**Dr. Rima Kumari: Date: 05/10/2020**

Online class and e- content for MSc IIIrdsemester students

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| Date and Time | Online class medium  | E. content topic |
| 05/10/202001:00 p.m to 1.40 p.m | Via Google meetLink: Meeting URL: https://meet.google.com/fwc-gbeq-gpj | **Lysosomes, peroxisomes, glyoxisomes** |

**Lysosomes:**

Lysosomes were first discovered by Christian de Duve. Unlike other organelles which were detected by microscope, these were first discovered biochemically. Later, electron microscope and biochemical methods shed more light on their nature and their participation in cell activities.

These particles were called lysosomes (lysis6= dissolution, soma = body) due to their

hydrolytic activity. A lysosome is a single membrane bound vesicle that either buds off from \* the releasing face of Golgi apparatus or arises directly from ER. The lysosomes are rich in hydrolases. Especially, acid phosphatase, of about 50 different types which digest all the significant groups of macro molecules. These enzymes are active at pH 5 within the organelle. The enzymes, which escape from lysosomes, become slow in their action because the pH of cytoplasm is 7.0. This large pH difference is a device to protect the cell from digestion.

**Polymorphism in Lysosomes:**

Polymorphism, i.e. existence of a structure inmore than one form, is an important feature of lysosomes. Several different forms of lysosomes have been identified within the cell as primary lysosomes, secondary lysosomes, residual bodies and autophagic vacuoles



Figure showing the polymorphism of lysosomes. Primary Iywsomes containing digestive enryme, fuse with the phagosome to form secondary lysosome. Digestion products are released by exocytosis.

Primary lysosome may fuse with some organelles like mitochondria to form autophagic vacuole. Incomplete digestion of foreign substances form residual bodies.

Primary lysosomes: These are newly formed organelles. They are believed to be derived from the maturing face of Golgi complex whose digestive enzymes have not yet taken part in hydrolysis.

Secondary lysosomes are formed from fusion of primary lysosomes with the vesicles

containing variety of substrates known as 'phagosome'. After fusion, their membrane

undergoes a change and enzymes are activated so that the substrate is digested. After

activation they may continue hydrolysis repeatedly. The secondary lysosomes which fuse . with vesicles containing extracellular substrate brought into the cell by endocytosis are known as heterophagic lysosomes or heterophagosome whereas lysosomes fusing with vesicles containing particles isolated from cell's own cytoplasm like mitochondria, microbodies, and fragments of endoplasmic reticulum are known as autophagic vacuoles. During pathological conditions or during cell growth, autodigestion of cellular organelles is a normal event.

Residual bodies: Incomplete digestion of foreign substances leads to the formation of

residual bodies. Residual bodies are huge, irregular in shape and are electron dense. In some cells they remain for a long time and play a role in the aging process. In some other cells, the content of the residual bodies leave the cell by exocytosis. Lysosomes are responsible for the .intracellular digestion of a variety of substances such as food molecules, disease causing organisms, etc. This process is called heterophagy. Lysosomes are also responsible for digestion of cell's own cytoplasmic constituents. This process is called autophagy. It is important that lysosomes do not rupture and release their contents inside living cells as they would start digesting the cell and ce!l will die.

**Endocytosis and Exocytosis**

Endocytosis is the process by which substances are brought into the cell from outside by formation of membrane bound vesicles. These extra cellular substances are enclosed in a small portion of plasma membrane which invaginates and pinches off to form an intracellular vesicle. The intake of fluids by.formation of vesicles is called as **pinocytosis** (pinein = drink). Pinocytosis is induced by the presence of appropriate concentrations of inducer molecules which can be proteins, amino acids or certain ions in the medium surrounding the cell. Ingestion of large particles by formation of larger vesicles is known as **phagocytosis** The process of phagocytosis is associated with heterophagic activity of the lysosomes such as the destruction of worn blobd cells in the liver, spleen and bone marrow. Exocytosis is the reverse sequence where the membranous intracellular vesicles fuses with plasma membrane and releases its content to the extracellular surroundings. The best understood form of, exocytosis is secretion by the cell. As you have studied earlier, Golgi apparatus plays an important role in the formation of cytoplasmic intracellular vesicles. The membrane of these vesicles is incorporated into plasma membrane and the vesicle's contents **are** discharged to the exterior.



**Microbodies: Peroxisomes and glyoxysomes:**

 Peroxisomes and glyoxysomes are microbodies formed from ER which superficially resemble the lysosomes. Peroxisomes are spherical bodies limited by a single membrane. The centre of peroxisomes is occupied by a fine granular core called 'nucleoid'. Peroxisomes contain oxidising enzymes which are synthesised by ribosomes. These enzymes are uric acid oxidase, D-amino acid oxidase, hydroxyl acid oxidase which produce hydrogen peroxide on oxidation, while peroxisomal catalase, the enzyme found in lysosomes, destroys hydrogen peroxide. Since hydrogen peroxide is toxic to the cell, catalase plays a protective role by breaking down hydrogen peroxide. Hence, peroxisomes play an important role in detoxification. In green plants, peroxisomes carry out a process called photorespiration.

Glyoxysomes are a form of peroxisome which contain enzymes like isocitrate lyase. And malate synthetase which are specific to gloxylate cycle. They also have several Krebs cycle enzymes about which you will study later. Glyoxysomes are the essential components of plant cell