

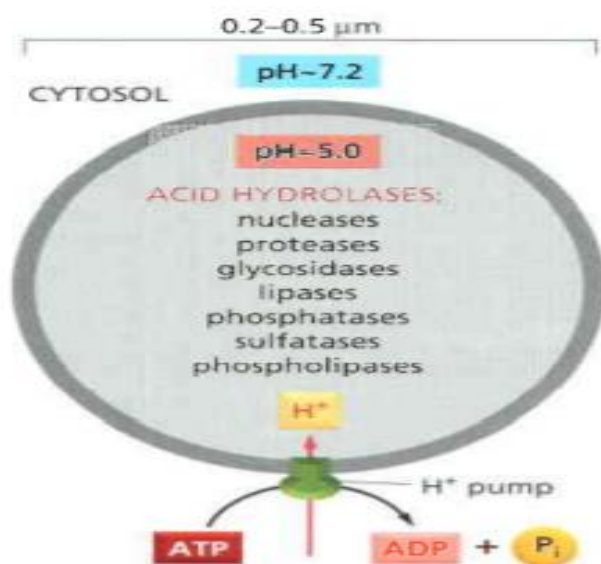
Faculty Science

Everest Shiwach
Department: Botany

B.Sc II Paper-II(Cytology, Genetics, Evolution& Ecology)

Unit-I Topic- Lysosome

Lysosomes (lyso means digestive, soma means body) are specialized vesicles within cells involved in intracellular digestion. They contain a variety of hydrolytic enzymes that remain active under acidic conditions. Christian de Duve in 1955 named them lysosome to reflect their digestive properties. These are also known as suicide bags. Lysosomes are found in most animal and few plant cells, absent in prokaryotes cells.



Structure: These are round vacuolar structures which remain filled with dense material and bounded by single unit membrane. Approx. spherical shape of diameter ranging up to 1 μm. A single lysosome contains many enzymes such as nucleases, proteases, glycosidases, lipases, phosphatases and sulfatases. These enzymes collectively known as acid hydrolases because they operate best at acidic pH. The interior of lysosomes is acidic (about pH 4.8 to 5) compared with the slightly basic (about pH 7.2) cytosol. The lysosomal membranes contain proton pumps (H⁺–ATPases) that concentrate protons from cytosol to maintain their acidic internal pH.

Types of Lysosomes (Polymorphism)

The lysosomes change the nature of their enzyme contents at different times in the same cell. On this basis, four types of lysosomes exist in animal and plant cells.

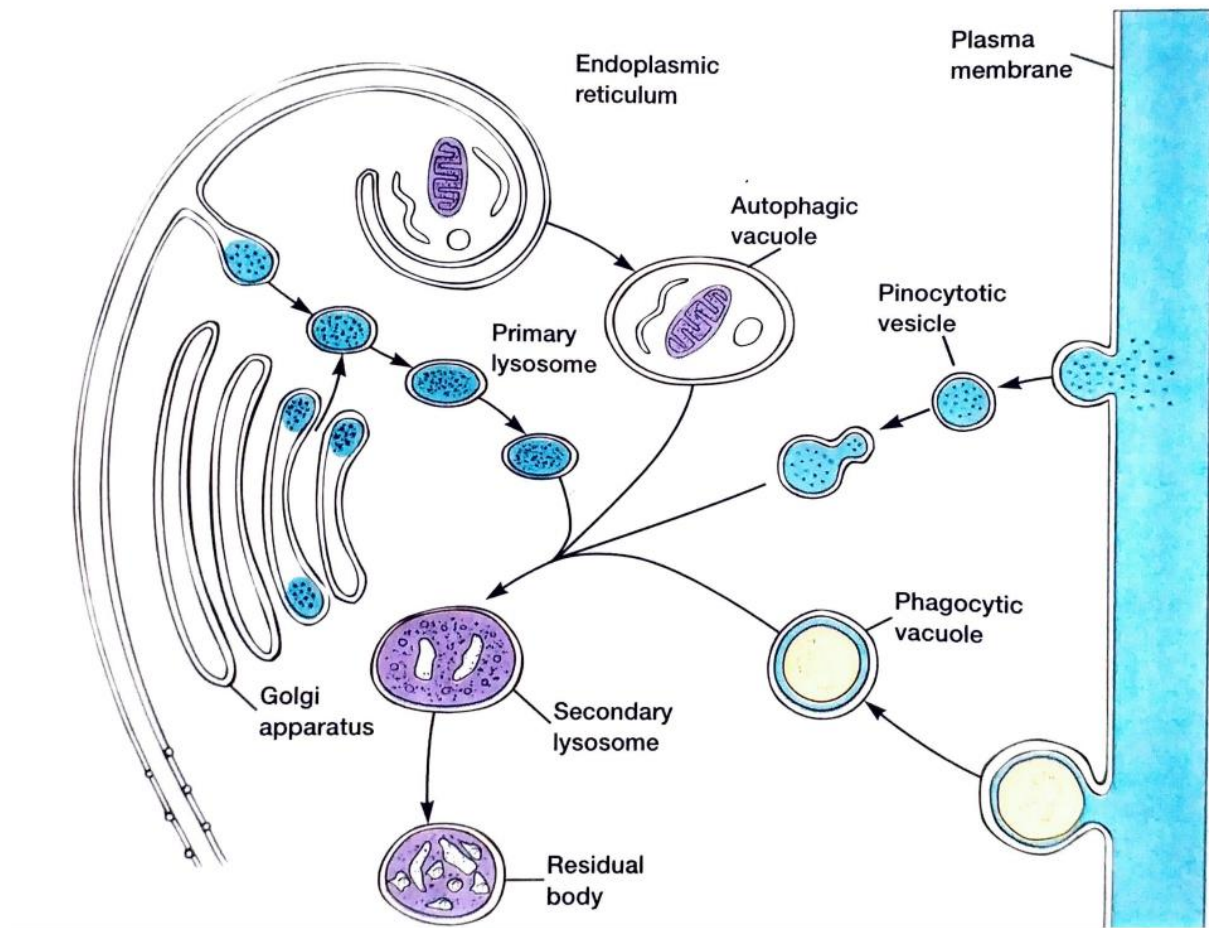


Diagram showing formation of different types of lysosomes

(i) Primary Lysosomes or Storage Granules-These are newly-formed lysosomes- They contain enzymes in an inactive state.

(ii) Secondary Lysosomes (Hetero-phagosomes or Digestive vacuoles)- These are formed by the fusion of a primary lysosome with a phagosome or pinosome. The proton pumps make their internal pH acidic which activates the hydrolytic enzymes. Secondary lysosomes often are called food vacuoles. Digested nutrients then leave the secondary lysosomes and enter the cytoplasm.

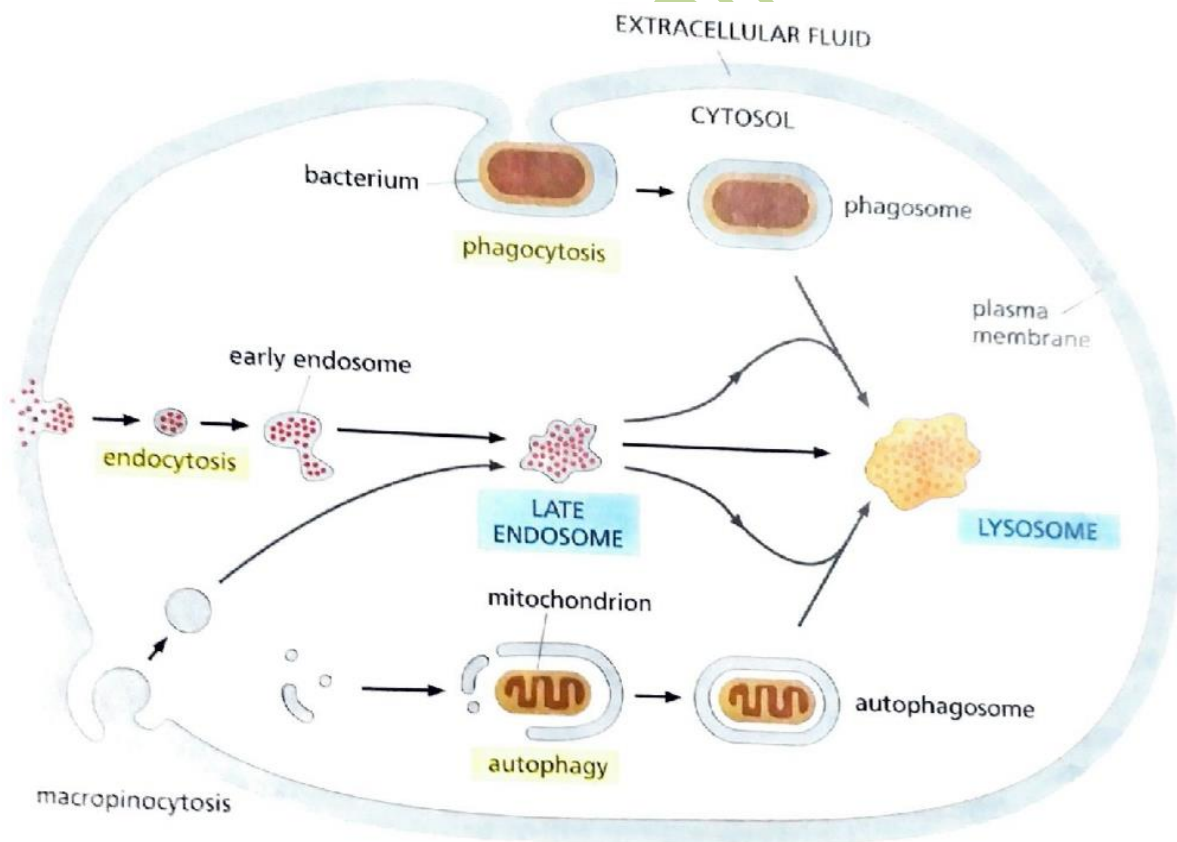
(iii) Autophagosomes (Autolysosomes or Autophagic vacuoles)-These are fused in two steps- first an unwanted organelle enclosed in a membranous vacuole derived from SER which then fuses with a lysosome, and its contents are digested. This process is called autophagy or auto-digestion, which is important for disposal of unwanted organelles and diseased cells, starvation management and remodelling of tissues during differentiation.

(iv) Residual bodies or Telolysosomes-These are secondary lysosomes or autolysosomes with indigestible materials. They expel their contents to the outside through exocytosis. Failure of exocytosis or absence of some lysosomal enzymes causes storage disease.

Functions of lysosome

They are involved in digestion of intracellular or extracellular particles depending upon the types of lysosomes. They carry out different functions in following ways:

1. **Exocytosis**- During this process they release enzymes outside the cell. The released enzymes destroy materials around the cell.
2. **Autophagy**- They break down the materials from inside the cell by fusing with vacuoles. During this they digest worn out organelles so that useful chemicals recycle back to the cell.
3. **Heterophagy**- They break down the materials from outside the cell by fusing with vacuoles. Heterophagy may be of following types:
 - a) **Phagocytic**- During this process the phagocytic cells engulf the extracellular debris, bacteria or other particles.
 - b) **Pinocytic**- The extracellular fluid is ingested by the cell.
 - c) **Endocytic**- They take-up molecules which are attached to the outer surface of the cell membrane.
4. **Autolysis**- In this process lysosomes destroy the cell. They rupture inside their cells and released their hydrolytic enzymes which digest and degrade the cell.



Different functions of lysosomes

References

1. Alberts B et al. (2015) in “The Molecular biology of the cell”, sixth edition. Garland Science, New York.
2. <https://www.biologydiscussion.com>

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