

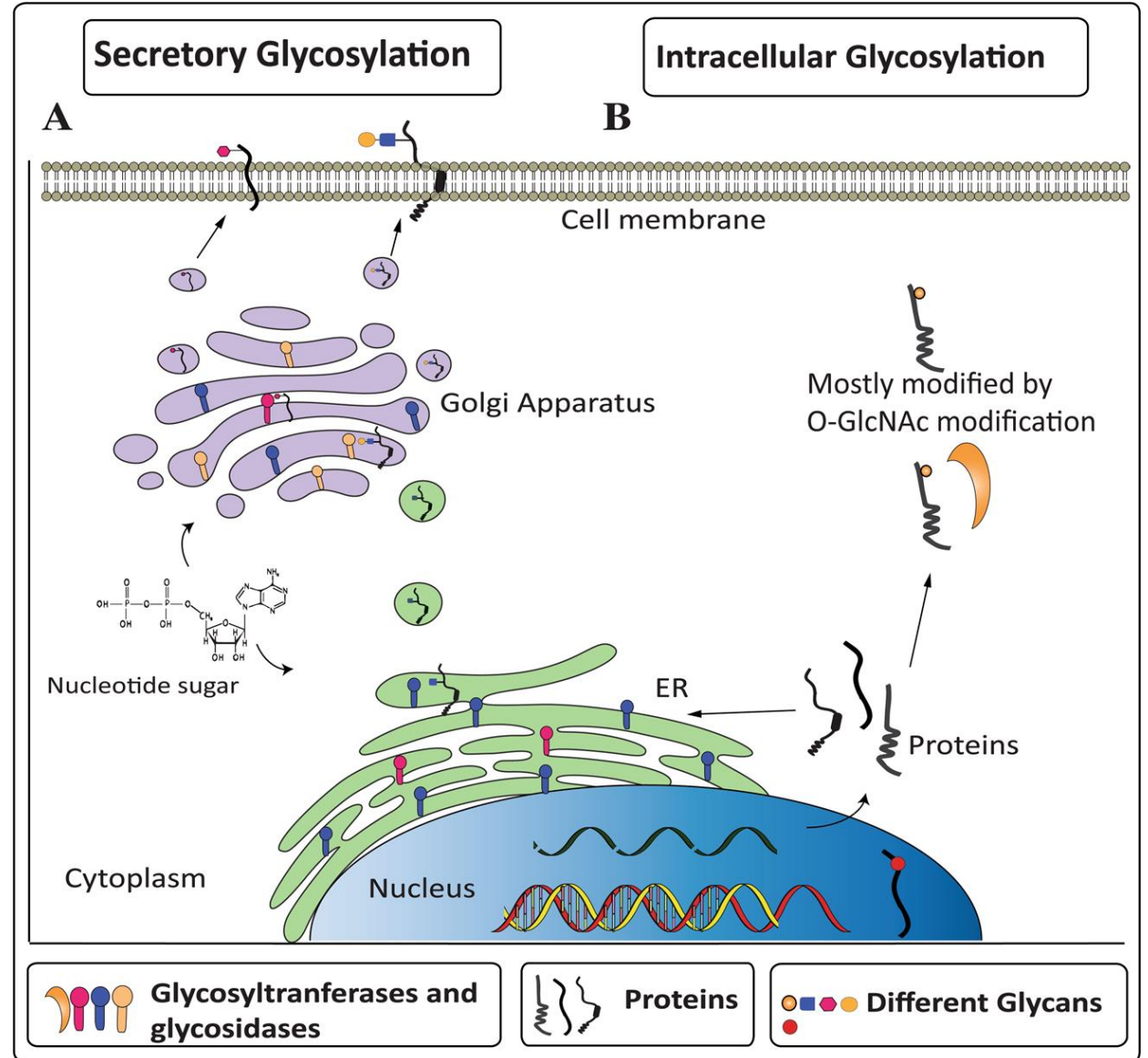
Golgi complex

Protein glycosylation

Dr. Rupesh B. Yadav

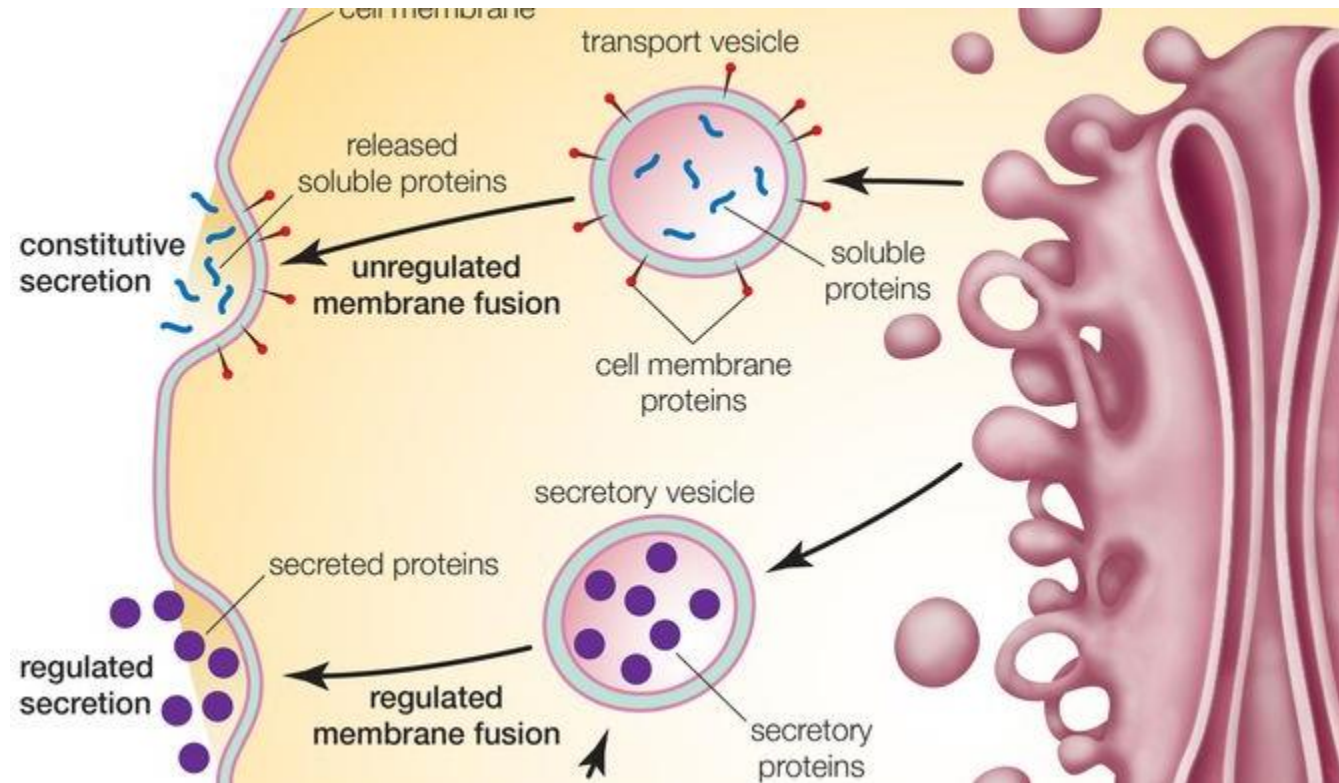
Asst. Prof.

TCSC, Mumbai.



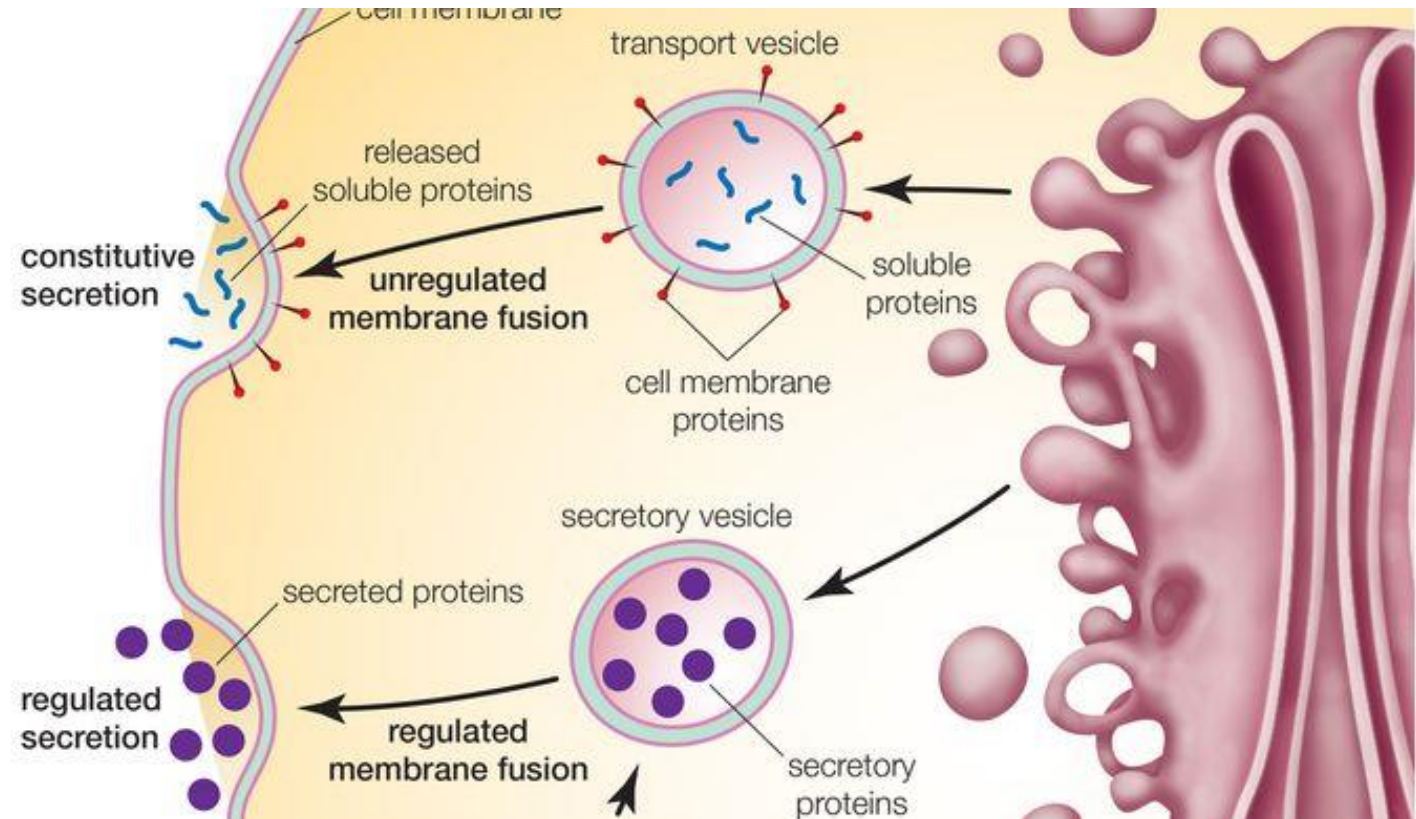
Introduction: glycosylation

- The **proteins and lipids received at the cis face** arrive in clusters of fused vesicles.
- These fused vesicles migrate along microtubules through a special **trafficking compartment**, called the vesicular-tubular cluster, that **lies between the endoplasmic reticulum and the Golgi apparatus**.
- When a **vesicle cluster fuses** with the **cis** membrane, the **contents are delivered into the lumen** of the cis face cisterna.
- As proteins and lipids progress from the cis face to the trans face, they are **modified into functional molecules** and are marked for delivery to specific intracellular or extracellular locations.



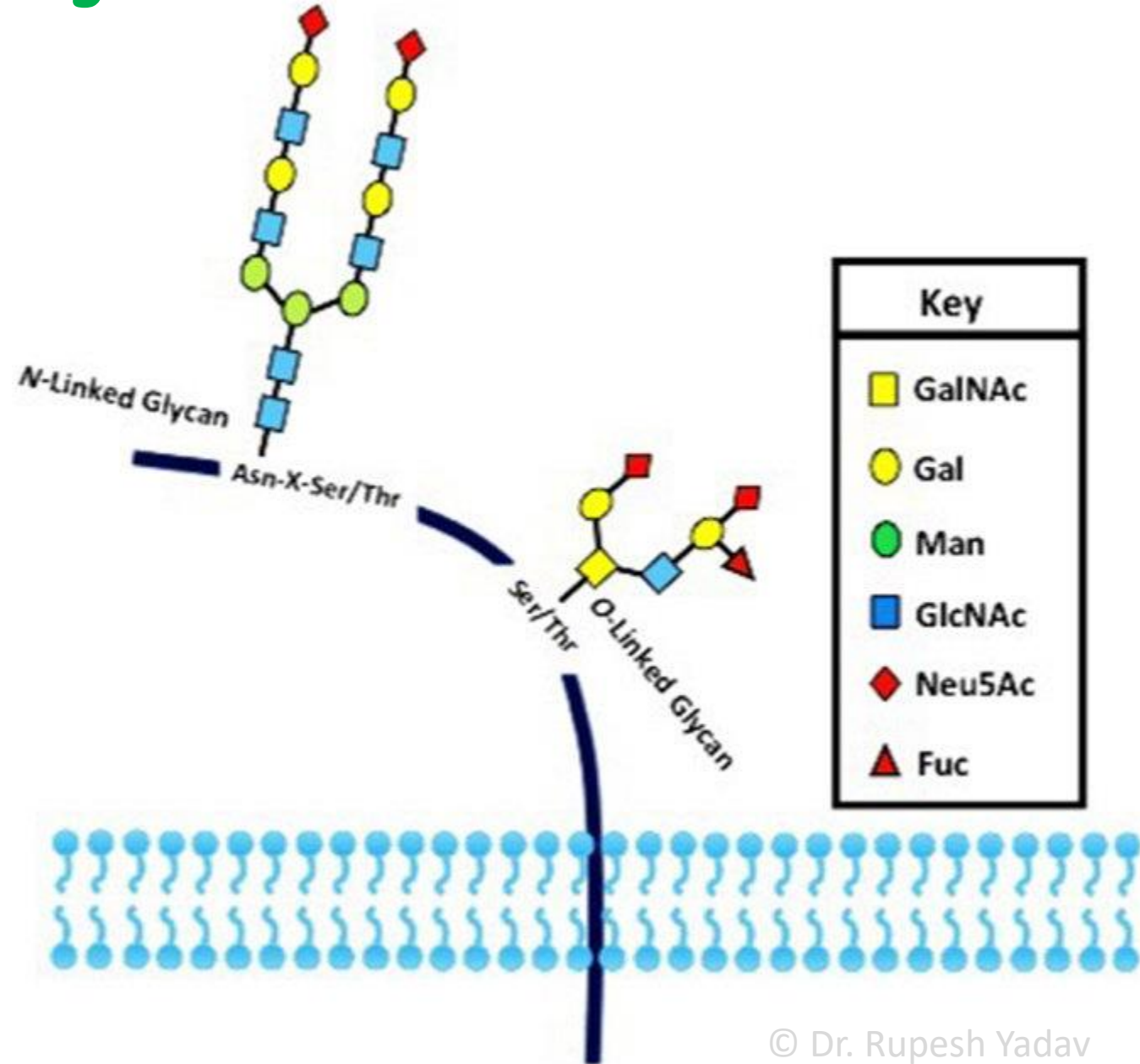
Glycosylation

- Some modifications involve cleavage of oligosaccharide side chains followed by attachment of different sugar moieties in place of the side chain.
- Other modifications may involve the addition of fatty acids or phosphate groups (phosphorylation) or the removal of monosaccharides.



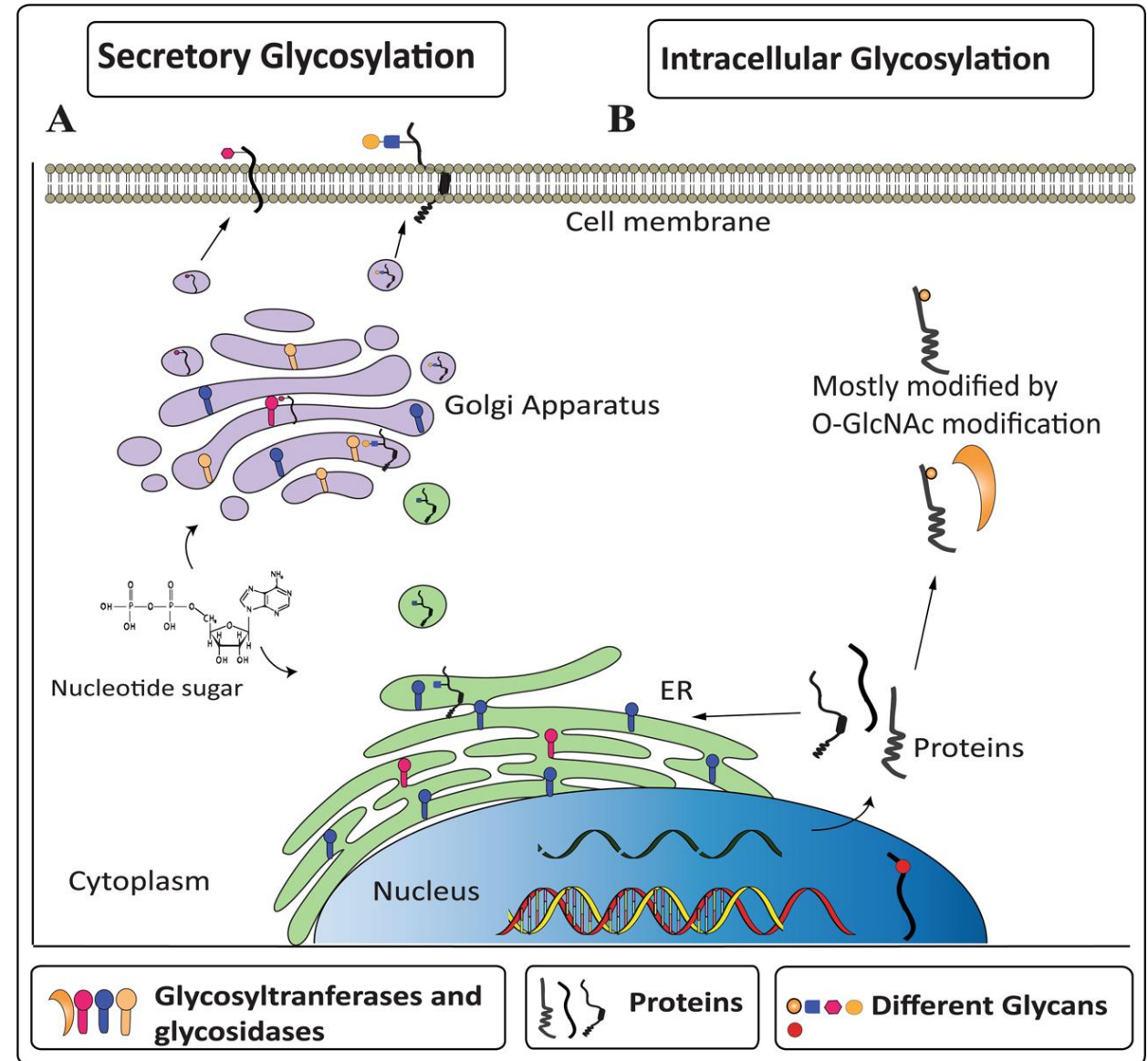
Glycosylation

- The different **enzyme-driven modification reactions** are specific to the compartments of the Golgi apparatus.
- For example, the **removal of mannose** moieties occurs primarily in the cis and medial cisternae, whereas the **addition of galactose** or sulfate occurs primarily in the trans cisternae.



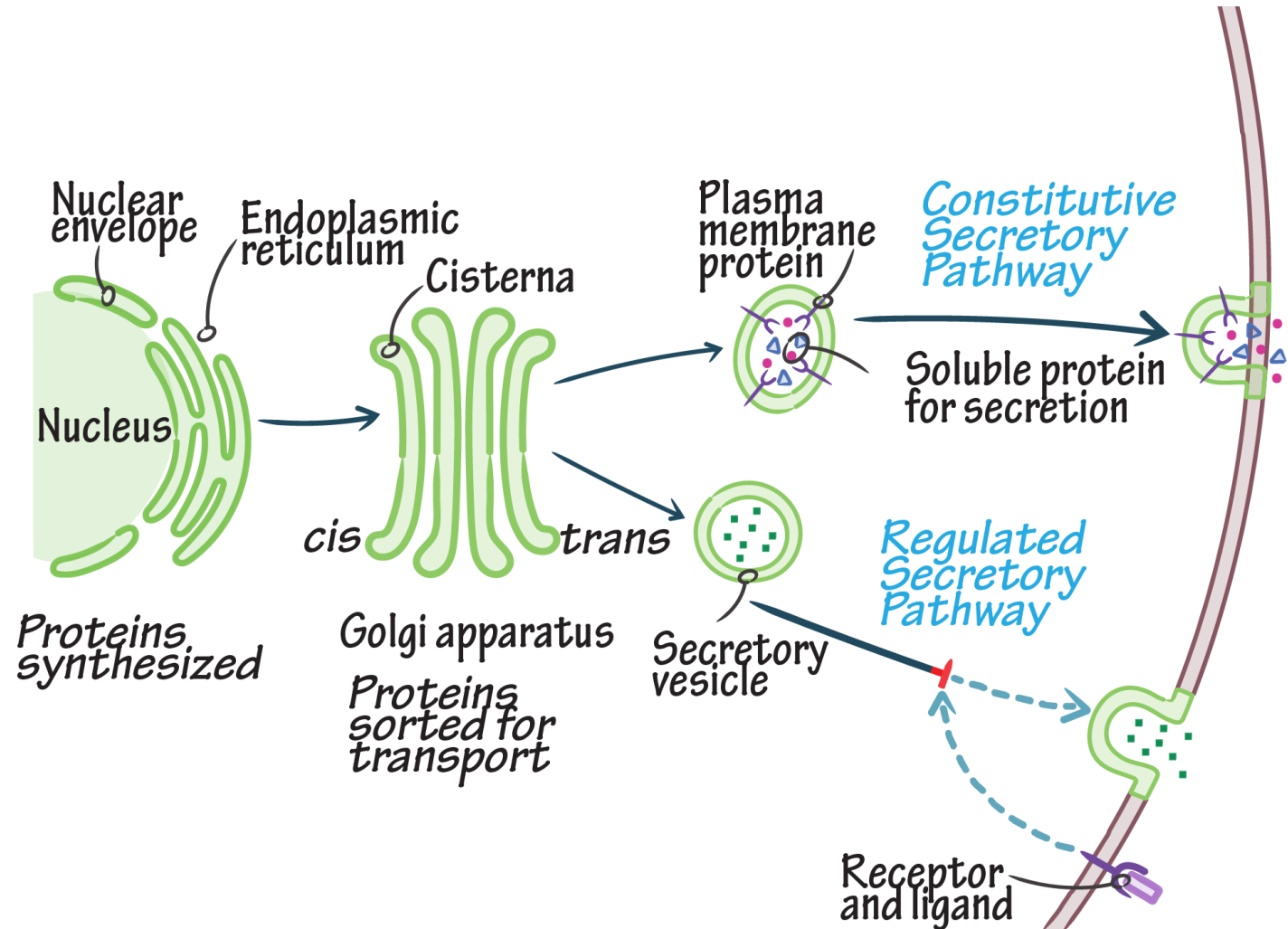
Glycosylation

- In the final stage of transport through the Golgi apparatus, modified **proteins and lipids** are sorted in the trans Golgi network and are **packaged into vesicles** at the trans face.
- These **vesicles** then **deliver the molecules to their target destinations**, such as lysosomes or the cell membrane.



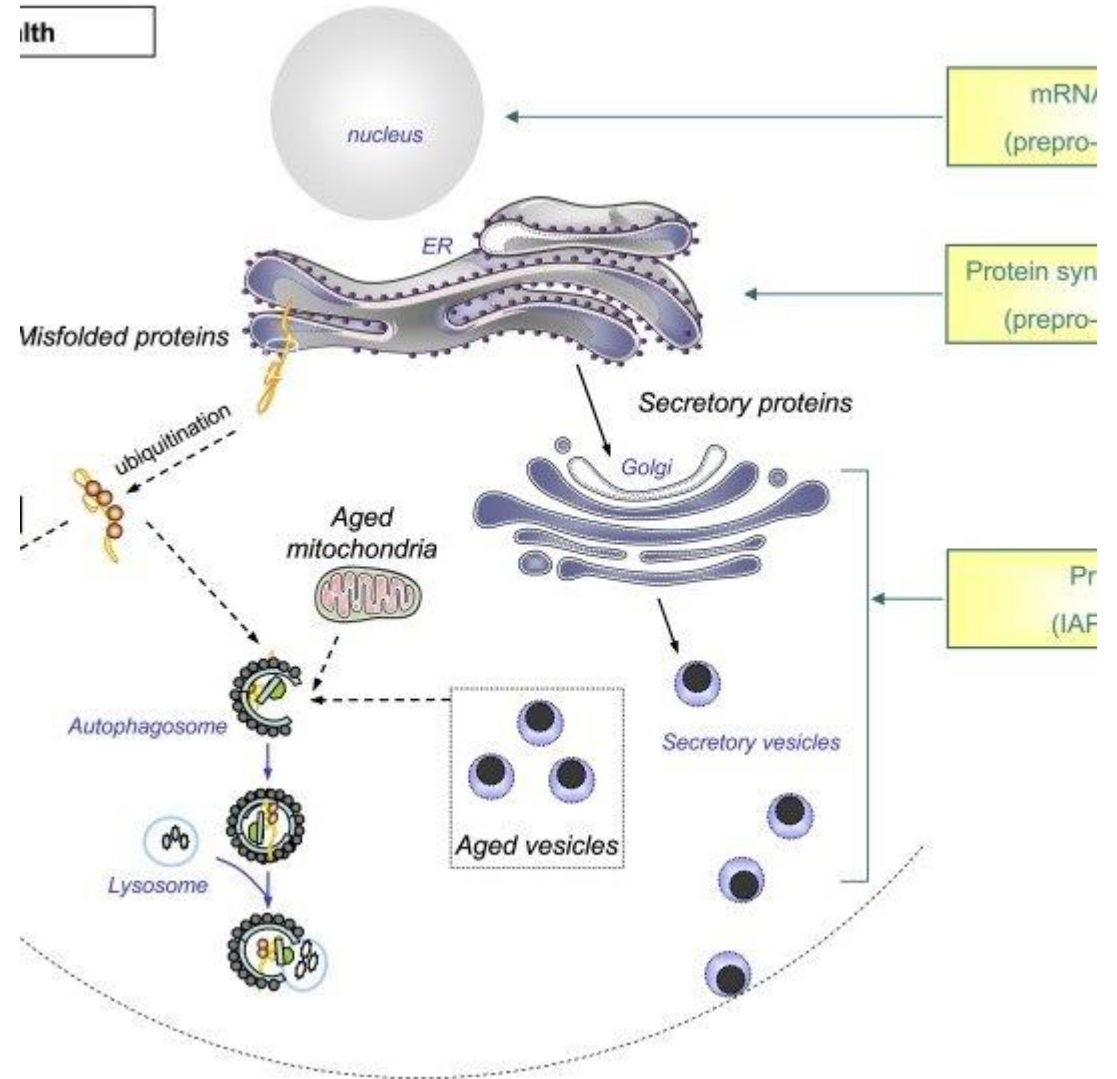
Glycosylation

- Some molecules, including certain soluble proteins and secretory proteins, are carried in vesicles to the cell membrane **for exocytosis** (release into the extracellular environment).
- The **exocytosis of secretory proteins** may be regulated, whereby a ligand must bind to a receptor to trigger vesicle fusion and protein secretion.



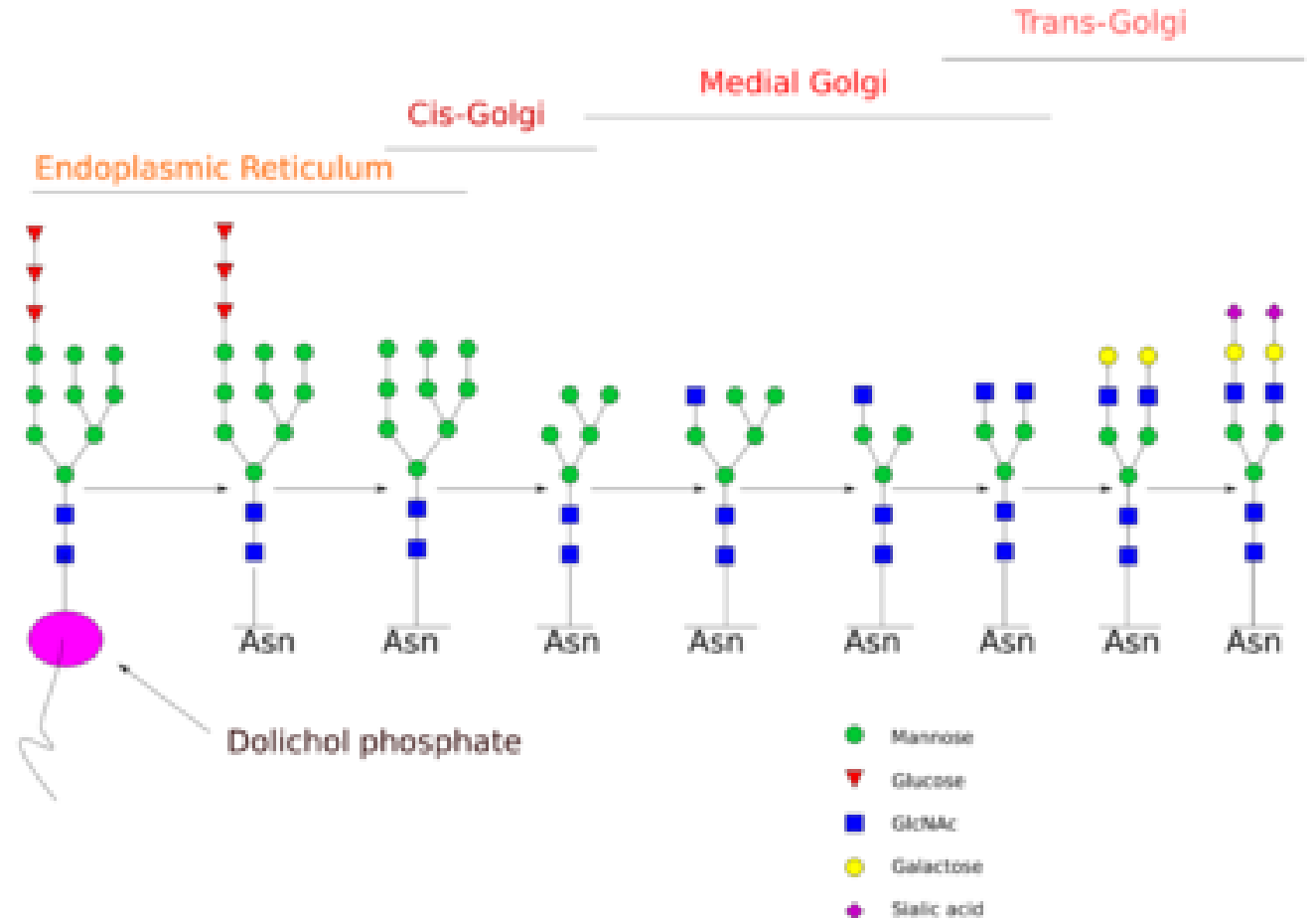
Glycosylation

- In addition, within the vesicles are proteases that cut many secretory proteins at specific amino acid positions.
- This often results in activation of the secretory protein, an example being the **conversion of inactive proinsulin to active insulin by removing a series of amino acids.**



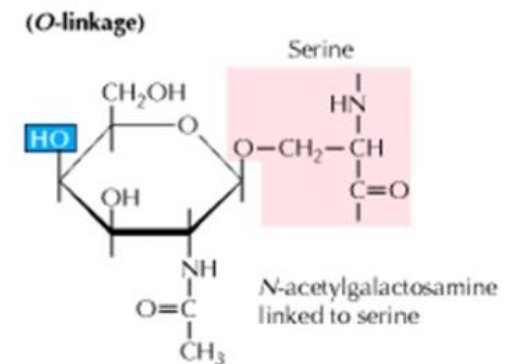
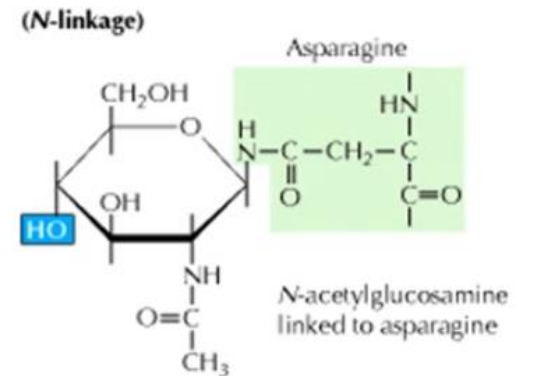
Protein glycosylation

- Glycosylation is the reaction in which a carbohydrate (or 'glycan'), i.e. a glycosyl donor, is attached to a hydroxyl or other functional group of another molecule (a glycosyl acceptor) in order to form a glycoconjugate.



Types of Protein glycosylation

- There are two types of Protein glycosylation generally found in cell.
- **1. N-Linked glycosylation (In ER):** N-linked glycans attached to a nitrogen of asparagine or arginine side-chains. N-linked glycosylation requires participation of a special lipid called dolichol phosphate.
- **2. O-Linked glycosylation (In Golgi):** O-linked glycans attached to the hydroxyl oxygen of serine, threonine, tyrosine, hydroxylysine, or hydroxyproline side-chains, or to oxygens on lipids such as ceramide.



Protein glycosylation

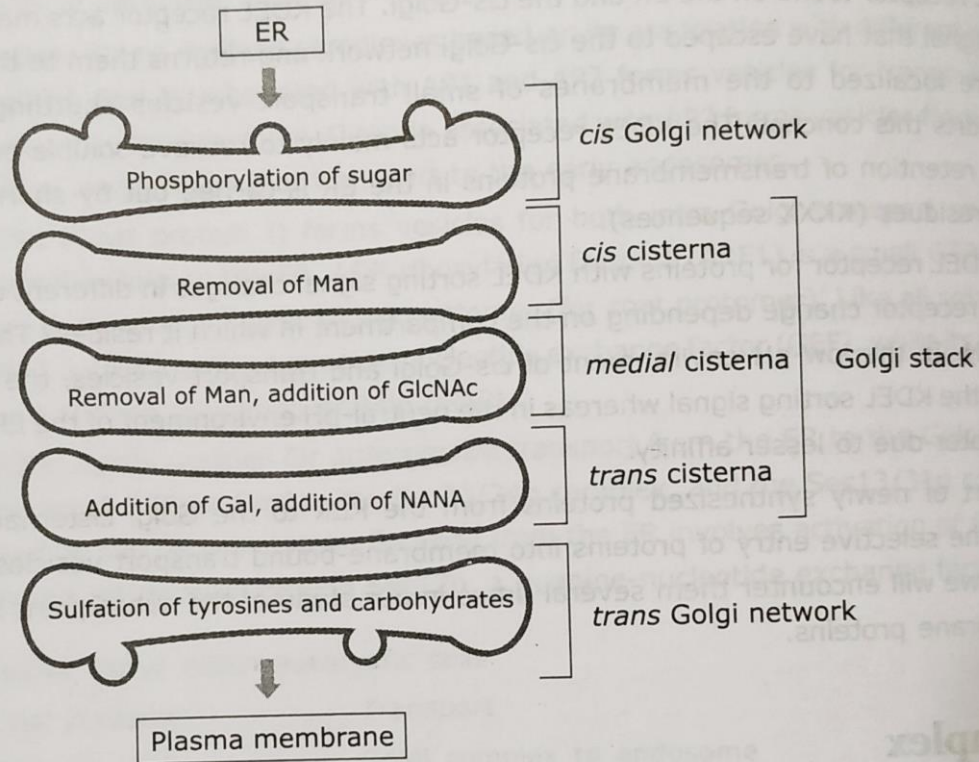


Figure 4.38 : The functional compartmentalization of the Golgi apparatus.

Glycosylation in the Golgi Complex

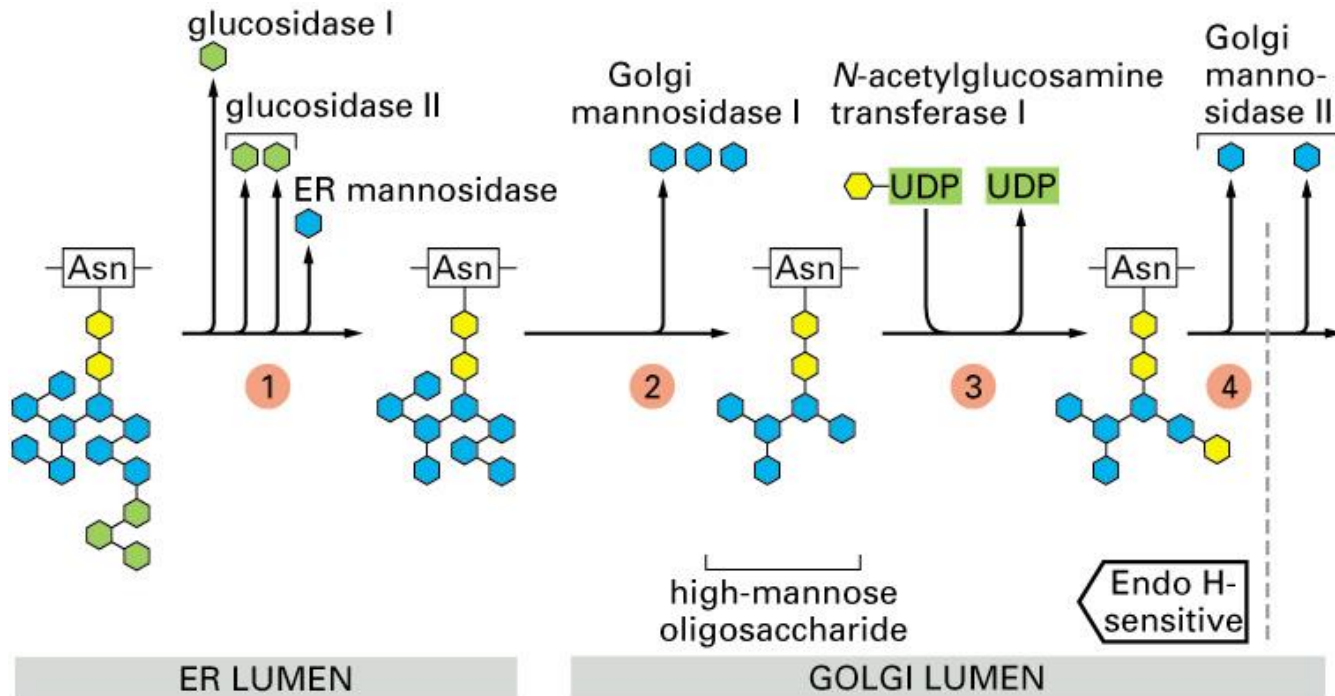
- The Golgi complex plays a key role in the assembly of the carbohydrate component of glycoproteins and glycolipids.
- As newly synthesized soluble and membrane glycoproteins pass through the *cis* and *medial* cisternae of the Golgi stack, most of the mannose residues are also removed from the core oligosaccharides, and other sugars are added sequentially by various glycosyltransferases.

Man – Manose

GlcNAc- N-acetylglucosamine

NANA - N-Acetylneuraminic acid (Neu5Ac)

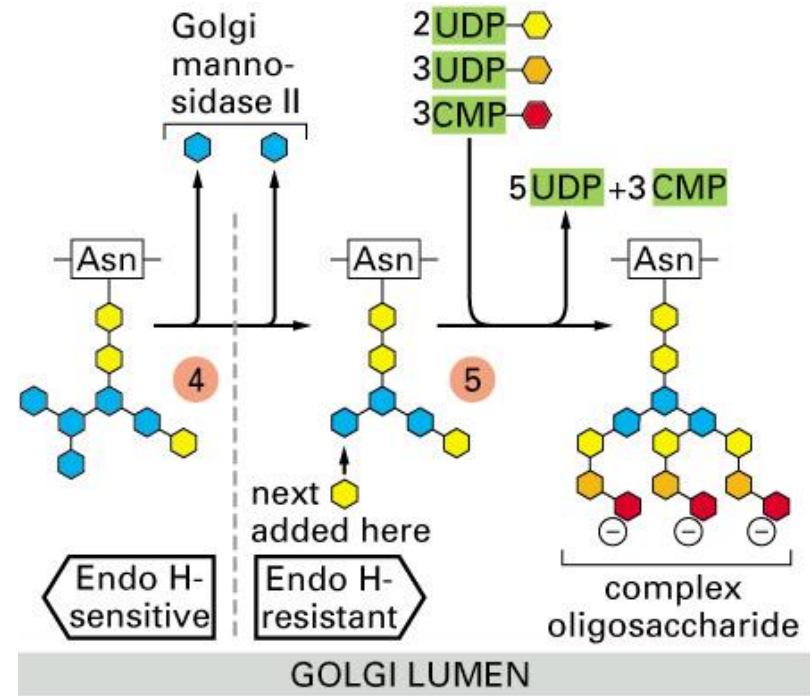
Protein glycosylation



KEY:

- = N-acetylglucosamine (GlcNAc)
- = mannose (Man)
- = glucose (Glc)
- = galactose (Gal)
- = N-acetylneuraminic acid (sialic acid, or NANA)

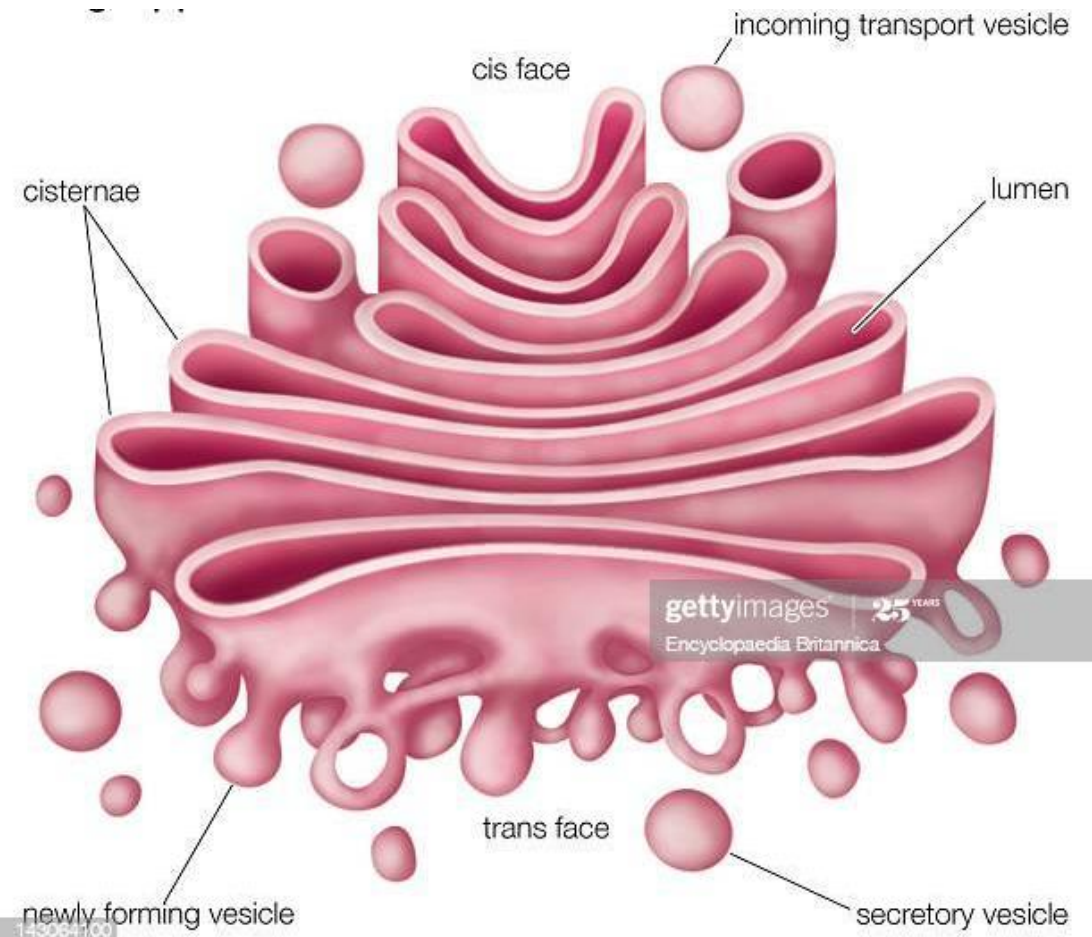
Figure 13-26 part 1 of 2. Molecular Biology of the Cell, 4th Edition.



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Figure 13-26 part 2 of 2. Molecular Biology of the Cell, 4th Edition.



*Thank
You*

Lipid and polysaccharide metabolism

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