. Lysosomes:

Lysosomes are surrounded by a single unit membrane. They are irregular or oval shaped structures present in the cytoplasm. Lysosomes contain acid hydrolases. They carry out intra cellular digestion (digest proteins, Lipids and glycogen during starvation), extra cellular digestion (digest foreign proteins, bacteria, viruses and help in defence), auto phagy (digest worn out organelles and other intracellular substances) and autolysis (some time due to rupture of the membrane the lysosomal enzymes cause destruction of the cell). Hence lysosomes are described as the suicidal baskets of the cell



## 5. Centrioles:

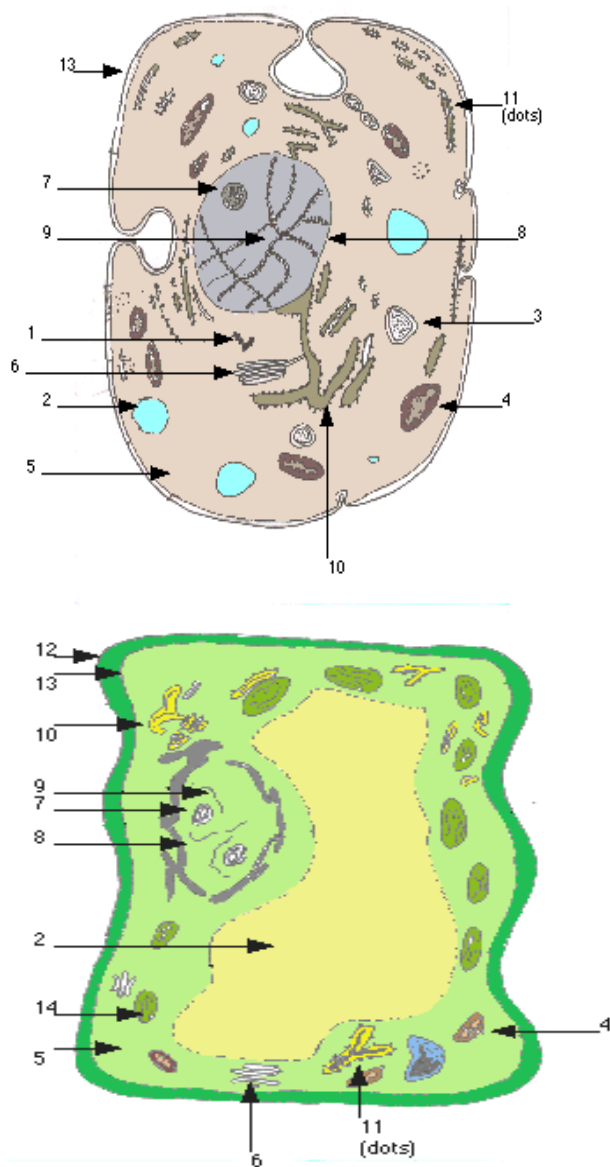
Centrioles are found in all animal cells except in mature RBC. Centrioles are cylindrical, rod shaped micro tubular structures found near the nucleus. They lie in a clear area of cytoplasm called the centrospheres. Centrioles and centrosphere put together called centrosome. They are not bound by any membrane. The main function of centrioles is to initiate cell division in animal cells.



## 6. Cytoplasmic Vacuoles:

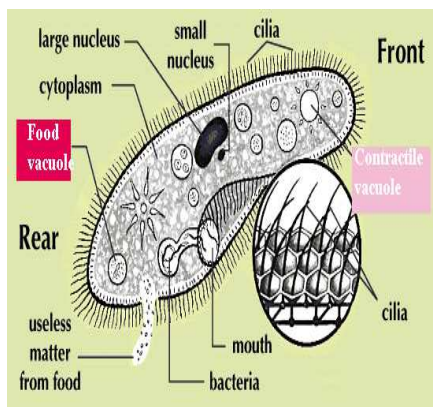
Vacuoles are membrane bound structure found in the cytoplasm of plants and animals. The membrane surrounding the vacuole in plant cell is called tonoplast. They are various types

**a) Sap vacuoles:** They are storage vacuoles. They contain cell sap rich in water, phenol, pigments (antho cyanins and antho xanthins), alkaloids and storage products such as proteins and sugars.



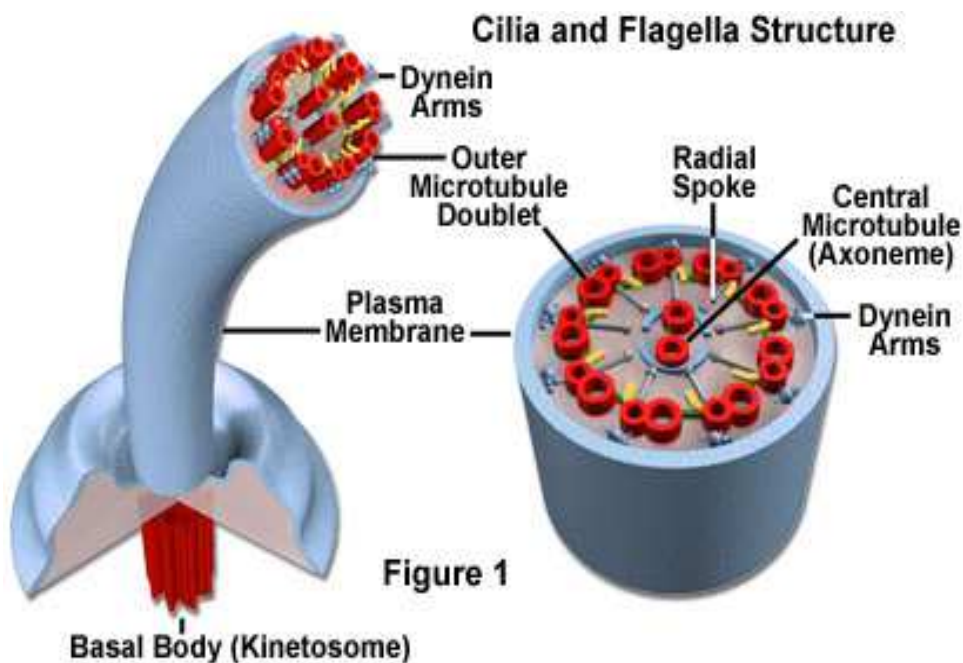
**b) Food Vacuoles:** Food vacuoles are vacuoles that function as the sites for storage and digestion of food substances.

**c) Contractile Vacuoles:** They are found in fresh water protozoan, algae etc. They are responsible for osmoregulation and excretion.



## 7. Microtubules:

They are found in almost all eukaryotic cells. They are hollow, cylindrical tubules made of a protein called Tubulin. The Transverse section of microtubules shows the presence of 13 subunits called protofilaments which are spirally arranged around a central axi



**Functions:**

1. They act as cytoskeleton and maintain cell shape.
2. They also act as the basic units for the origin of centrioles, basal granules, cilia and flagella.
3. The micro tubules are also concerned with the formation of asters and spindle fibres during cell division.
4. They help in the intra cellular transport of water and ions.

**Plastids:** Plastids are characteristic of plant cells but are also found in case of certain animal cells. They may be coloured green like chloroplasts or colour less like leucoplasts. The chloroplasts help in photo synthesis and protein storage. The leucoplasts store starch and lipids.

**Cilia and flagella:** The cilia and flagella are filamentous processes that help in movement of the entire cell, create food currents, act as sense organs and perform many other mechanical functions in the cell. Cilia and flagella are connected with cytoplasm by basal bodies or blepharoplasts. The cilia and flagella consists of nine outer fibrils encircling the two large central fibrils, and each other fibril consists of two microtubules.

### **Cell Inclusions (Deutoplasm):**

Cell inclusions are usually stored secretory substances of the cell that are metabolically inactive. They are not bound by membranes and are non living materials. It includes

- 1) Reserved food materials (starch, glycogen, fat droplets)
- 2) Secretory substances (alkaloids, resins, oils, tannins in plant cells and mucus in animal cells)
- 3) Inorganic crystals (calcium oxalate, calcium carbonate and calcium sulphate etc)



- 4) Pigment granules (found in the skin of vertebrates such as melanophores and lipophores)

### Check points

- The cytoplasm of the cell contains non-living and living structures. The non-living structures are called as inclusions and living structures are called organelles.
- The main function of ribosomes is protein synthesis.
- Golgi complex is mainly associated with secretory activities such as secretion of lipids, hormones and enzymes.
- Peroxisomes mainly cause breakdown of hydrogen peroxide and protect the cells from toxic effects.
- Glyoxysomes help in the oxidation of fatty acids and gluconeogenesis.
- Lysosomes contain acid hydrolases and are described as suicidal baskets of the cell.
- Centrioles initiate cell division in animal cells. They are absent in plant cells.
- Vacuoles perform different functions. They help in storage products, intra cellular digestion, osmoregulation and excretion.
- Cell inclusions includes reserve food materials, secretory substances, inorganic crystals and pigments.

### Object Type Questions:

1. The cell organelle responsible for digestive activities within the cell  
A. Ribosomes   **B. Lysosome**   C. Peroxysomes   D. Kinetosome
2. Suicidal baskets of the cell  
A. Ribosomes   **B. Lysosomes**   C. Peroxysomes   D. Kinetosome
3. Ribosomes are most abundant in the

- A. Pancreas   B. Muscle fibres   C. Brain cell   **D. A & C**
4. Cell organelles that contains double unit membranes  
A. Centrioles   B. Golgi   C. Mitochondria   **D. B & C**
5. One of the following cell organelle contains single unit membrane  
A. **Lysosomes**   B. Mitochondria   C. Golgi   D. Centriole
6. ----- cause break down of hydrogen peroxide and protect the cells from toxic effects  
A. **Peroxisomes**   B. Glyoxysomes   C. Dictyosomes   D. Lysosomes
7. ----- initiate cell division in animal cells  
A. Golgi   B. Glyoxysomes   **C. Centrioles**   D. Ribosomes
8. ----- act as cytoskeleton and help in maintaining cell shape  
A. Basal granules   B. Centrioles   C. Spindle fibres   **D. Micro tubules**
9. The non-living, stored secretory substances present in the cell are called -----  
A. **Inclusions**   B. Organelles   C. Pigments   D. Crystals
10. Association and dissociation of the two ribosome sub units is dependent on the concentration of ----- ions  
A. Calcium   **B. Magnesium**   C. Sulphur   D. None

### Short Answer Questions:

1. Describe ribosomes?
2. List out the functions of Golgi complex?
3. Write short notes on micro bodies?
4. Why lisosomes are describe as suicidal baskets of the cell?
5. Describe centrioles?
6. What are micro tubules? List out their functions?

7. Write short notes on cell inclusions?