

Subject: Zoology

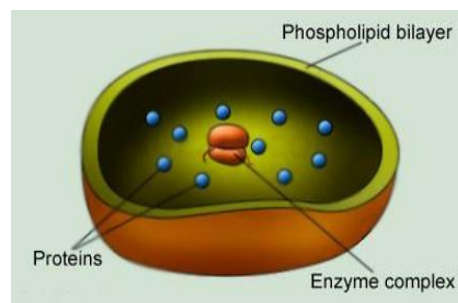
Cell Biology

Name of the Topic : Lysosomes

Lysosomes

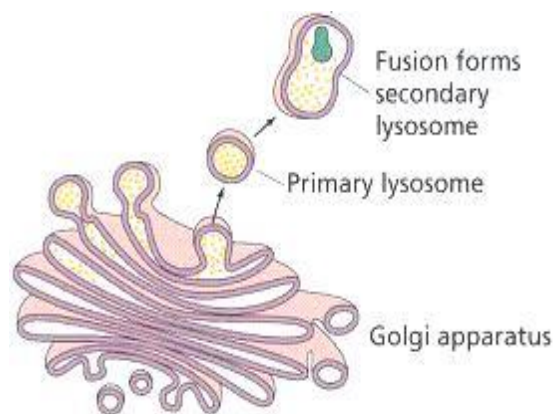
Animal cells have another set of organelles not found in plant cells i.e lysosomes. Lysosomes were initially named as '**perinuclear dense bodies**'. The name 'lysosome' was coined by **C.De Duve in 1955**. Lysosomes occur in all animal cells. However, they are not found in mature mammalian erythrocytes. Muscle cells contain very few lysosomes. They are numerous in epithelial cells of secretory and excretory organs. The lysosomes are so called because they contain lytic or destructive enzymes. Since most of the lysosomal enzymes function better under acidic conditions, they are collectively called as **Acidic hydrolases**. Enzymes within the lysosomes aid the breakdown of proteins, polysaccharides, lipids, nucleic acids, and even worn-out organelles. These enzymes are active at a much lower pH than that of the cytoplasm. Therefore, the pH within lysosomes is more acidic than the pH of the cytoplasm.

Lysosomes are involved in intracellular digestion and are primarily meant for destroying unwanted and aged organelles inside the cells. The **lysosomes** are the cell's "garbage disposal." Recent studies reveal that lysosomes may contain up to 40 hydrolytic enzymes. The enzymes are mostly **proteases, nucleases, glycosidases, lipases, phospholipases, phosphatases, and sulphatases**. All the enzymes do not occur in the same lysosome but there are different sets of enzymes in different types of lysosomes. Because of the presence of these digestive enzymes, lysosomes are called "Suicidal bags". Another interesting property of lysosomes, isolated from kidney cells is their ability to trap and concentrate the foreign proteins injected, suggesting that these may help in digestion or detoxification of foreign materials by pinocytosis.



Lysosomes are small vesicles bounded by a single membrane and contain hydrolytic enzymes in the form of minute or semi minute crystalline granules of 5-8 nm. The single layered membrane is made-up of lipoprotein and is difficult to identify the lysosomes based on morphological characters. Each is filled with a dense material. Their shapes and densities vary.

Formation of Lysosomes: Lysosomes are believed to be formed by joint action of Golgi complex and endoplasmic reticulum. The precursors of hydrolytic enzymes are mostly synthesized at the rough endoplasmic reticulum which transfers them to the forming face of Golgi complex through its vesicles. In Golgi complex the precursors are changed to enzymes. They are then packed into larger vesicles which are pinched off as lysosomes from the maturing face.

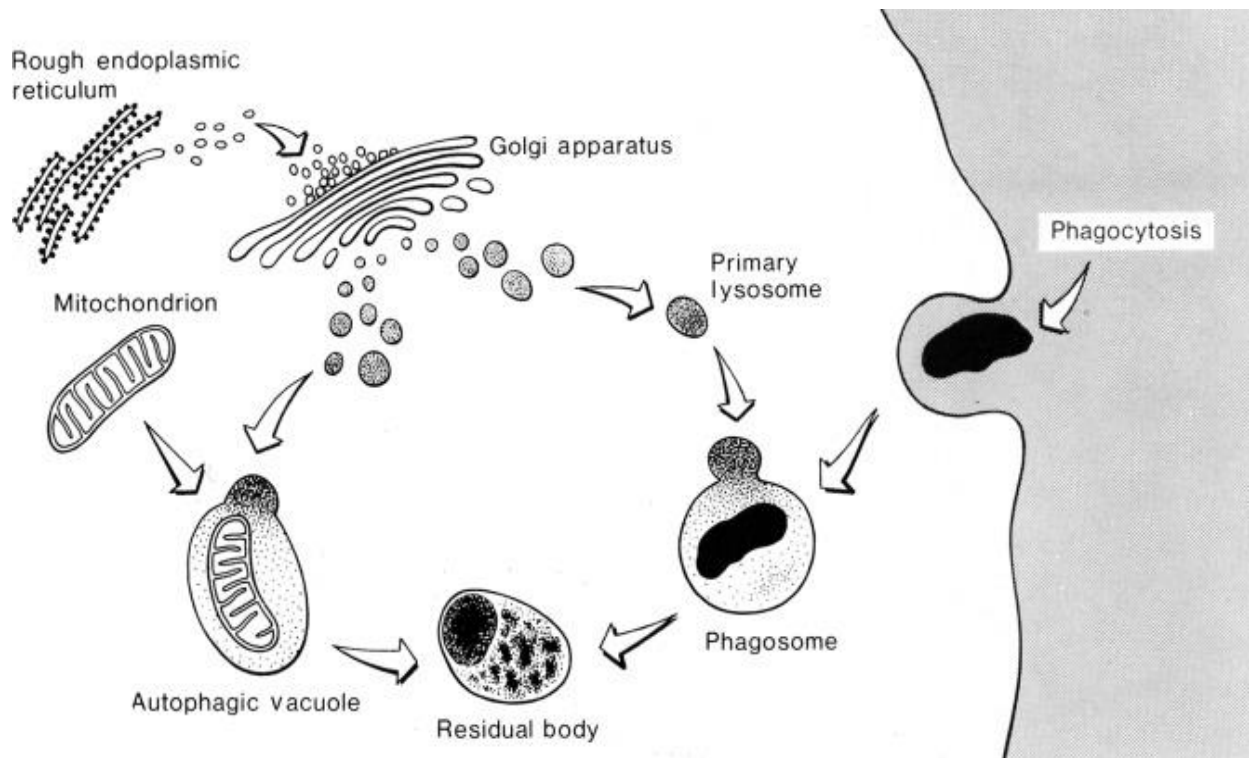


Polymorphism in Lysosomes: Lysosomes pass through various stages in the same cell. They appear as polymorphic structures because their contents vary with the stages of digestion. Based on this they are of **4 types**.

1.Primary lysosomes: They are small sac like structures with digestive enzymes. Since they store enzymes they are also known as storage granules and are believed to be derived or pinched off from the Golgi complex.

2. lysosomes: They are formed by the fusion of Primary lysosomes with phagosomes or pinosomes. Once the fusion is over the engulfed material is progressively digested by the enzymes present in primary lysosomes, as the digestion process continues it becomes difficult to identify the nature of the secondary lysosomes and they are called digestive vacuoles.

3.Residual Bodies: The secondary lysosomes with undigested waste are called residual lysosomes. The residual bodies are also called “telo lysosomes” or “dense bodies”. These represent the final stages of breakdown of foreign material or cellular organelles by the lysosome

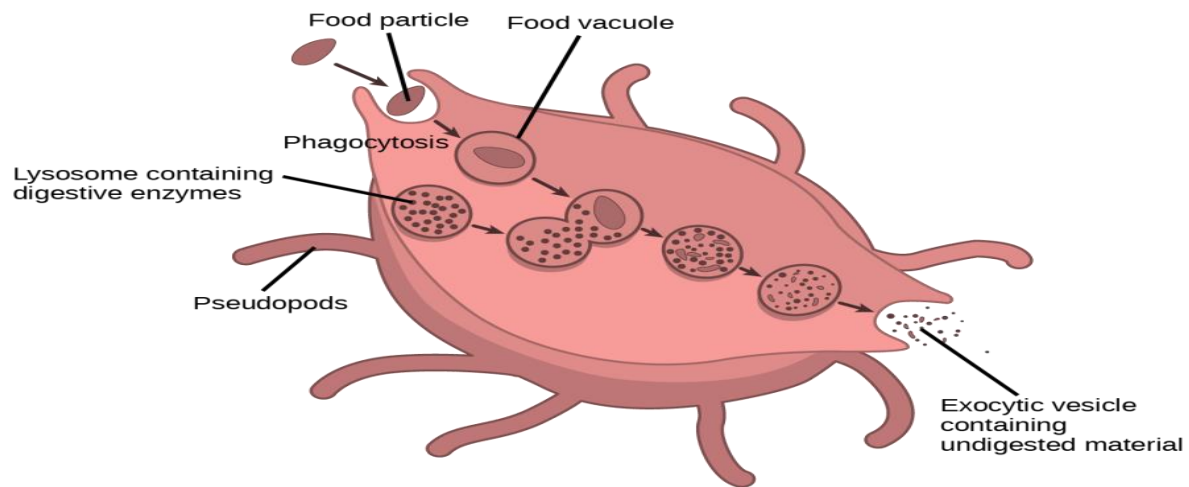


4.Autophagy Vacuoles: These are special types of lysosomes which are formed when the cells feed on their own intra cellular organelles such as mitochondria, ER etc., and they digest them ultimately. This happens only during starvation. Lysosomes performing autolysis do not enclose the structure to be broken down. Instead they themselves burst to release the digestive enzymes. Autolysis occurs in tissues undergoing degeneration or necrosis.

FUNCTIONS OF LYSOSOMES:

1.Extra cellular digestion: it is also known as Heterophagy. It is the lysosomal digestion of the extra cellular material. The food materials enclosed in vesicles called phagosomes or phenosomes. These vesicles fuse with lysosomes to form hetero phagosomes. The enzymes of lysosomes digest the food material, which diffuses in to the cytoplasm through the hetero phagosome membrane.

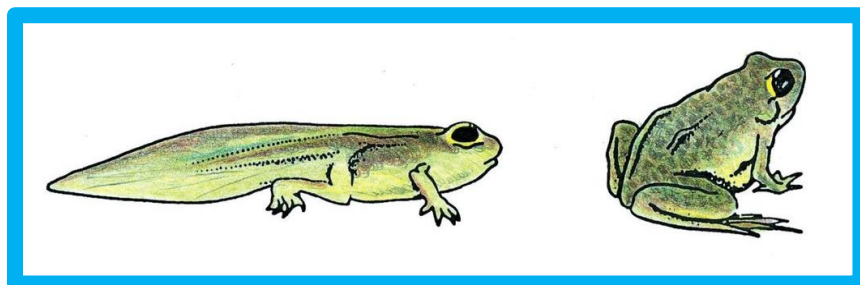
Phagocytosis



2. Intra cellular digestion: It is also known as Autophagy. It refers to the digestion of intra cellular food materials. In autophagy the cell organelles, worn out cells, dead cells, cell debris and stored food materials are digested by the lysosomes.

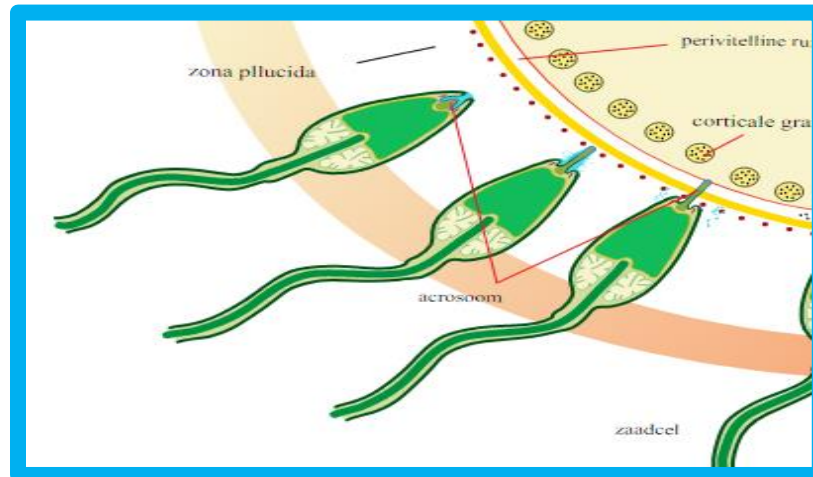


3. Autolysis: Auto means self and lysis means digestion. It is the self-digestion, in autolysis the lysosomes digest its own cell. In this process the lysosome ruptures inside its cell and releases enzymes that digest and degrade the cell. As a lysosome kills in its own cell, it is also called as Suicidal bags.



Autolysis occurs during amphibian metamorphosis and menstruation etc,. During amphibian metamorphosis the cells in the tail are digested by autolysis. Similarly during menstruation the cells in the uterine epithelium are lysed by autolysis.

4.Fertilization: during fertilization the acrosome of sperm ruptures and releases enzymes such as hyaluronidase , protease etc,. These enzymes dissolve the egg membrane and make way for the entry of sperm into the egg.



Extreme actions of Lysosomes:

- Sometimes Lysosomes present in the Lungs will become damaged due to the accumulation of Silica in the Lungs. So the enzymes present in the Lysosomes are released and can harm the Lungs .
- An enzyme called DNA ase in the lysosomes destroy the DNA part of molecule called Deletion. If this deletion may occur in 21st chromosome of the humans it can cause Leukemia

1. <https://hi-static.z-dn.net/files/d48/42c4eb59e34598b6de12550a7afea239.jpg>
2. <https://qph.fs.quoracdn.net/main-qimg-9be3140f9581613a64bd420028d5d689>
3. <https://www.assignmentpoint.com/wp-content/uploads/2017/05/Lysosome0.jpg>
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5. <https://slideplayer.com/slide/15095953/91/images/7/Programmed+cell+death+eliminates+unwanted+cells.jpg>
6. https://upload.wikimedia.org/wikipedia/commons/8/88/Acrosome_reaction_diagram_nl.svg

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