

**COURSE - M.SC. BOTANY, PART-II PAPER-
VII**

TOPIC-PEROXISOME(CELL BIOLOGY)

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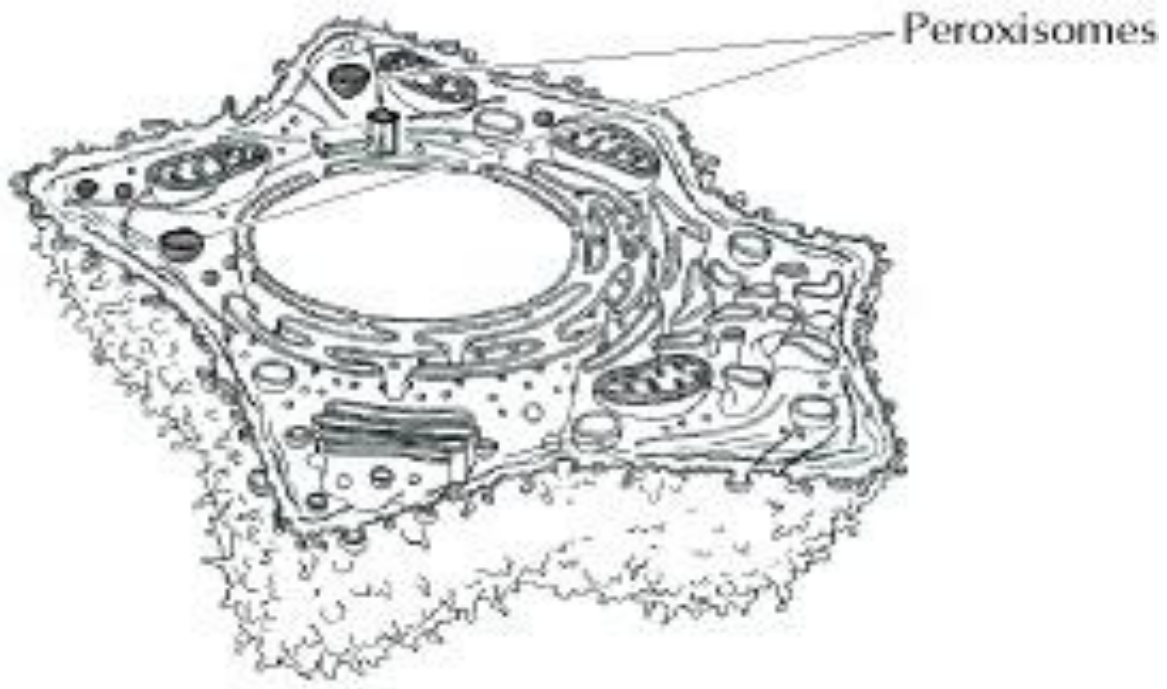
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Peroxisome

A peroxisome is a membrane-bound organelle, formerly known as a microbody, (discovered by De Duve and his Co-workers in 1966.) found in the cytoplasm of virtually all eukaryotic cells. Peroxisomes are oxidative organelles. Frequently, molecular oxygen serves as a co-substrate, from which hydrogen peroxide (H_2O_2) is then formed.

They are ovoid granules surrounded by a single membrane. They contain a fine granular substance condensing in the centre to form an opaque homogeneous core, the nucleoid. The average diameter of a peroxisome in mammalian cells is $0.1\ \mu\text{m}$ to $1.5\ \mu\text{m}$ and their number per cell may range from 70 to 100 as against 15-20 lysosomes per cell. They are particularly abundant in liver and kidney cells.

Peroxisomes differ from mitochondria and chloroplasts in having a single membrane and they do not contain DNA or ribosomes. Since peroxisomes differ from chloroplast and mitochondria in not having their own genomes and protein synthesis machinery, all their protein must be imported by a process of selective import from cytosole, although they are capable of self replicating like endoplasmic reticulum.



Electron micrograph of peroxisomes

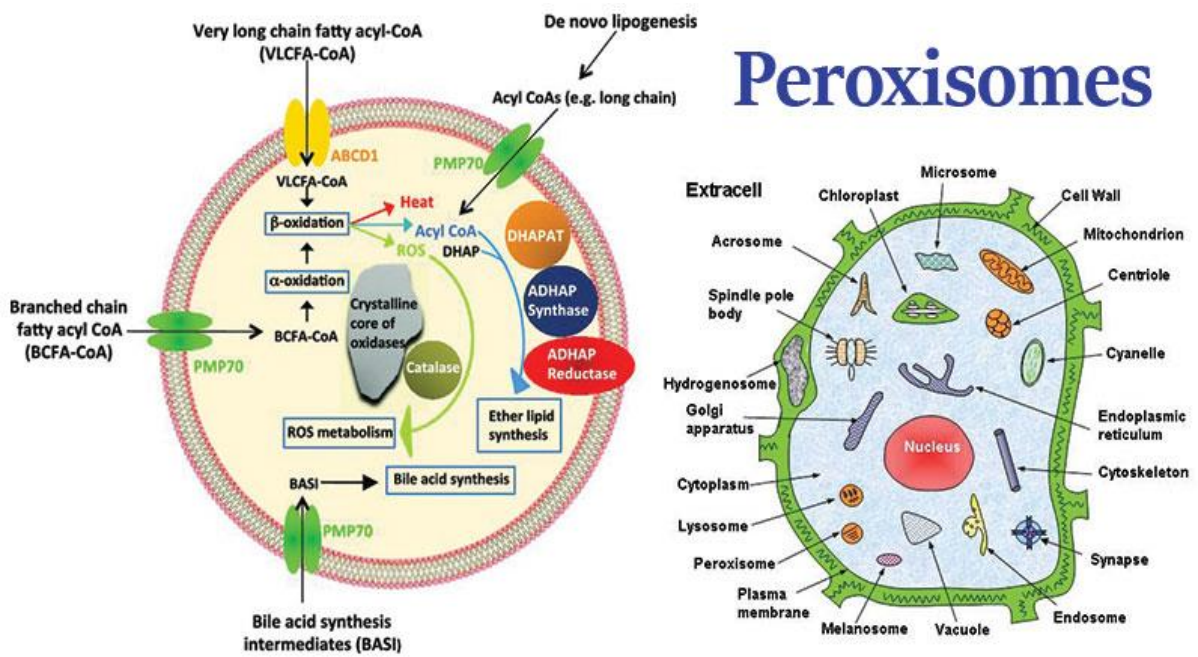


Figure: Diagram of Peroxisomes.

Functions of Peroxisomes

Peroxisomes contain at least 50 different enzymes, which are involved in a variety of biochemical pathways in different types of cells. Peroxisomes originally were defined as organelles that carry out oxidation reactions leading to the production of hydrogen peroxide. Because hydrogen peroxide is harmful to the cell, peroxisomes also contain the enzyme catalase, which decomposes hydrogen peroxide either by converting it to water or by using it to oxidize another organic compound. A variety of substrates are broken down by such oxidative reactions in peroxisomes, including uric acid, amino acids, and fatty acids. The oxidation of fatty acid is a particularly important example, since it provides a major source of metabolic energy. In animal cells, fatty acids are oxidized in both peroxisomes and mitochondria, but in yeasts and plants fatty acid oxidation is restricted to peroxisomes.

Peroxisomes contain enzymes that oxidize certain molecules normally found in the cell, notably fatty acids and amino acids. Those oxidation reactions produce hydrogen peroxide, which is the basis of the name peroxisome.

Peroxisomes are particularly abundant in organs such as liver where lipids are stored, broken down or synthesised Building up Peroxisomes produce chemicals as well as breaking them down. They make cholesterol in animal cells and peroxisomes in liver cells produce bile acids.

Peroxisome: Peroxisomes are membrane-bound packets of oxidative enzymes. In plant cells, peroxisomes play a variety of roles including converting fatty acids to sugar and assisting chloroplasts in photorespiration. In animal cells, peroxisomes protect the cell from its own production of toxic hydrogen peroxide.

Lysosomes are said to be common in the cells of animals and very small or rare in plants. ... Lysosomes contain hydrolase. This is the component or enzyme that is responsible for digestion. Peroxisomes, on the other hand, contain three oxidative enzymes such as catalase, D-amino acid oxidase, and uric acid oxidase.
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Prokaryotic cells are enclosed by a plasma membrane. ... These organelles include (but are not limited to) endoplasmic reticulum, Golgi, lysosomes, peroxisomes, mitochondria, chloroplasts, endosomes, and nuclei, all bounded by membranes.

Peroxisomes differ from mitochondria and chloroplasts in many ways. Most notably, they are surrounded by only a single membrane, and they do not contain

DNA or ribosomes. Like mitochondria and chloroplasts, however, peroxisomes are thought to acquire their proteins by selective import from the cytosol.

Peroxisomal Enzymes

- Approximately 60 known enzymes are present in the matrix of peroxisomes.
- They are responsible to carry out oxidation reactions leading to the production of hydrogen peroxide.
- The main groups of enzymes include:
 1. Urate oxidase
 2. D-amino acid oxidase
 3. Catalase