

## LYSOSOMES:

In 1949 a class of cell particles with centrifugal properties intermediate between those of **mitochondria** and **ribosomes** was isolated. The particles were observed in liver cells as rounded, dense bodies. In 1955 **de Duve** termed these organelles as **lysosomes** because they contain digestive enzymes capable of lysis or digestion. A lysosome is a lytic body.

### Occurance:

Lysosomes occur from all the animal cells with **exception of mammalian R.B.C.** These are most abundant in **macrophages** which perform special digestive functions and in the cells of those organs which are associated with **enzymatic action** such as **liver, pancreas, thyroid, spleen, intestine and kidney.**

### Structure

Structurally lysosomes are rounded or spherical bodies. Each is bounded by a single unit membrane and enclose a dense matrix formed of **acid phosphatases or acid hydrolases.** The matrix may appear to be almost solid or differentiated into **very dense outer zone** and a **less dense central mass.** The central mass may enclose cavities or vacuoles with granular substances.

### Types of lysosomes:

The lysosomes are **polymorphic.** According to present concept there are **four types** of lysosomes.

**Primary lysosomes or storage granules:** Each is a small body, filled with acid hydrolases enzymes in an inactive stage. These enzymes are synthesized in **ribosome.**

**Digestive vacuoles or heterophagosomes:** They are formed as a result of the fusion of primary lysosomes with phagosomes. The heterophagosomes the enzymes and material to be digested and already digested are present.

**Residual bodies:** They are final particles containing indigestible materials. It is formed when digestion is complete.

**Autophagic vacuoles or autophagosomes:** It is special type of secondary lysosomes in which lysosomes contain part of the cell in process of digestion, such as mitochondria or E.R etc.

### **Chemistry:**

Lysosomes possess a variety of **enzymes** for e.g., **Nucleases, proteases, phosphatases, lipid, digestive enzymes, glucosidase, galactosidase** etc. which breakdown all the principal constituents of living things i.e. **protein, polysaccharides, nucleic acid, organic linked phosphatases** etc. as most of these enzymes work more efficiently. Under a slightly acid constituents, they are together known as acid hydrolases. They do not contain any oxidative enzymes, which is however present in mitochondria.

### **Function:**

The lysosome is essentially a **bag containing digestive enzymes**. The enzymes may be released within the cell itself or outside the cell. The membrane of the lysosomes may be ruptured by a variety of labilizers, for e.g. Vit-K, and A, detergent, U/V rays and freezing and thawing. On the other hand, certain substances like cortisone, hydrocortisone, cholesterol strengthen the membranes which are stabilizer. Lysosomes of dead cells or injured cells rupture together and release the enzymes. In this way the useless cells of an organism are get rid of.

**Digestion of external particles (Lysosomal digestion):** - large molecules of food ingested by the cells are digested by lysosomes. The cells engulf by the particles by forming an invagination which becomes pinched off from the cell membrane in the form of food vacuoles. It is known as phagocytosis. It migrates towards the lysosomes and fuses with it. Thereby the content of the two bodies are mixed together and enzymes of lysosomes. come in contact with the ingested particles and digest them. The lysosomes under the process of digestion are known as digestive vacuoles or phagosomes.

**Digestion of intracellular substances or autophagy:** - Lysosomes are able to dissolve and digest parts of their own cells and the process is known as autophagy. The proteins, fats and polysaccharides are synthesized and stored by the cells in various forms. During starvation these substances of the cells are digested by its own lysosomes to provide energy for body activities.

**Cellular digestion:** - The lysosomal enzymes can be discharged outside the cell to destroy surrounding structure, perhaps, the lysosomes first migrate to the surface of the cell and then burst out. It is seen in the **destruction of bone by osteoblast cells**.

**Sperm penetration:** - During fertilization, the acrosome of sperm head produces some **lytic or lysosomal** enzymes which dissolve the tissue around the ovum and help in the penetration of sperm into ovum.

**Osteogenesis:** - During conversion of cartilage into bone, the special **osteoblast** cells produce lytic substances which erode the matrix of cartilage and help in the formation of bone.

**Lysosomes and cancer:** - It is presumed that the chromosomal abnormality which are found in malignant cells is caused by chromosomal breakage presumably produced by the lysosomal enzyme. The partial deletion of chromosome 21 in man is associated with the **chronic myeloid leukemia (Blood cancer)**.

**Chromosome breaks:** - Lysosomes contain the enzyme DNAase. This enzyme causes **chromosomal breaks and their rearrangement**. DNAase has two active sites and break down both the strands of DNA. This break leads to various syndromes.

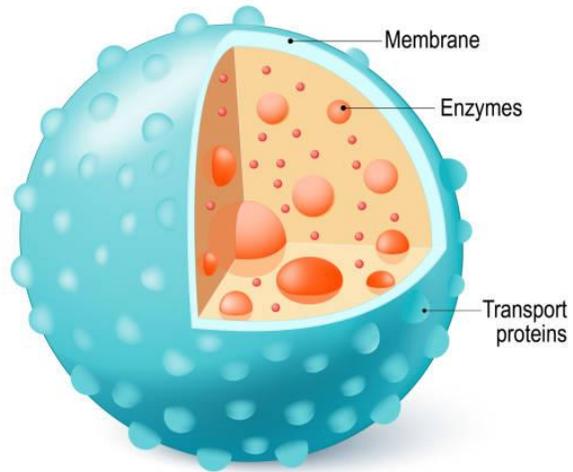
**Lysosomes and disease:** - Inhalation of foreign particles like silica, asbestos etc. leads to inflammation and deposition of fibrous tissue in the lungs. These particles increase the permeability of lysosomal membrane and rupture of lysosomes. This leads to the lysis of lung cells resulting in their inflammation.

A metabolic disorder, the **gout** is caused by the **accumulation of sodium urate crystals in the joints**. This is picked up by the phagocytes resulting in their lysosome rupture. This leads to acute inflammation.

**Cell division:** - Lysosomal breakdown initiates mitosis. Experiments on cultured lymphocytes show that lysosomal **stabilizer** like cortisone and chloroquine prevents mitosis, whereas lysosomal **labilizers** like bacterial toxin increase mitosis.

**Seed segmentation on plants:** - During seed germination, lysosomal enzymes are released by the seedling, which attack the stored food material, making it available to the developing plants.

# LYSOSOME



Nanda LVI