Lysosome

- **Lysosomes were discovered by the Belgium cytologist Christian de Duve in 1955, and named as "suicide bags" or "suicide sacs“.**
- **It is a membrane bounded organelle, found in the cytoplasm of eukaryotic cells, which contains digestive enzymes.**
- **They are found in animal cells, while in plant cell the same roles are performed by the vacuole.**
- **They are most abundant in cells which are related with enzymatic reactions such as liver cells, pancreatic cells, kidney cells, spleen cells, leucocytes, macrophages.**

- **Lysosomes contain many different enzymes capable of digesting, i.e., destroying by hydrolysis, cell proteins, polysaccharides, and lipids that are no longer needed.**
- **The proteins and other components to be degraded are selectively brought into the lysosomes and hydrolyzed there into their simple building block components, which are then discharged back into the cytoplasm.**
- **These enzymes work best in an acidic environment, at about pH 5.**

Lysosome Structure

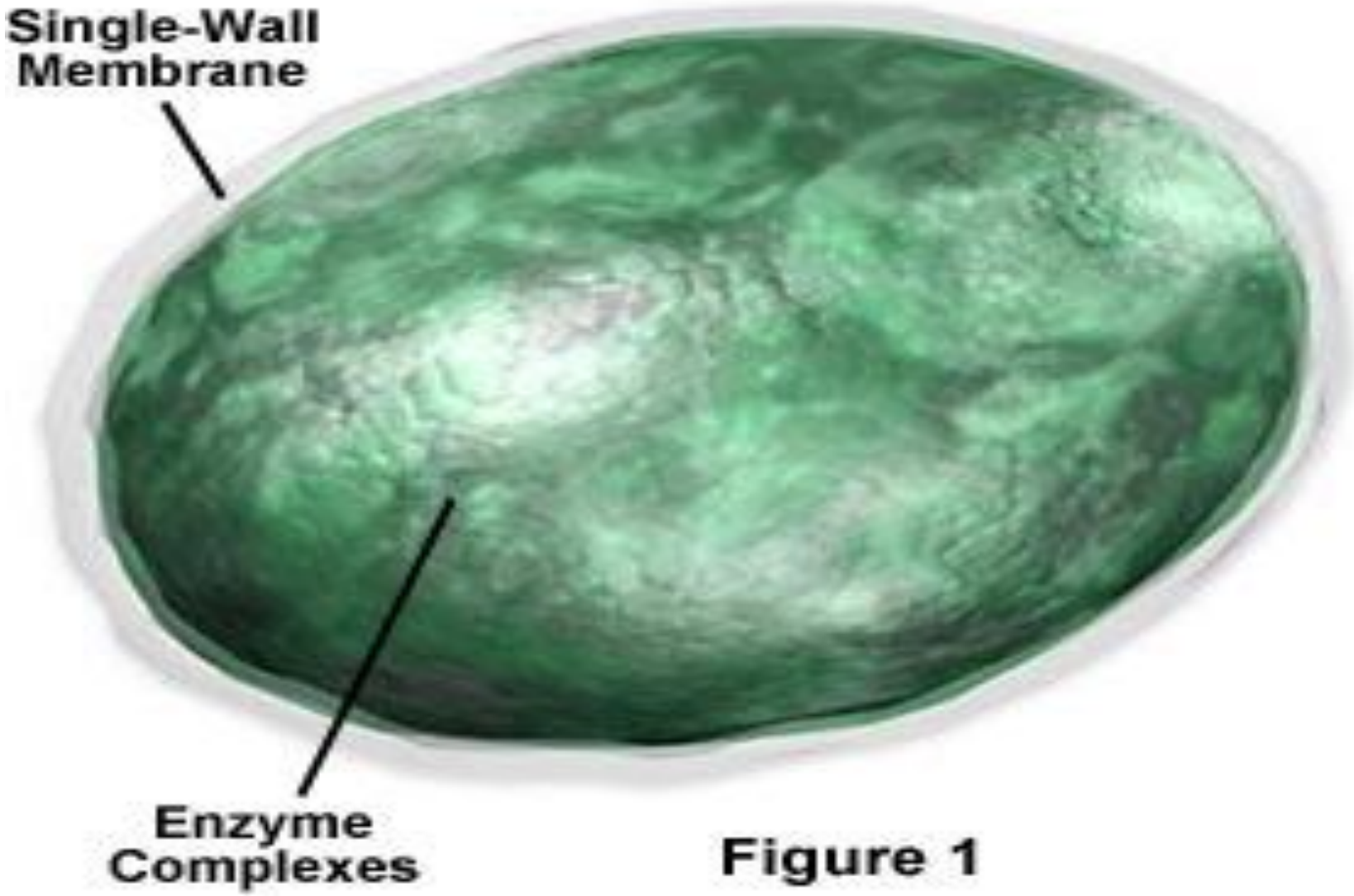
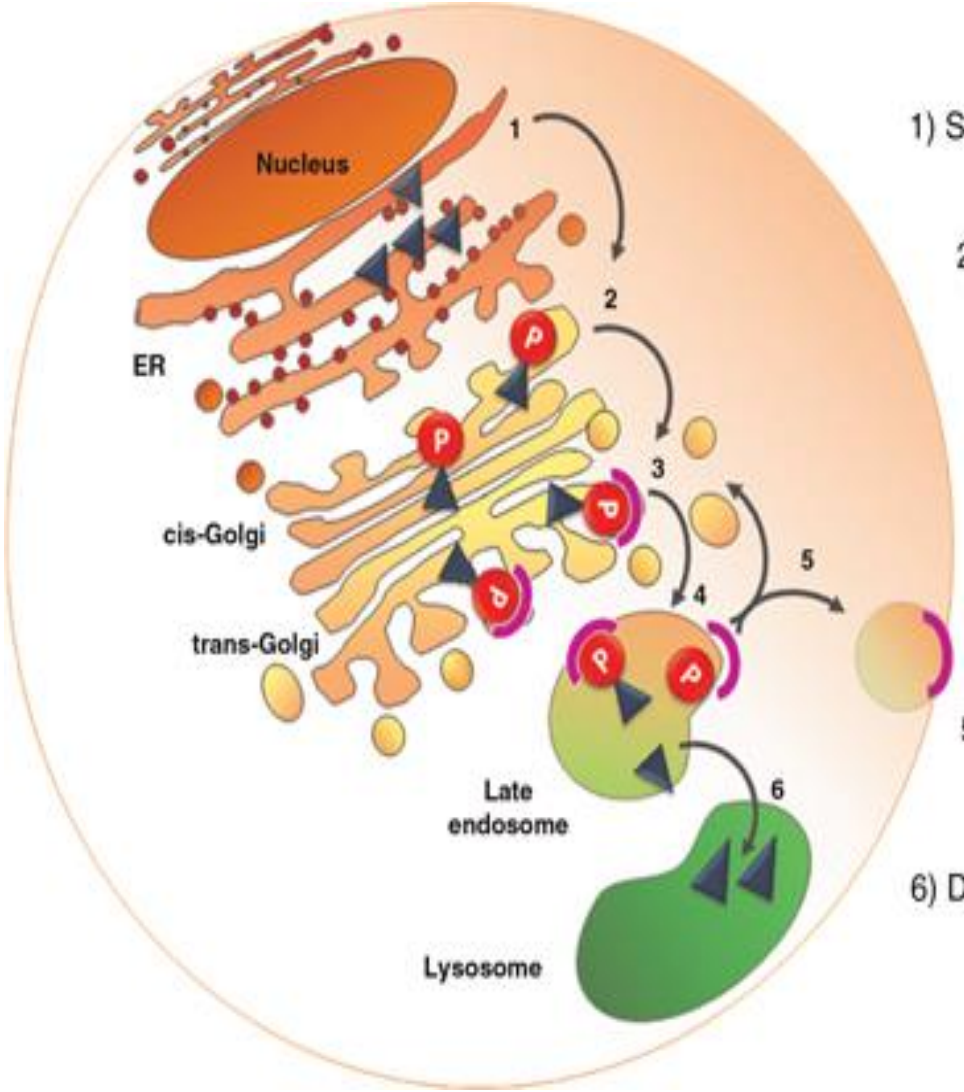


Figure 1

- **The lysosomal membrane separate the destructive hydrolytic enzymes from the cytosol.**
- **Lysosomal enzymes are synthesized in the endoplasmic reticulum (ER), are transported to the Golgi apparatus, and are tagged for lysosomes by the addition of mannose-6-phosphate label.**
- **The lysosomal enzymes are collectively called as hydrolases.**



1) Synthesis in endoplasmic reticulum (ER)

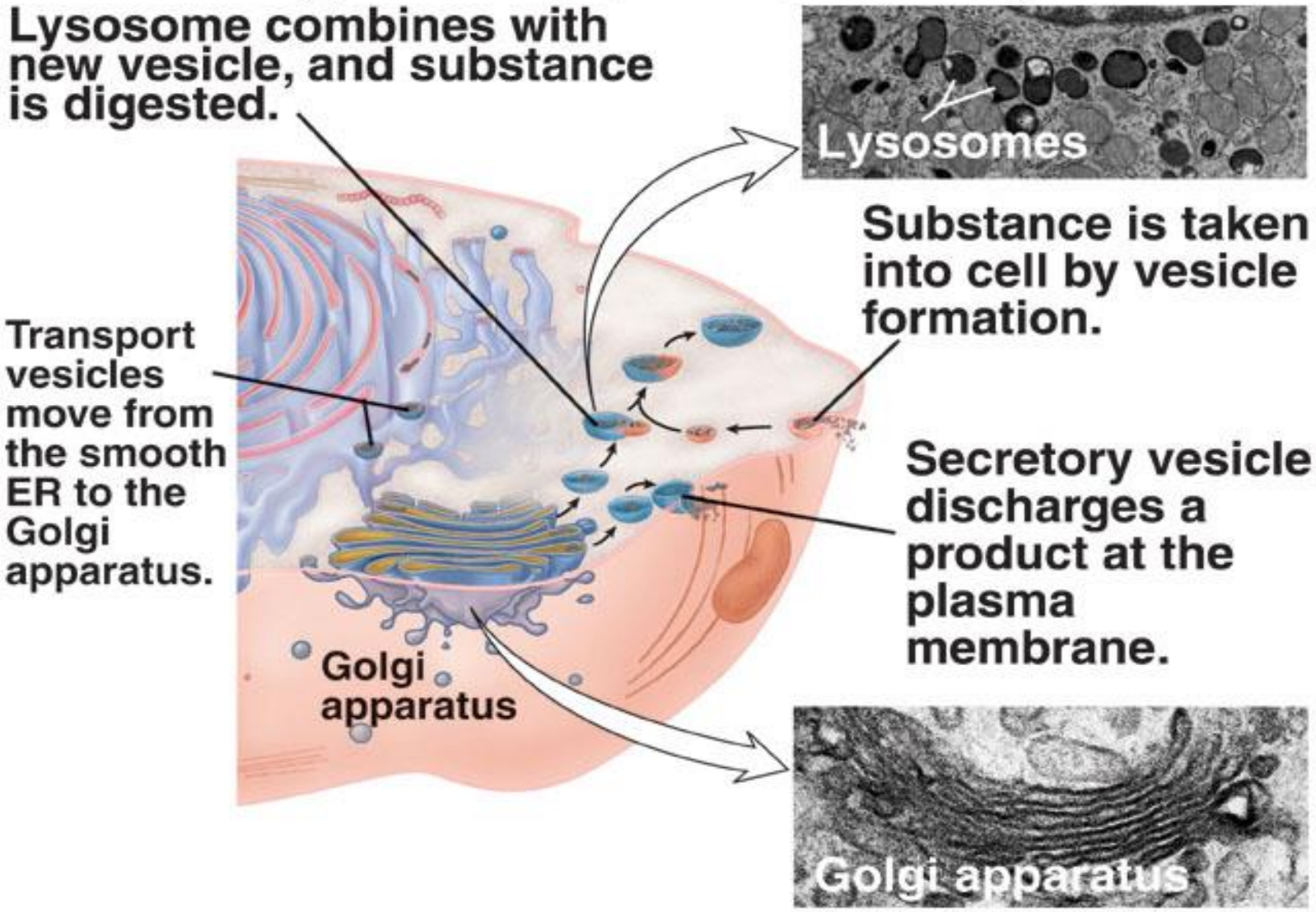
2) Enzymes requiring M6P ligand move to *cis*-Golgi, where M6P acquisition occurs

3) Interaction enzymes with M6P receptors (budding from *trans*-Golgi)

4) Receptor-protein complex moves to late endosome, where dissociation occurs

5) Receptors are recycled to plasma membrane or back to Golgi

6) Delivery to lysosome



Lysosomal Enzymes

Nulceases

Nucleases hydrolyse nucleic acids into nitrogen bases, phosphates and sugars. The nucleases are of two types namely deoxyribonuclease and ribonuclease.

Proteases

Proteases hydrolyse proteins into amino acid residues.

Glycosidases

Glycosidases hydrolyse glycosidic bonds of polysaccharides into monosaccharides.

Lipases

Lipases hydrolyze lipids into fatty acids and alcohol.

Phosphatases

Phosphatases release phosphates from organic compounds with phosphates.

Sulphatases

Sulphatases release sulphates from the organic compounds with sulphate.

Lytic component

Lytic component present in lysosome include lactoferrin which act as iron chelators i.e. it removes iron from the lysoendosomal vesicle during the lytic function of lysosome.

Function

- Lysosome carry out intracellular digestion

- **Digestion products including simple sugars, amino acids and other monomers pass into the cytosol and become nutrients for the cell.**

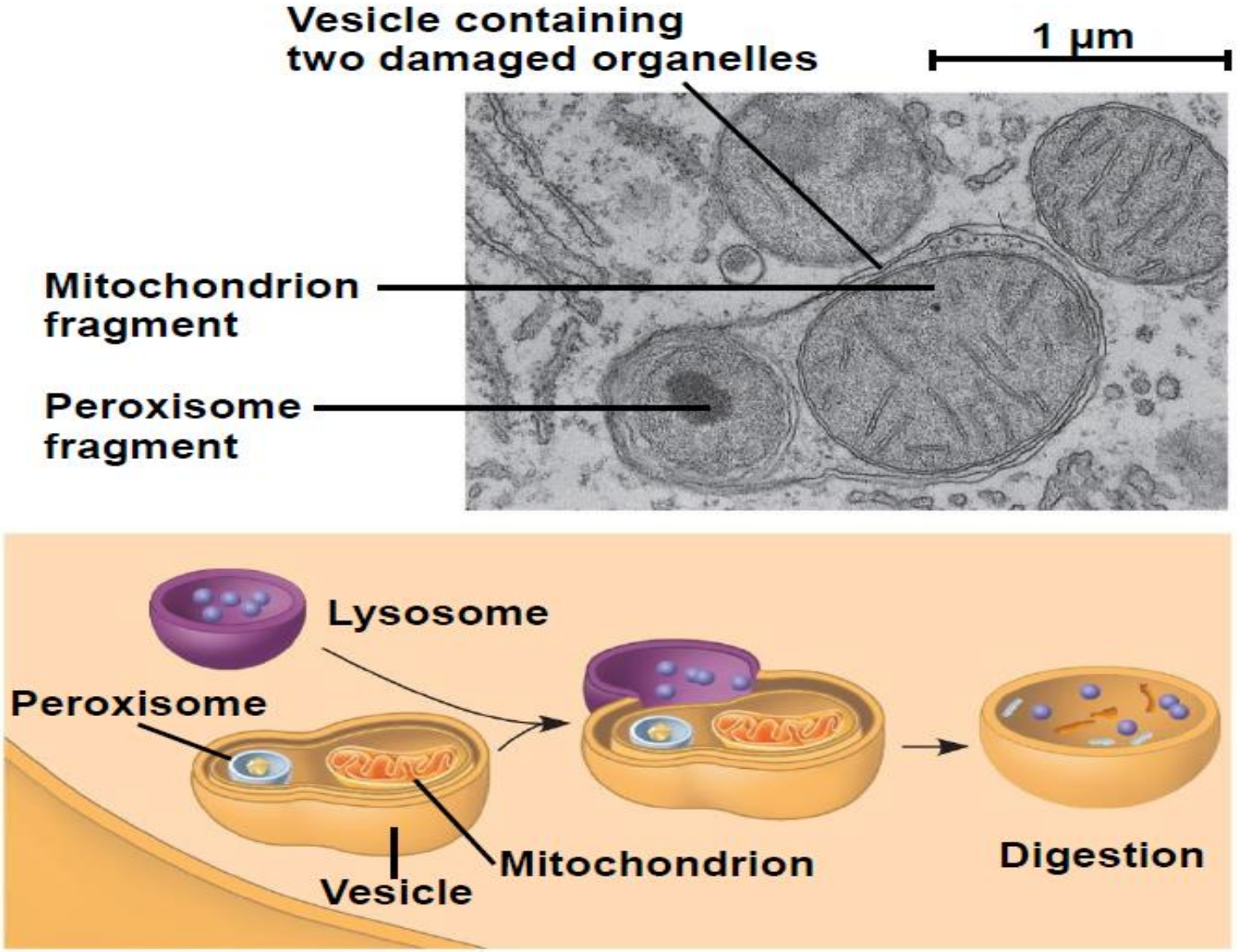
- **Lysosome use their hydrolytic enzymes to recycle the cell's own organic materials, a process called autophagy.**

  Autophagy: **It is occur when lysosome engulf another organelle or a small amount of cytosol.**

- **The lysosomal enzyme dismantle the ingested material, and the organic monomers are returned to the cytosol for reuse.**

e.g., human liver cell recycle half of its macromolecules each week.

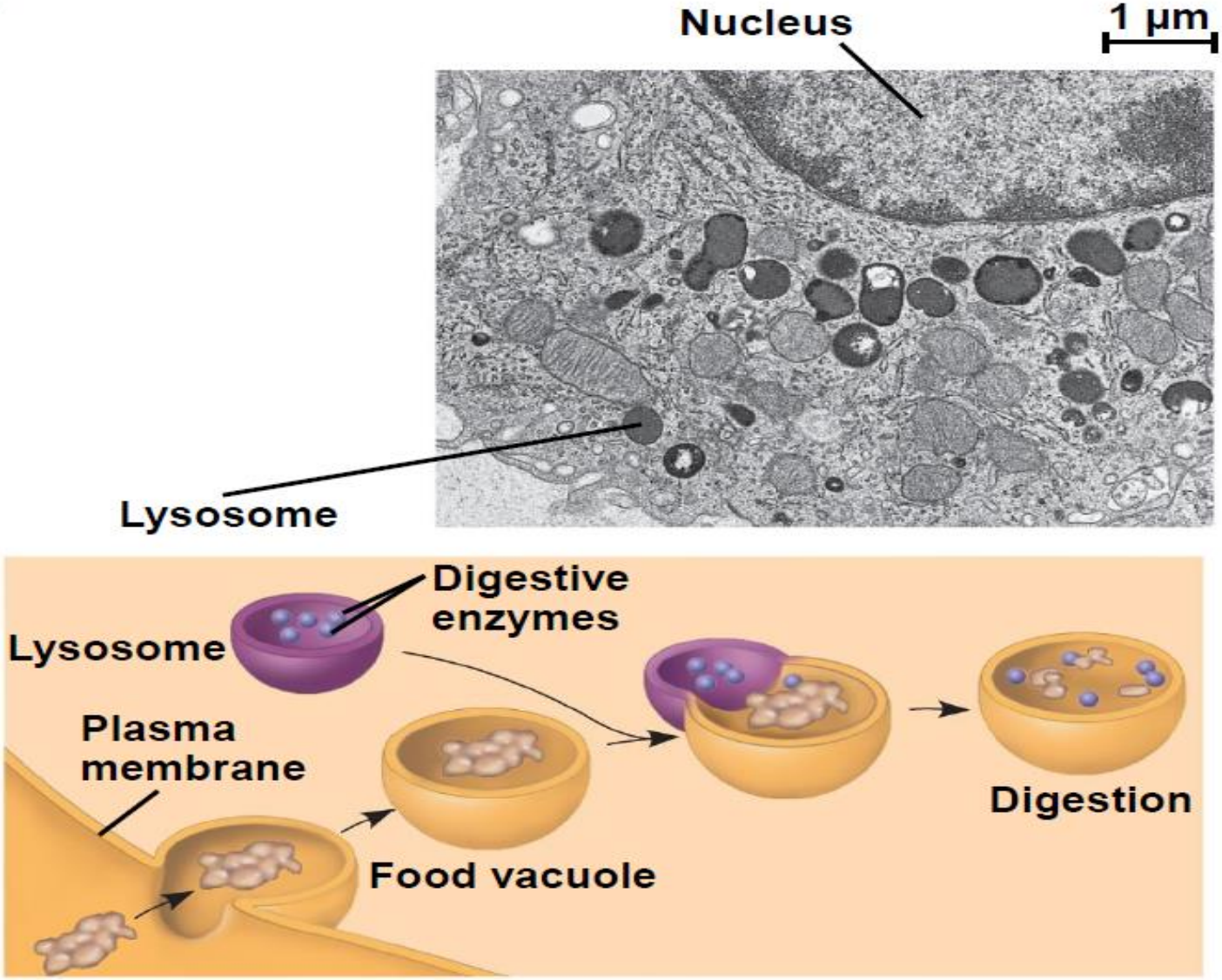
Fig. 6-14b



(b) Autophagy

- **Some types of cell can engulf another cell by phagocytosis; this forms a food vacuole**
- **A lysosome fuses with the food vacuole and digests the molecules**

Fig. 6-14a



(a) Phagocytosis

Lysosomal storage disease

A variety of inherited disorders called lysosomal storage diseases affect lysosomal metabolism.

- **In these diseases. There is a lack of functioning hydrolytic enzymes, so this causes accumulation of indigestible substrates which interfere with other cellular activities.**

e.g., *Pompe's disease:*

In this disease the liver is damaged by an accumulation of glycogen due to the absence of lysosomal enzyme needed to breakdown that polysaccharide.

Tay-Sachs disease:

In this disease, the lipid-digesting enzyme is missing or inactive, so the brain becomes impaired by an accumulation of lipids in the cell.