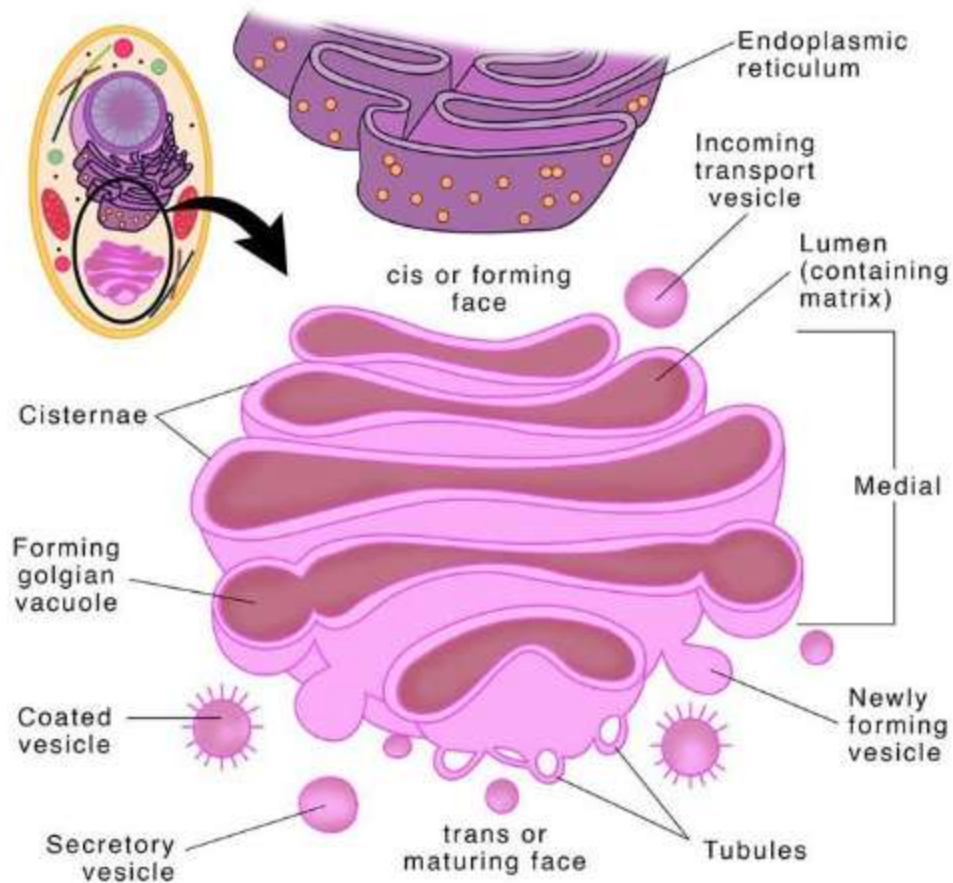


# Golgi Apparatus

## Golgi Apparatus

Science Facts



# Discovery of Golgi body

- The Golgi apparatus is noticeable with both light and electron microscope. It is also called **Golgi complex**.
- The Golgi complex was discovered by an Italian physician and Noble Laureate **Camillo Golgi** in 1898 during an investigation of the nervous system.
- Its electron microscopic structure was described by **Dalton** and **Felix** in 1954.

# Location

- The Golgi apparatus is present in all Eukaryotic cells and absent in Prokaryotes.
- The Golgi apparatus is specially extensive in the secretory cells.
- It is absent in few cell types, such as the mammalian RBCs, sperm cells of Bryophytes and Pteridophytes and sieve tubes of plants.

- A cell may have one large Golgi complex or several very small ones. It occupies different positions in different kind of cells.
- In secretory and absorptive cells, it usually lies between the nucleus.
- The invertebrate and plant cells usually have several small Golgi complexes, called Dictyosomes, scattered throughout the cytoplasm.

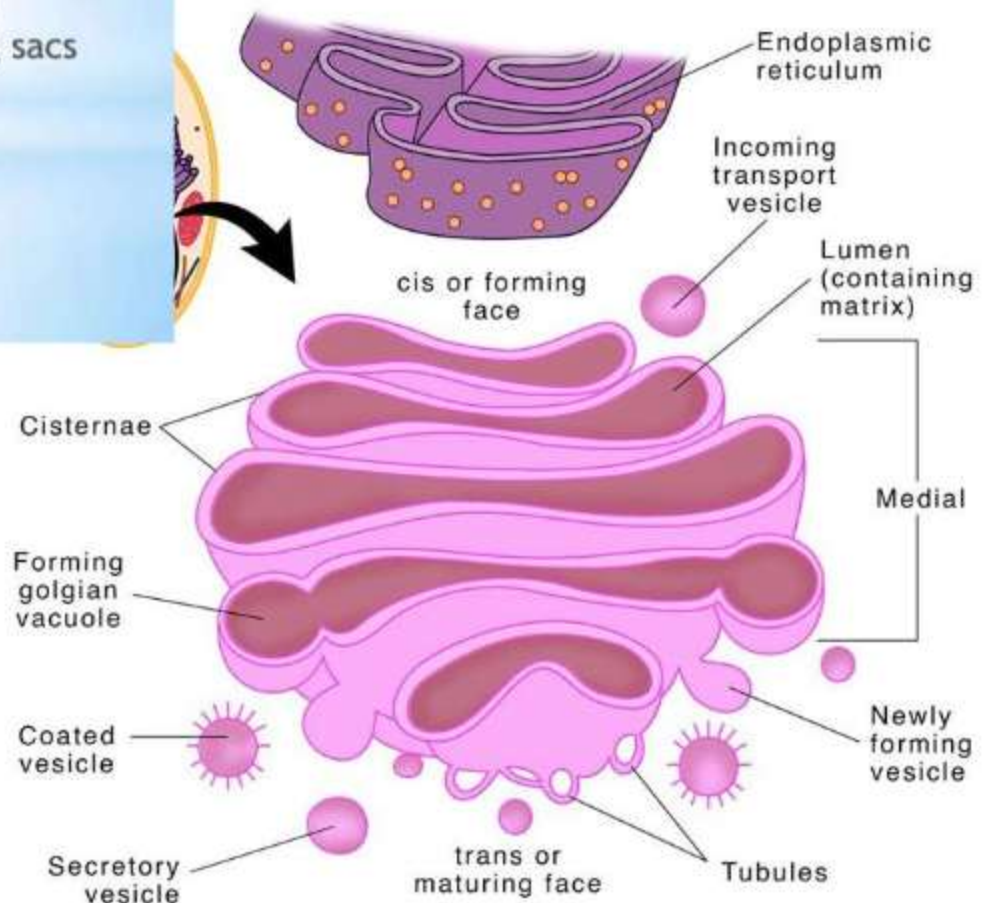


# Structure of Golgi complex

- Golgi complex varies in size and form in different cell types but usually has similar organization for any one kind of cells.
- Electron microscope shows it as a central stack (pile) of parallel, flattened, intercommunicating sacs or cisternae and many peripheral tubules and vesicles.

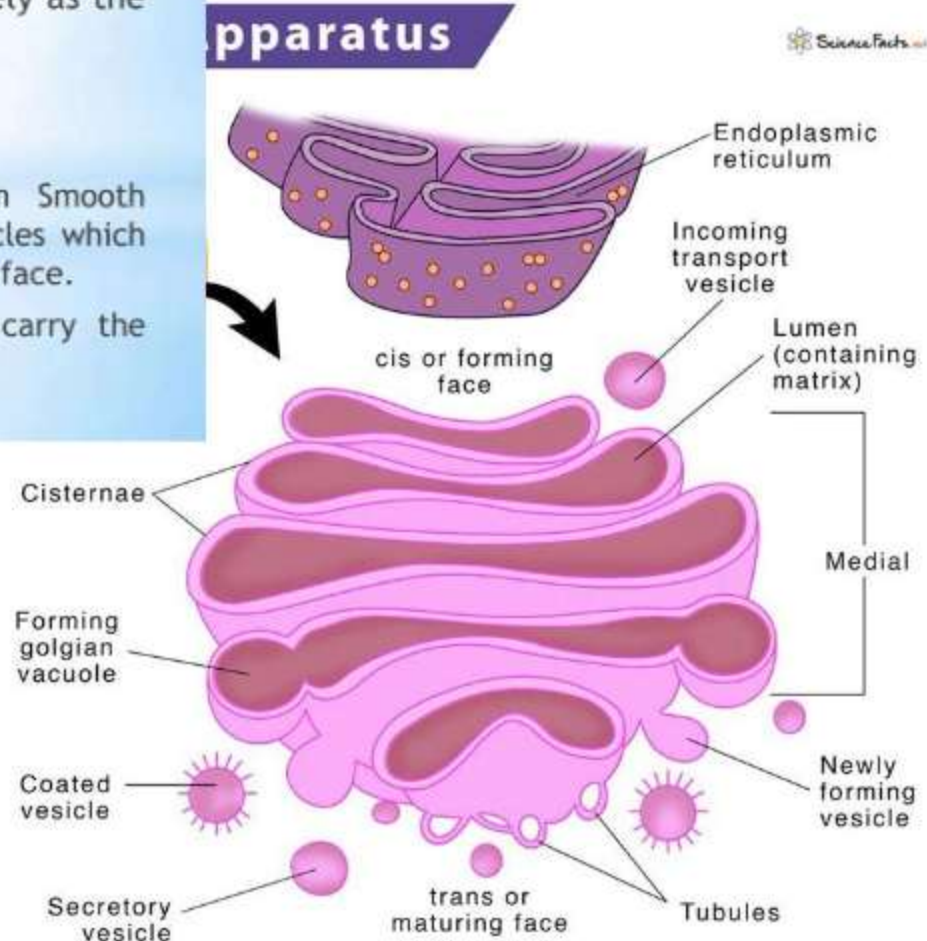
## Apparatus

ScienceFacts.net



## I. Cisternae:

- The cisternae vary in number from 3-7 in most animal cells and from 10-20 in plant cells.
- Usually equally spaced in the stack, separated from each other by thin layers of **intercisternal cytoplasm**.
- Cisternae may be flat but are often curved.
- Golgi complex has a distinct polarity, the two poles are called cis face and trans face, which act respectively as the receiving and shipping departments.
- Convex side of stack -> **forming (cis) face**.
- Concave side of stack -> **maturing (trans) face**.
- Secretory materials reach the Golgi complex from Smooth Endoplasmic Reticulum (SER) by way of transport vesicles which bud off from SER and fuse with golgi cisternae on the cis face.
- From the trans face Secretory vesicles arise that carry the processed material to their destination.



➤ **Tubules:** Small, round tubules arise from the periphery of the cisternae. Some of these enlarge at their ends to form vesicles.

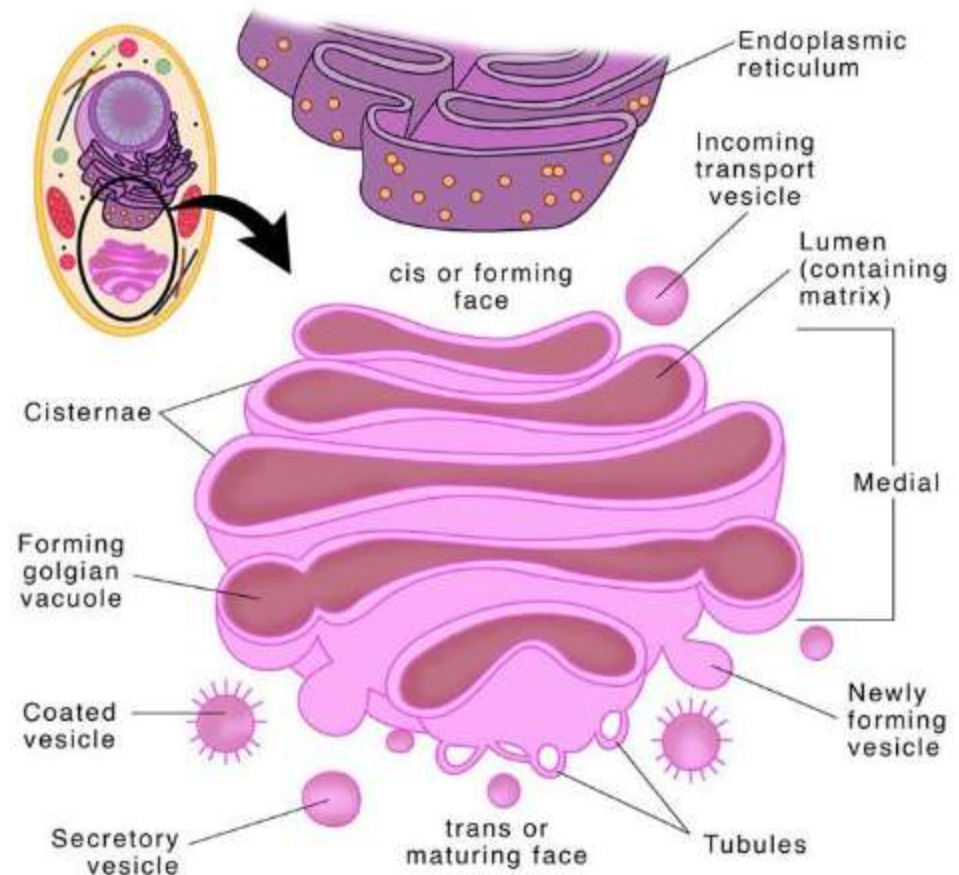
➤ **Vesicles:** the vesicles lie near the ends and concave surface of the Golgi complex.

They are of two types: **smooth or secretory vesicles** and **coated vesicles**.

All the Golgi elements are filled with a fluid, the **Golgi matrix**.

## Golgi Apparatus

Science Facts





# Functions of Golgi Complex

- Secretion
- Synthesis
- Sulfation
- Apoptosis
- Phosphorylation
- Cell-specific functions



## 1. SECRETION-



Although the golgi apparatus is involved in many different cellular processes ,its principle role in many cells is in secretion.



Golgi plays an important role in the synthesis of proteoglycans, which are molecules present in the extracellular matrix of animals.

## 2. SYNTHESIS

- ➡ It is also a major site of carbohydrate synthesis
- ➡ This includes the production of glycosaminoglycans (GAGs), long unbranched polysaccharides which the Golgi then attaches to a protein synthesised in the endoplasmic reticulum to form proteoglycans.
- ➡ Enzymes in the Golgi polymerize several of these GAGs via a xylose link onto the core protein.

### 3. SULFATION

- ➡ Another task of the Golgi involves the sulfation of certain molecules passing through its lumen via sulfotranferases that gain their sulfur molecule from a donor called PAPS.

Phosphoadenosine-5'-phosphosulfate

- ➡ This process occurs on the GAGs of proteoglycans as well as on the core protein.
- ➡ Sulfation is generally performed in the trans-Golgi network.
- ➡ The level of sulfation is very important to the proteoglycans' signalling abilities as well as giving the proteoglycan its overall negative charge.

## 4. APOPTOSIS

- ➡ The Golgi has a putative role in apoptosis, with several Bcl-2 family members localised there, as well as to the mitochondria.
- ➡ A newly characterized protein, GAAP (Golgi anti-apoptotic protein), almost exclusively resides in the Golgi and protects cells from apoptosis by an as-yet undefined mechanism.



## 5. PHOSPHORYLATION

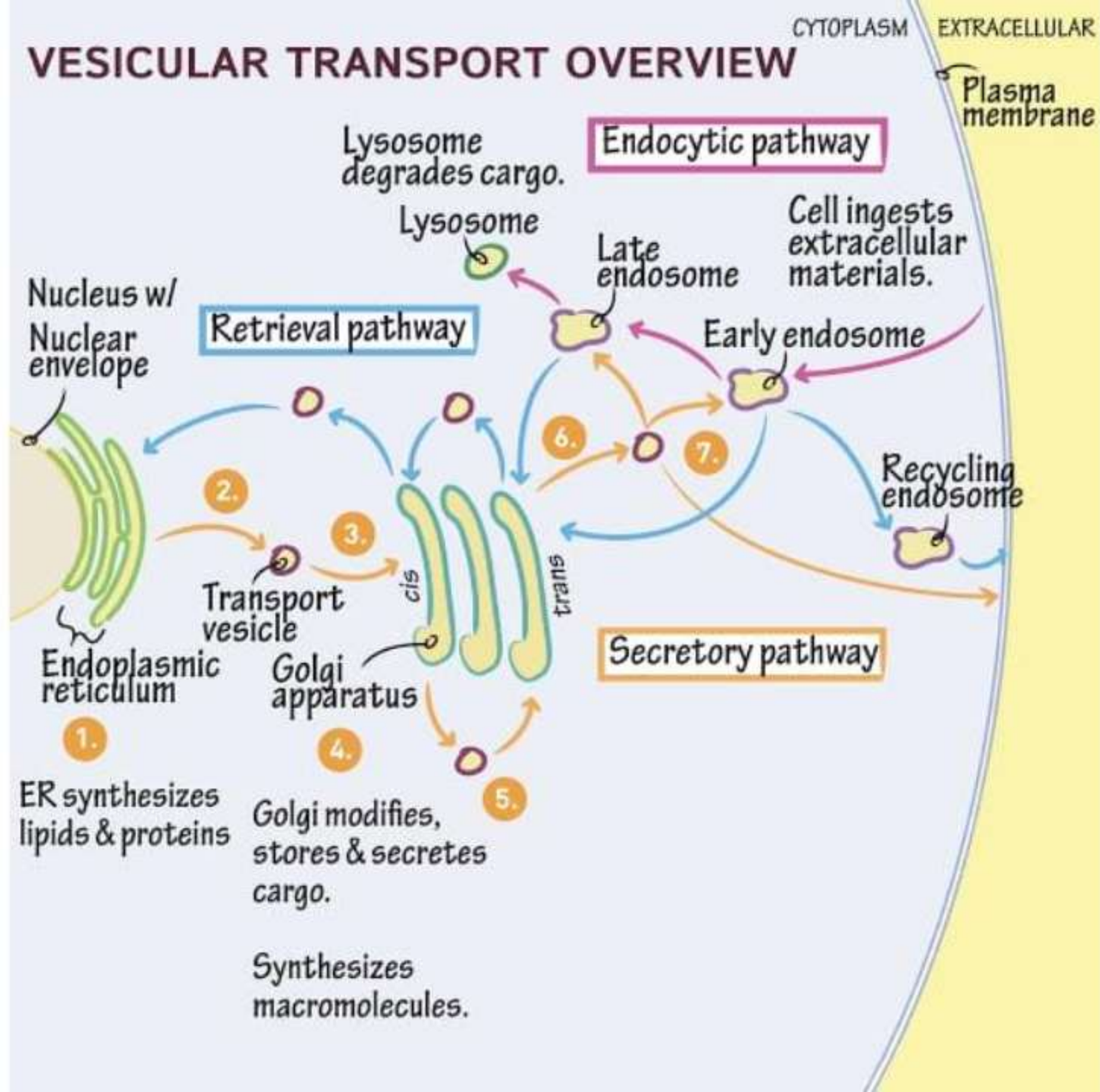
➡ The phosphorylation of molecules requires energy in the form of ATP .

➡ That ATP is imported into the lumen of the Golgi utilised by resident kinases such as casein kinase 1 and casein kinase 2.

➡ One molecule that is phosphorylated in the Golgi is Apolipoprotein, which forms a molecule known as VLDL that is a constituent of blood serum.

It is thought that the phosphorylation of these molecules is important to help aid in their sorting for secretion into the blood

# VESICULAR TRANSPORT OVERVIEW



# CELL SPECIFIC FUNCTIONS

- \* Formation of cell wall and cell plate in Plant Tissues.
- \* Acrosome development in sperm cells.
- \* Secretion of Zymogen in the Exocrine cells of Pancreas.
- \* Secretion and transformation of Lipid in the liver cells.
- \* Similar secretory functions are carried out in the Brunner's gland cells, alveolar epithelium, Paneth cells, connective tissues as well.

- Brunner's glands are specialized duodenal glands that secrete an alkaline mucus containing bicarbonate, which helps to neutralize the acidic chyme entering the duodenum from the stomach

- Paneth cells are specialized secretory epithelial cells located in the small intestinal crypts, playing a crucial role in maintaining intestinal homeostasis and host defense.




# SUMMARY AND CONCLUSION

- \* GA is made of a stack of membrane bound sacs.
- \* It receives most of the substances from Endoplasmic Reticulum.
- \* It produces vesicles which carry secretions on to the cell surface.
- \* Basically, it functions as a “post office”- where the proteins and lipids are taken, labelled and transported to other locations within the body.



# Glycosylation of proteins within Golgi

In the Golgi, glycosylation refers to **the modification of proteins by adding sugar chains, also called glycans**. This process, which starts in the endoplasmic reticulum (ER), is completed and refined in the Golgi, where various glycosyltransferases and glycosidases work to add, modify, and process the sugar moieties. The Golgi is crucial for generating the vast diversity of glycan structures needed for cellular function. 



Here's a more detailed look:

## Initial Glycosylation:


N-linked glycosylation begins in the ER, where oligosaccharides are transferred to asparagine residues on proteins. O-linked glycosylation, however, occurs entirely within the Golgi. 

## Golgi Processing:


The Golgi takes the initial oligosaccharide and further modifies it. This includes:

- **Glycosyltransferases:** These enzymes add specific sugars to the growing glycan chain. 
- **Glycosidases:** These enzymes remove specific sugars, shaping the final glycan structure. 

## Structural Diversity:

The Golgi's enzymes allow for the generation of a wide variety of glycan structures, including core fucosylation and branching, as well as the synthesis of glycosaminoglycans like chondroitin and heparan sulfate. 

## Importance of Glycosylation:

Glycosylation is essential for protein folding, stability, trafficking, and interactions with other molecules. It also plays a role in cell-cell recognition and signaling. 

## Enzymes and Trafficking:

The Golgi is equipped with numerous glycosylation enzymes that are organized in a specific order, from the cis-Golgi to the trans-Golgi network (TGN). This arrangement allows for the efficient processing and sorting of glycoproteins. 

