

CHPATER 9

9 OTHER CYTOPLASMIC ORGANELLES

9.1 SPHEROSOMES AND RELATED VACUOLES IN PLANTS.

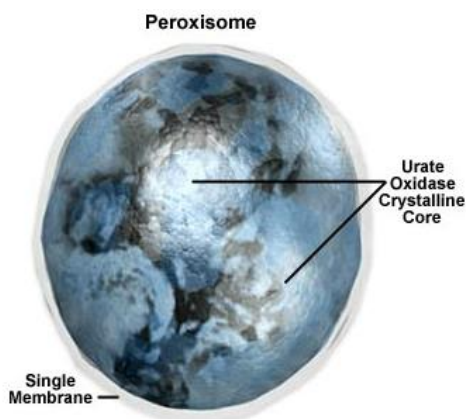
9.1.1 Definition and properties

- i) **Sphaerosomes:** are small membrane enclosed vesicles found in plants. They Resemble lysosome in animals.
- ii) Measure between 0.5 – 1.0 μm in diameter.
- iii) Sphaerosomes have acid hydrolase activity.
- iv) Sphaerosome stain intensely with fat soluble dyes indicating a high lipid content, unlike animal lysosomes.

9.1.2 Functions of sphaerosomes.

- i) Storing and mobilizing reserve lipid (lipid metabolism).
- ii) Digesting and recycling intracellular constituents in a manner analogous to the animal cell lysosome. Digestion of extracellular matter by sphaerosome is limited because cell wall in plants limit phagocytosis from bringing in foreign particulate matter .

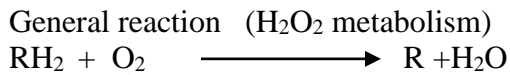
9.2 PEROXISOMES.



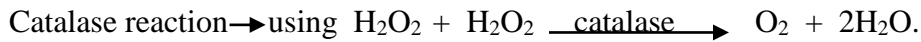
Functions

- i) Breakdown of hydrogen peroxide (H_2O_2 – hydrogen peroxide metabolism).
- ii) Process catalase , hydrogen producing oxidase e.g. urate oxidase.
Location of peroxisomes - found in liver and kidney of vertebrates and in leaves and seeds of plants in eukaryotes micro – organisms e.g. yeast , protozoa and fungi.
- iii) In mammals, it is involved in a variety of essential catabolic and anabolic pathways such as the oxidative degradation of long-chain fatty acids, purines, amino acids, and pipercolic acid as well as the biosynthesis of plasmalogens, cholesterol, and bile acid.

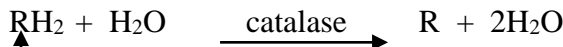
vi) Also process D-amino acid oxidase , glucose oxidase.



Use O₂ as oxidizing agent



Peroxidatic mode → electron donor is a substrate other than H₂O₂

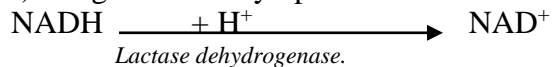


Can be ethanol,
phenol, Nitrate
formaldehydes

Metabolic functions of peroxisomes

- i) Inactivation of toxic substance e.g. use of catalase to degrade hydrogen peroxide.
- ii) Regulation of oxygen tension. Respiration takes place in both mitochondria and peroxisomes – with energy released from mitochondria being released as ATP and from peroxisomes being released as heat. Respiration in mitochondria is at maximum when oxygen concentration is 2%, but respiration in peroxisomes increases with increase in oxygen tension , thus prevents cells from damage by increased oxygen tension.

iii) Regulation of cytoplasmic NAD⁺



Example Pyruvate $\xrightarrow{\text{reduced}}$ lactate.

Pyruvate is produced in peroxisomes by oxidation of lactate and can be reduced back to lactate in the cell sap accompanied by conversion of NADH to NAD⁺

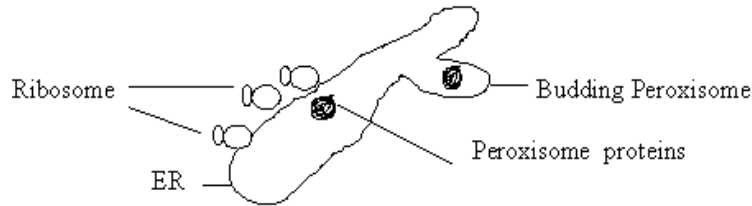
This is important in cases where NADH is being produced in the cell sap by glycolysis faster than it can be regenerated back to NAD⁺

iii) Metabolism of nitrogenous bases, lipids and carbohydrates.

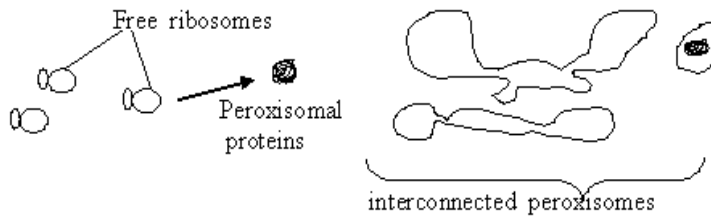
Biosynthesis of peroxisomes.

Two theories have been proposed.

- i) Peroxisomal proteins are synthesised on ribosomes bound to the endoplasmic reticulum.



- ii) Peroxisomal proteins are synthesised by free ribosomes.



9.3 GLYOXYSOMES

Are special types of peroxisomes in plants.

Used in conversion of lipid to CHO in plant seeds using germination.

9.4 Other microbodies.

i) Hydrogenosome - involved in oxidation of pyruvate.

ii) Glycosome - appear to be involved in the catalysing of the anaerobic breakdown of glucose.