**ENDOPLASMIC RECTICULUM (ER)**

1. It is a complex network of inter-connecting membrane bound vacuoles. 2. The vacuoles are present in the endoplasmic portion of cytoplasm. 3. It was discovered by K.R.Porter. **STRUCTURE**  1. The cavities of ER are bounded by thin membrane. 2. The membranes are 50 – 60 A\* thick and trilaminar. 3. The outer and inner layer are made up of protein. 4. The outer and inner layer are separated by phospholipid layer. 5. The membranes of ER are attach with plasma-membrane, nuclear-membrane and golgi complex. 6. The ER is found in three forms:- i. Cisternae ii. Vesicles iii. Tubules 

**i. Cisternae** :- These are the long, flat, sac like, unbranched tubules, 40 – 50 in diameter and arranged parallel in bundles or stack. **ii. Vesicles** :- These are the oval structure, 25 – 500 in diameter. **iii. Tubules** :- These are the branched structure, form reticulate system with cisternae and vesicles. They usually have the diameter from 50 – 190 . **ULTRASTRUCTURE OF ER**  1. The cavities of cisternae, vesicles and tubules of the ER are bounded by a thin membrane. 2. The membrane is of 50 – 60 A\* thick. 3. The membrane of ER is trilaminar. 4. The outer and inner layer are made up of dense protein molecules. 5. Both these layer are separated from each-other by a layer of phospho-lipid. 6. The membrane of ER remain attach with the membranes of plasma-membrane, nuclear- membrane and golgi complex.



 **PEROXISOME** 1. The peroxisome are the microbodies in the plant cells. 2. They are present in the photosynthetic cells of higher plants in etiolated leaf tissues, in coleoptiles and hypocotyls and in ripening fruits etc.

**STRUCTURE** 1. These are of various shape and size. 2. They are in circular form, whose diameter is 0.2 – 1.5 . 3. They have single limiting membrane. the membrane is lipo-proteinaceous. 4. The membrane is filled with granular matrix. 5. In some matrix have thread or fibrils.

**FUNCTION**  1. It breaks the long chain of fatty acids by the B – oxidation. 2. It have 50 different enzymes, which are involved in several biochemical pathways. 3. It carries the oxidation reaction to form H**2**O**2 .** The H**2**O**2 are** harmful for cell, so the peroxisome having enzyme catalase decompose the H**2**O**2** into water. 4. During oxidative reaction in peroxisome variety of substrate breakdown. Eg :- Uric acid, Amino acid, Fatty acid provide energy.

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 **LYSOSOME**  1. The lysosome are the tiny, membrane bounded, vesicular structure. 2. They are found in the cytoplasm. 3. They are filled with the enzyme hydrolases. 4. It was first reported by Christian de duve. 5. The lysosome of plant cell are many membrane bounded, storage granules like structure having digestive enzymes, which shows lysosome like activities. **OCCURRENCE**  1. They are distributed in the cytoplasm. 2. They are in fungi, root tips, seeds etc. **SHAPE AND SIZE** 1. It is generally of spherical shape. 2. In some of the meristematic cells of plant they are of irregular shape and size. **STRUCTURE**  1. The lysosome or storage granule like structure of plant cell are rounded vacuolar structure. 2. It is filled with enzyme hydrolases or in plant cell called digestive enzyme. 3. They are bounded by lipo-proteinaceous membrane. 4. These storage granules are of following types :- I. Spherosomes II. Aleurone grain III. Vacoules **I. Spherosome** :- i. These are bounded by a membrane, and are spherical in most plant cells. ii. The membrane is rich in lipid and protein. iii. It is a fine granule of 0.2 – 2.5 in diameter. iv. It is the cut off of the ER as small vesicles called prospherosome. v. The prospherosome grows in size called spherosome. vi. The spherosome of maize root tip cell and of tobacco endosperm have hydrolytic enzymes, so considered as lysosome. **II. Aleurone grain** :- i. These are bounded by a membrane and are of spherical shape. ii. It occurs in endosperm and cotyledons of seed. iii. These are formed after fruit ripening and disappear during seed germination. iv. The aleurone grain of pea seeds have hydrolytic enzymes, so considered as lysosome. **III. Vacoules** :- i. They are bounded by a membrane and are of spherical shape. ii. They are derived from the ER. iii. They contain hydrolytic enzyme so considered as lysosome.

**FUNCTION**  It digest various cell organelles of cell. So the cell dies, due to this it is called suicide bag of cell or autolysis.

  **RIBOSOME** 1. These are the naked granular organelles. 2. These are responsible for protein synthesis. 3. It was first observed by George Emil Palade. 4. The term ribosome was proposed by Richards B. Robert. **OCCURENCE**  1. Ribosome are found in all organism. 2. This is present in both eukaryotic and prokaryotic cellular organism. 3. The ribosomes found in the cytoplasm are known as cytoplasmic ribosome. 4. The cytoplasmic ribosome may remain free or may attach with the ER or nuclear membrane. 5. Some of the ribosome occur inside the organelles. Such as mitochondria and the plastids. 6. The ribosome in the mitochondria are called mitroribosomes & in the plastids are called plastidoribosomes. 7. They are collectively called the organellar ribosomes. 8. In the cytoplasm, the ribosomes occur in groups or in free state. 9. The group of ribosome is called polysome or polyribosome. **STRUCTURE** 1. The ribosome consist of two sub-units. 2. One is larger and the other is smaller. 3. The two sub-units comes together only during protein synthesis. 4. The association and deassociation of the two sub-units depends on magnesium (Mg) concentration. 5. If the concentration of magnesium is low, the sub-unit remain deassociated and if the concentration of magnesium is high, the two sub-unit associate to form a dimer (a molecule composed two identical, simplex molecules.). **TYPES OF RIBOSOME** Genarally the ribosomes are of following types :- I. 70 S Ribosome II. 80 S Ribosome. **I. 70 S Ribosome** 1. These ribosome are of smaller size. 2. These occur in the prokaryotic cells and in the mitochondria and plastids of eukaryotic cells. 3. The 70 S ribosome are made up of two sub-units :- (i). 50 S -- Larger sub-unit & (ii). 30 S --- Smaller sub-unit . **II. 80 S Ribosome** 1.These ribosome are of larger size. 2. These ribosome occur in the eukaryotic cells. 3. The 80 S ribosome are made up of two sub-units :- (i). 60 S --- Larger sub-unit & (ii). 40 S --- Smaller sub-unit. **FUNCTION** Ribosome forms the protein in the cell. So known as protein factories of the cell.

 **GOLGI COMPLEX / GOLGI APPARATUS** 1. The golgi complex was observed by Camillo Golgi. 2. In plant cells, golgi complex remain independent called dictyosomes.

**OCCURRENCE**  1. It is found in all eukaryotic cells. (except conducting elements of phloem). 2. It is found in the cytoplasm.

**STRUCTURE**  It is made up of following components :- I. Cisternae II. Tubules III. Vesicles.



 Fig :- Golgi complex **I. Cisternae** :- 1. These are 3 – 7, flattened plate like bodies. 2. They are stacked one above the another. 3. They are slightly curve with concave and convex surfaces.

**II. Tubules** :- 1. These are the short, filamentous structure. 2. They are found on the sides of cisternae.

**III. Vesicles** :- 1. These are small sac like bodies, pinched off from tubules. 2. They have the secretory products. 3. They moves towards the plasma-membrane and throw out the products by the process exocytosis.

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