B.Sc. Botany – 2ND SEM
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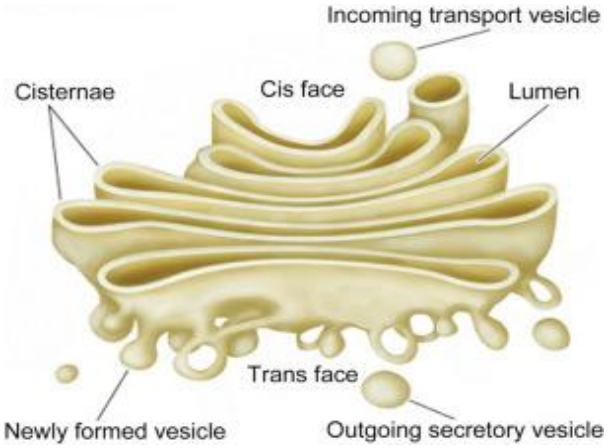
Golgi Apparatus

- The Golgi apparatus has multiple names such as Golgi complex or Golgi body. They are membrane-bound organelle present in the cytosol of the cell.
- It is called dictyosomes, in plants and lower invertebrates.
- The Golgi body was observed in 1898 by **Camillo Golgi** in the **nerve cells of owl and cat**. It is named after him.
- It is found in all the eukaryotic cells, plants as well as animals.
- Different types of cells contain only one or more Golgi apparatus but **plant cells** can contain it abundantly which might be **in hundred**.
- Animal cells generally contain around 10 to 20 Golgi stacks per cell, which are connected by tubular connections. Golgi complex is mostly found near the nucleus
- It is not found in prokaryotic cells. Examples: PPLO, bacteria, and blue-green algae.
- It is found in all eukaryotic cells except: **sieve tubes of plants, sperms of bryophytes and pteridophytes, red blood cell of animals**

Structure of Golgi body

- The shape and size of the Golgi body aren't fixed.
- They depend on the physiological condition of the cells.
- Usually, the Golgi body is formed from four parts. They are:
    - Cisternae
    - Tubules
    - Vesicles
    - Vacuoles



a. Cisternae

- The Golgi body comprises 5 to 8 cup-shaped, series of compartments known as cisternae.
- Cisternae is a flattened, disk-shaped, stacked pouches that make up the Golgi apparatus. A Golgi stack mostly contains **4 to 8 cisternae**. However, ~60 cisternae are found in some protists. A mammalian cell contains ~40 to 100 stacks of cisternae.
- Matrix proteins hold the cisternae, and therefore the whole of the Golgi body is supported by cytoplasmic microtubules.
- The cisternae have a smooth membrane, but they are of variable thickness.
- They enclose the lumen.
- It contains a fluid which is also called a matrix.
- Cisterna is the functional unit of the Golgi complex.
- One face of the apparatus is convex. The other face of the apparatus is concave. The convex side is present in the proximal end which is called forming face or cis-face. It is directed towards the nucleus.
- At this end, cisternae constantly receive vesicles (also called transitional vesicles) from the smooth endoplasmic reticulum.
- The concave side of the apparatus is called the **maturing face** (trans-face). The concave face or distal face cisternae is present towards the plasma membrane.
- The thickness of the maturing face is 7-8 nm.
- In the case of the forming face, they are about 4 nm in thickness.
- Their contents undergo various cisternae with the assistance of coated vesicles and intercisternal connectives.
- They ultimately reach the maturing face where they’re budded off as secretion, coated or Golgian vesicles, or vacuoles.

b. Tubules

- They are short and branched.
- The tubules interconnect the various cisternae.
- They form a sophisticated network towards the periphery and maturing face of the apparatus.
- Tubules arise because of fenestrations of the cisternae.
- The diameter is generally 30-50 nm.
- They are mainly involved in the elaboration of secretory products.

c. Vesicles

- They are small sacs of 20-80 nm diameters that develop from tubules.
- The vesicles are found attached to the tips of tubules at various levels within the network.
- They're of two types: Coated and smooth vesicles.

i. Coated vesicles

- The coated vesicles have a rough surface.
- Fine bristle-like outgrowths cover the coated vesicles.
- They bud off from the ends of peripheral tubules and pass into the cell membrane and helps in endocytosis.
- They elaborate membrane proteins.

ii. Smooth vesicles

- The smooth vesicles have a smooth surface.
- They contain secretory substances and are hence called secretory vesicles.
- They bud off from the tubules within the network.
- On being pinched off, they pass into the cell membrane and help in exocytosis.

d. Golgian vacuoles

- They are round vesicles or sacs which are enlarged parts of the cisternae.
- They became modified to make vacuoles.
- From the concave or maturing face of distal sacisternae, the vacuoles get developed.
- Golgian vacuoles contain amorphous or granular substances.
- Golgian vacuoles also function as lysosomes.

Functions of Golgi body

- Its main function is the packaging and secretion of proteins. It receives proteins from Endoplasmic Reticulum. It packages it into membrane-bound vesicles, which are then transported to various destinations, such as lysosomes, plasma membrane. They also take part in the transport of lipids and the formation of lysosomes.
- From the Endoplasmic reticulum proteins, pro-enzymes, lipids, steroids, and other substances pass to the Golgi complex. It may occur directly or through the agency of transitional vesicles.
- Golgi complex concentrates, modifies, and packages these bio-chemicals into the secretion vesicles. It later pinches off and passes out the secretory bio-chemicals through exocytosis or reverse pinocytosis.
- It helps in the transformation of one type of membrane into another type.
- It converts the membrane of the endoplasmic membrane into the selectively permeable plasma membrane, the differentiated membrane of the lysosome, etc.
- It also helps in recycling the cell membrane.
- In the plant cells, a cell plate is formed in the middle of the dividing cell. It happens when the vesicles get fused which is produced by the Golgi complex.
- In the plant cells, complex polysaccharides of the cell wall are synthesised in the Golgi apparatus.
- Golgi complex stores, condense packs and transports various substances.
- The digestive enzyme obtained through the endoplasmic reticulum is stored by some of the vesicles or vacuoles of the Golgi complex.
- Vesicles of the Golgi complex forms the acrosome of sperms.
- The membrane of the vesicle of the Golgi complex helps the formation of plasma membrane after cytokinesis.
- Post-translational modification and enzymatic processing occur near the membrane surface in Golgi bodies, e.g. phosphorylation, glycosylation, etc.
- Golgi apparatus is the site for the synthesis of various glycolipids eg. sphingomyelin, etc.