



# Lecture 3: Protein Sorting (Golgi Apparatus and Vesicular Transport)

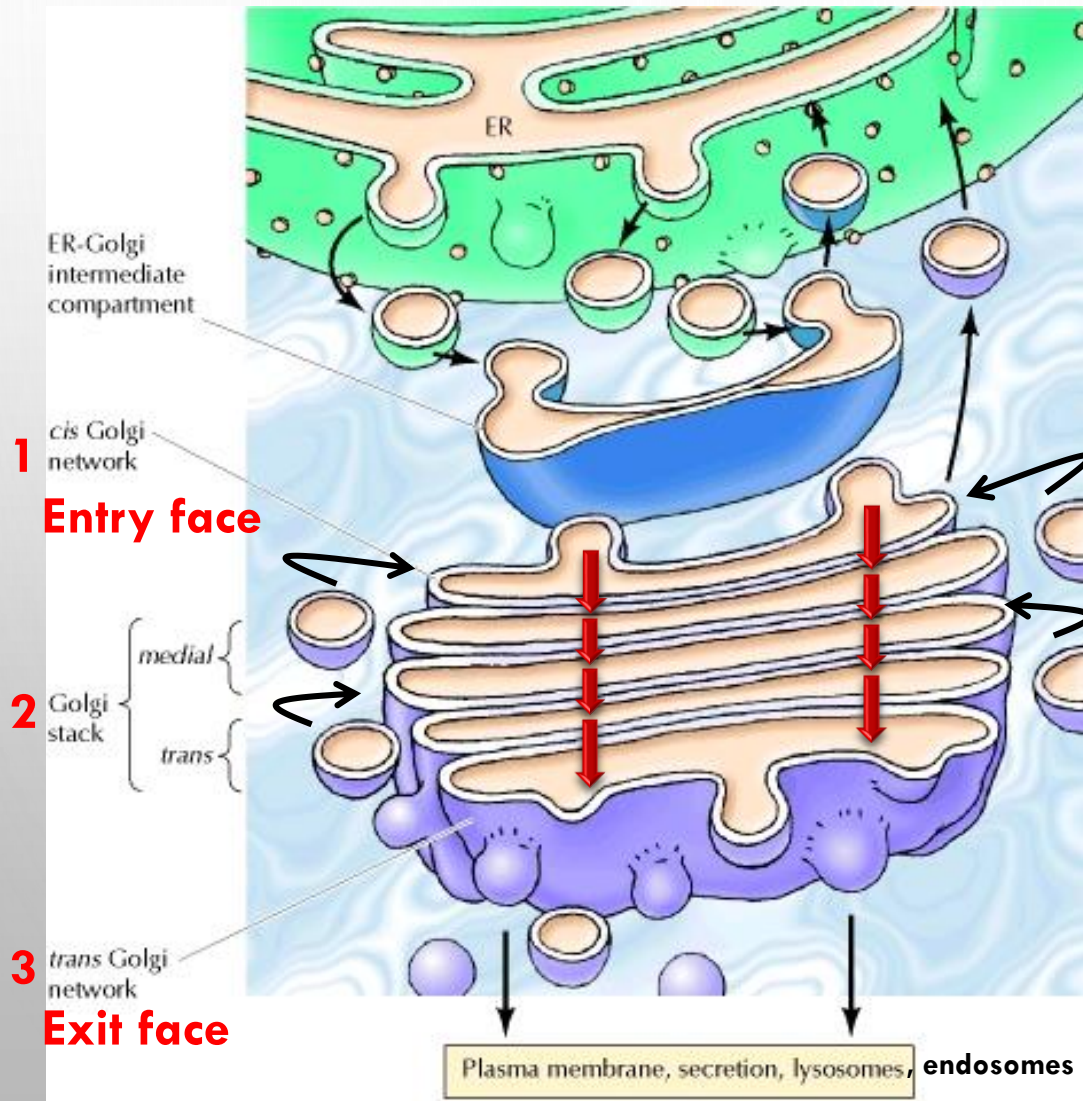
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***Principles of Genetics and Molecular Biology***

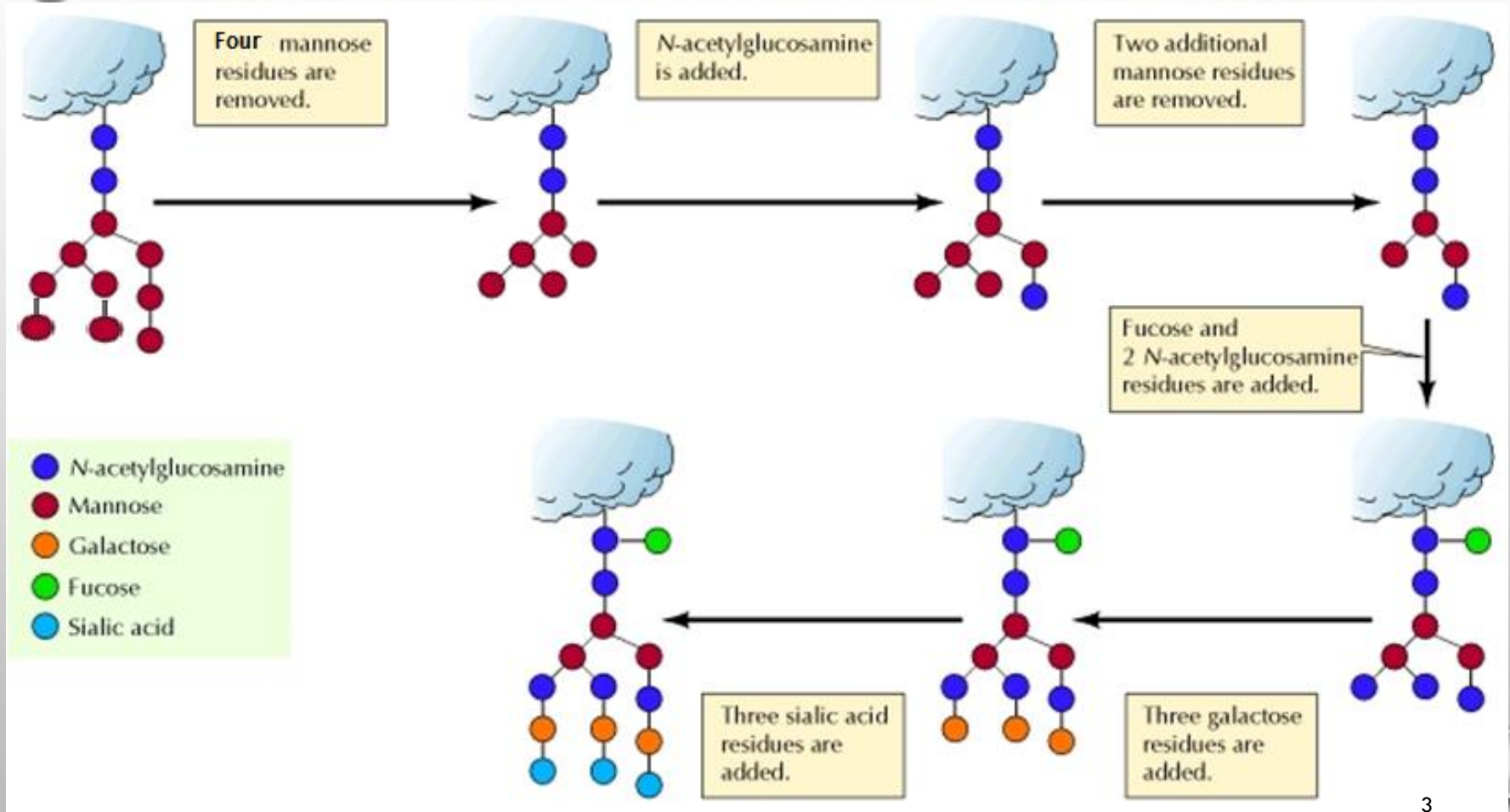
# Structure and Functions of Golgi



- Composed of flattened membrane-enclosed sacs (cisternae) and associated vesicles.
- Structural and functional polarity.
- Further protein processing and modification
- Protein sorting and distribution
- Synthesis of glycolipids and sphingomyelin

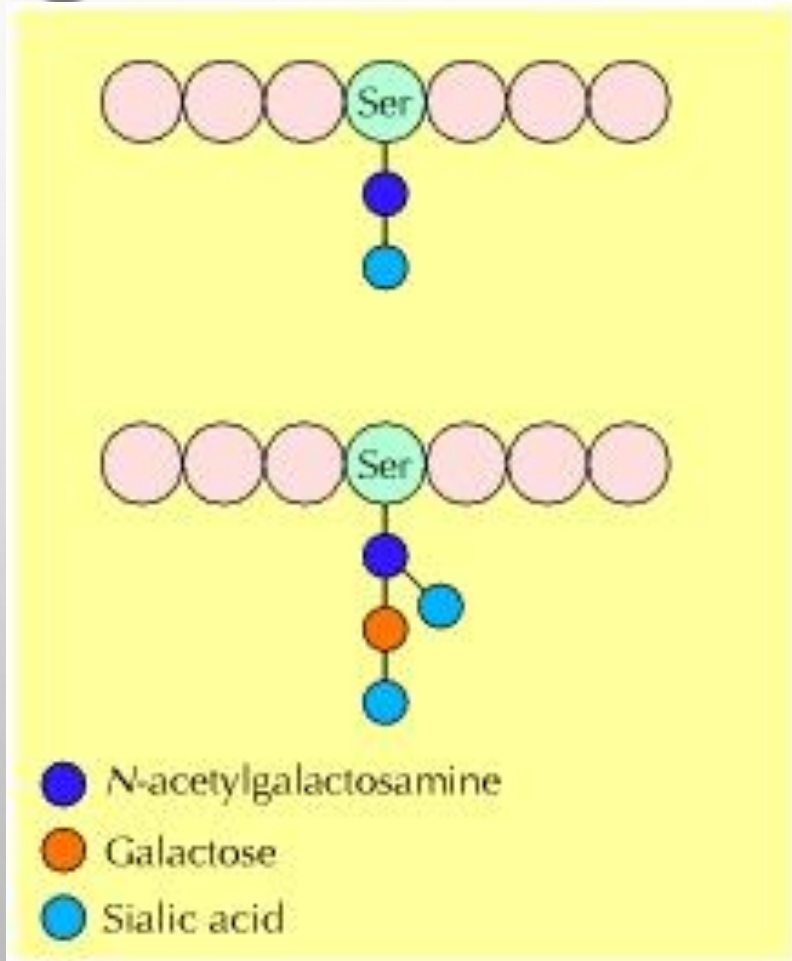
# Protein glycosylation within Golgi

## Processing of *N*-linked Oligosaccharides in Golgi





# O-linked Glycosylation

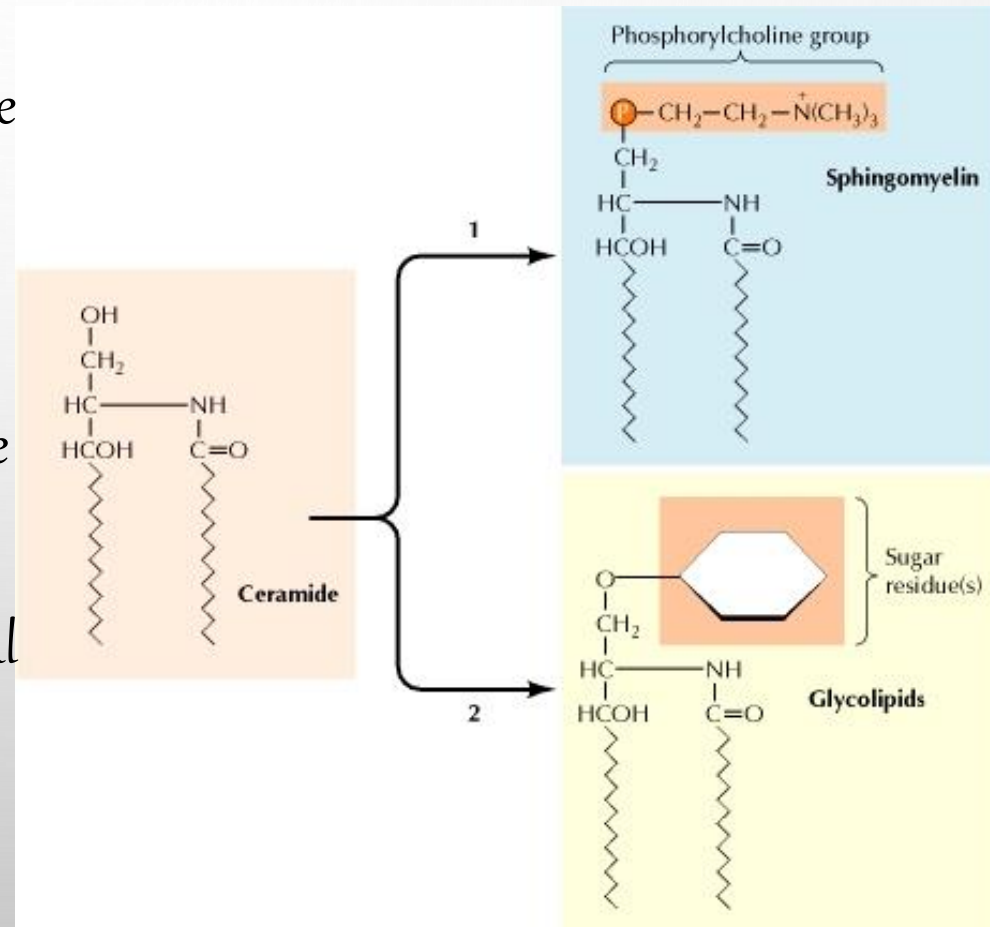


- Carbohydrates are added to the side chains of acceptor serine and threonine residues.
- The serine or threonine is usually linked directly to *N*-acetylgalactosamine, to which other sugars can then be added.
- Some of the added sugars are further modified by the addition of sulfate groups.

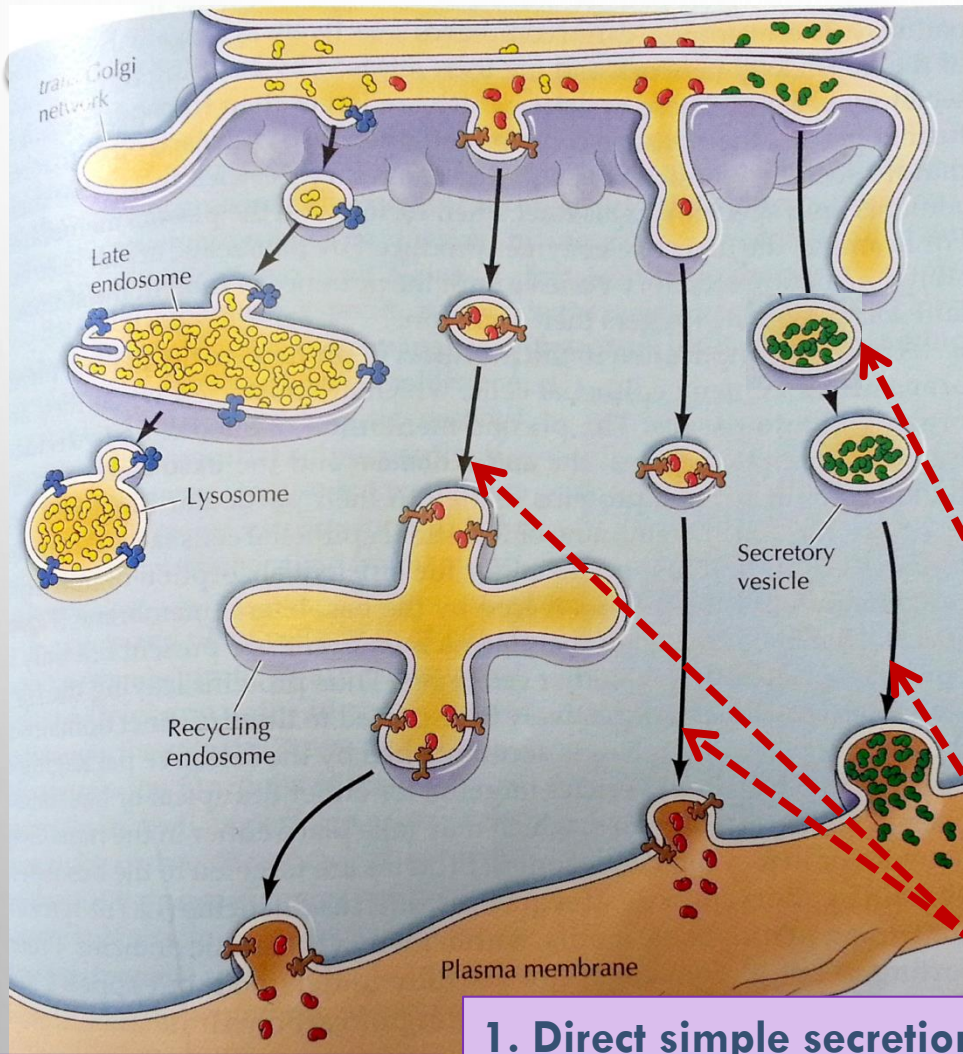
# Lipid and Polysaccharide Metabolism in the Golgi

- Transfer of phosphorylcholine group from phosphatidylcholine to ceramide.
  - Sphingomyelin is synthesized on the luminal surface.
- Addition of sugar residues (glycolipids).
  - Glucose is added to ceramide on the cytosolic side and glucosylceramide then apparently flips and additional carbohydrates are added on the luminal side of the membrane

**Ceramide is synthesized in the ER**



# Protein Sorting and Export



In contrast to the ER, all of the proteins retained within the Golgi complex are associated with the Golgi membrane rather than being soluble proteins within the lumen. Retention signal is the length of their transmembrane domains

- Protein packaging mediated by cargo receptor
- Processing in immature secretory vesicles

3. Regulated secretion after signaling (e.g. hormones) from specialized vesicles

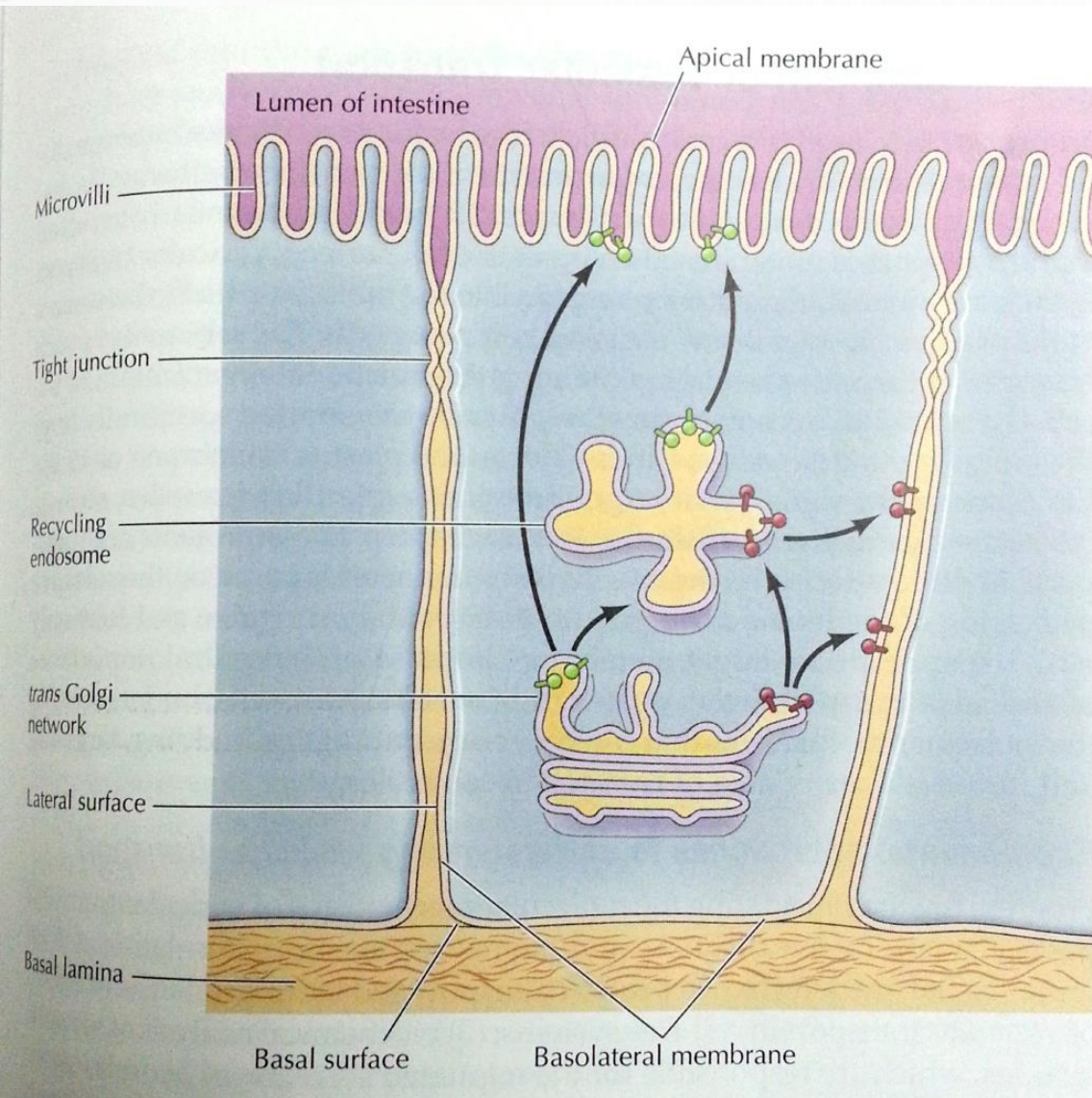
Continuous, unregulated secretion

1. Direct simple secretion

2. Transport via recycling endosomes



# Transport to the plasma membrane of polarized cells



- Selective packaging of proteins into transport vesicles from the *trans* Golgi or recycling endosomes.
- Targeting is determined by special sequences (basolateral) or sugar modification (apical)