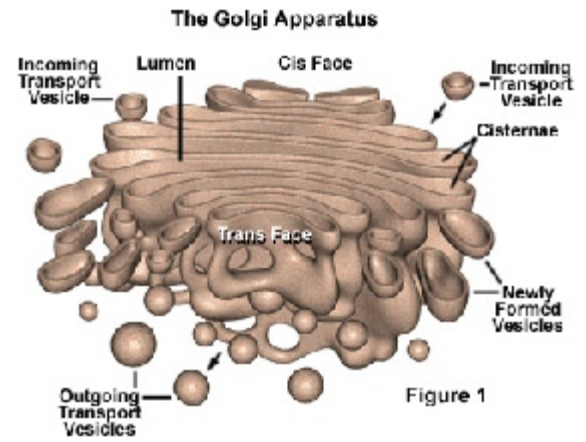


GOLGI APPARATUS, SECRETION

rvsd 10/26/92, 10/25/93, 10/26/94, 10/28/96, 10/15/99, 23 Oct 00, 24 Oct 01, 28 Oct 02, 7Nov07, 21Nov08, 16Nov09, 15Nov10
BPR. p. 239-254, BKH 4th pp339-357, BKH 5th: pp333-353, 6th: 328-349, 7th: 333-

Discovered by Camillo Golgi in 1898 (stained with osmium tetroxide),
not believed until 1950s when studied with EM
(Called “dictyosomes” in plants [dictyo- net, fr *dikein*, throw])

- (p 333): **cis face** (**forming face**) receives **transition vesicles** from rough ER, empty into **cisternae** in Golgi Apparatus.
- coated vesicles** Shuttle vesicles transfer between cisternae. Covered with clathrin*, or cytosolic coat protein (COP) common feature which marks vesicle for inter-compartmental transfer.
- trans face** (**maturing face**) vesicles bud off as secretory granules



Highly dynamic: **Palade et al:**

PULSE AND CHASE experiment:
shows 40 minutes from cis to trans face.

Major functions:

- accept proteins from rER
- label with oligosaccharide, PO₄, etc
- sort according to labels
- package into addressed vesicles:
 - for exocytosis
 - for lysosomes
 - return to rER

Glycosylation responsible for most protein processing: (p 336)

- core oligosaccharide** [oligo: few]
synthesized at cis end of Golgi, cytoplasm side: add 2 NAG and mannose residues
- “Flippase”
translocation moves polysaccharide to lumen side
- Completion
additional glycosylation inside. Most important enzymes for Golgi:
glucan synthetases synthesize oligosaccharides
glycosyl transferase attach oligosaccharides to proteins
- Transferase
Oligosaccharide transferred to certain amino acid residues of protein being labeled
“N-linked” oligosaccharide attached to certain asparagine residues
“O-linked” oligosaccharide attached to certain serine or threonine residues
- Terminal glycosylation
At trans end of Golgi. Can either add or subtract saccharides, PO₄, SO₄, etc. Accounts for specificity of fate of proteins (export, etc) (NB: Proteins “address-marked” with mannose-6-PO₄ for lysosomes)

Best overall diagram: p 338 YouTube: <http://www.youtube.com/watch?v=rvfvRgk0MfA&feature=related>

EXOCYTOSIS: p 342 YouTube: <http://www.youtube.com/watch?v=K7yku3sa4Y8&feature=related> (Exocytosis last 1/3rd)

- concentration of contents occurs at periphery of Golgi,
- condensing vacuoles forming secretory granules: zymogen granules
- Ca⁺⁺ triggers discharge from cell, elevation caused by hormones, etc
- Mech not clear: probably recognition sites on plasma membrane (polarized secretion: only apical surface)

ENDOCYTOSIS: p 343

Occurs in phagocytic cells, leads to major membrane exchange

PINOCYTOSIS: esp in macrophages, kidney cells, GI epithelial cells, plant roots.

- Triggered by specific proteins, amino acids, or ions in medium
- These bind to receptors, causing invagination

***RECEPTOR-MEDIATED ENDOCYTOSIS:** p 345 YouTube: <http://www.youtube.com/watch?v=eRSIV6lrVxY&NR=1>

- It is the major means for uptake of **macromolecules & peptide hormones**
- one mechanism by **coated pits**, clathrin [lattice-work - agent] lined. (same as coated basket vesicles)

ligands on external molecule bind to specific **membrane-bound receptors:**

ligand-receptor complexes **collect clathrins**, migrate laterally

- coated pits are formed**
- 1) invagination
 - 2) release of vesicle into cell
 - 3) H⁺ injected into vesicle
 - 4) clathrin released, migrates back to plasma membrane

Net result is major shuffling of membranes between compartments.

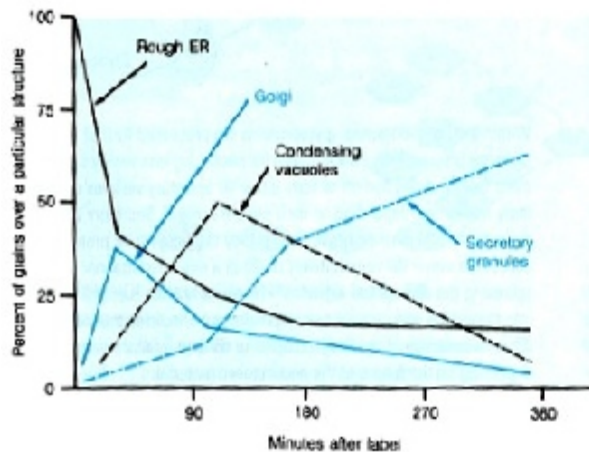


Figure 9-18 Autoradiographic Evidence of the Secretory Pathway.
To trace the path of newly synthesized proteins in the cell, George Palade and his colleagues injected rabbits with a radioactively labeled amino acid and used autoradiography to determine the distribution of radioactivity within the parotid gland cells at various times during the first six hours after injection. Initially, most of the radioactivity (measured as silver grains on the autoradiogram) was in the rough ER. Then it moved through the Golgi complex to vesicles called condensing vacuoles and finally to mature secretory granules for secretion by exocytosis.