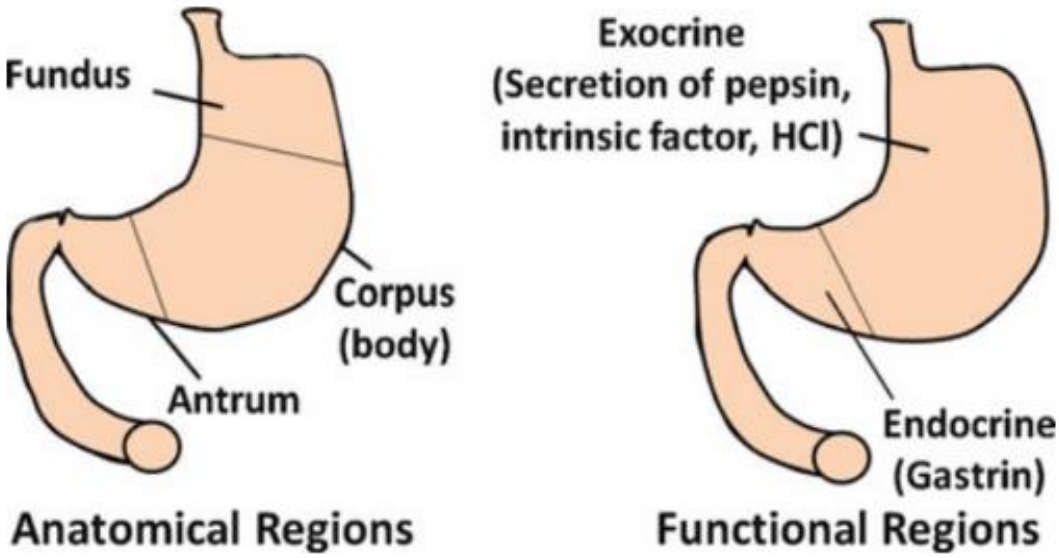
Gastric secretions

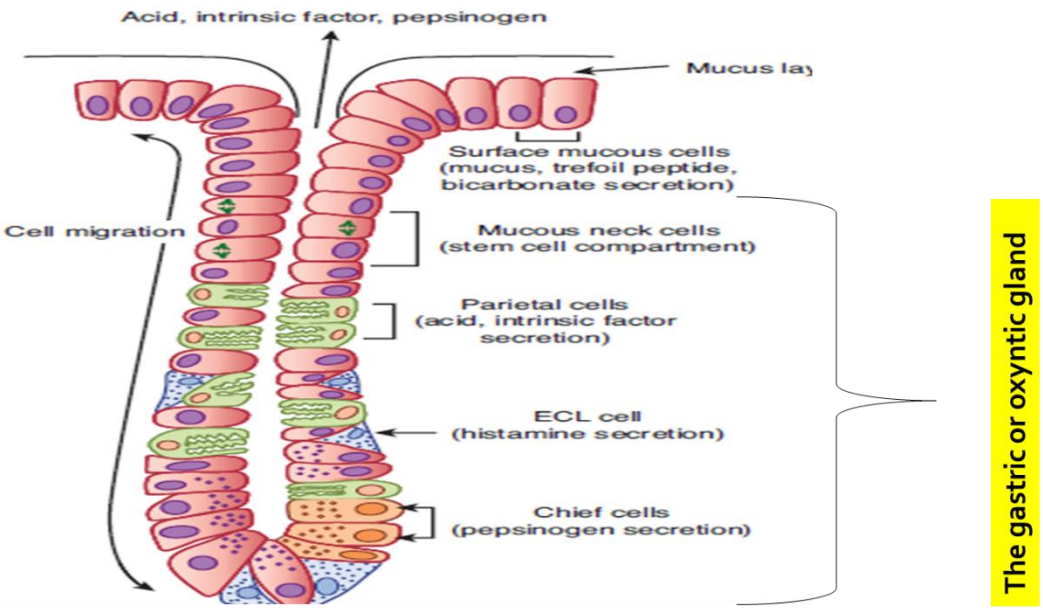
-Functional and Anatomical Organization of the Stomach:



Anatomical regions of stomach include: fundus, body, antrum and pylorus. Depending on motility, we devided stomach to orad and caudad regions.

Functional regions of stomach are:

1)Exocrine region: <u>acid-secreting</u> area. This area consists of tubular glands called gastric (oxyntic) glands.



Exocrine area is in proximal part of stomach, and it includes: fundus and body. This area makes 75% of total glands in stomach.

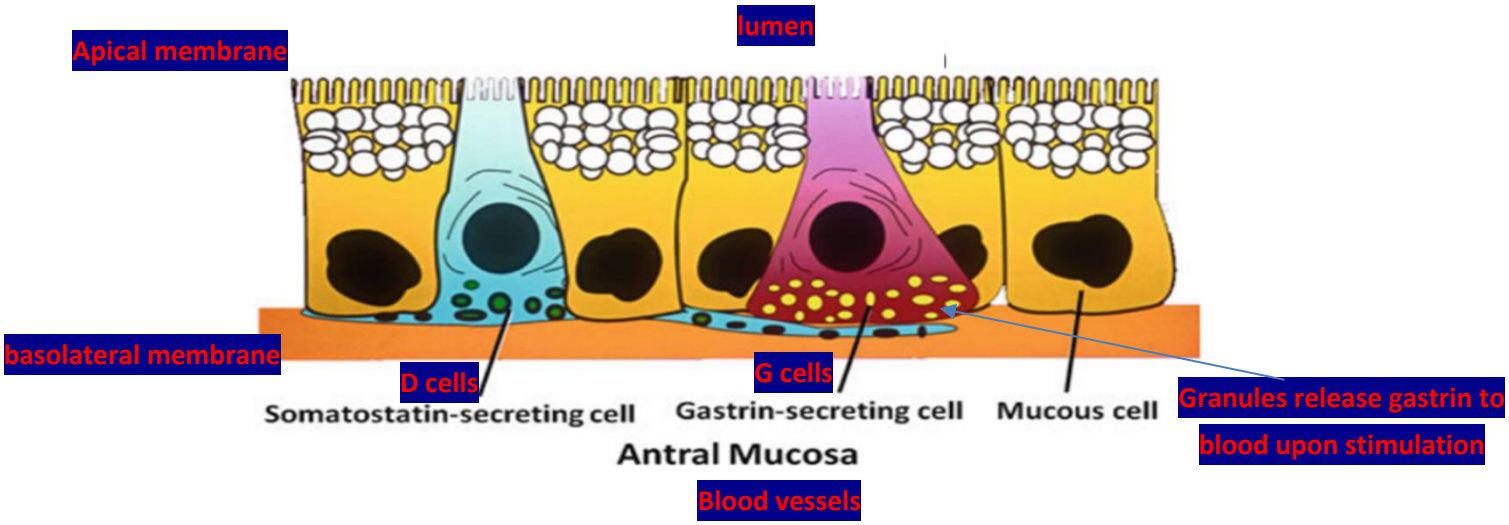
Exocrine area has pits; which are invaginations in gastric mucosa.

Surface mucous cells are simple columnar epithelium, these cells secrete mucous with alkaline material.

In neck area: Mucous neck cells also secrete mucous. Parietal cells secrete intrinsic factor (essential for survival, it has a role in B12 absorption) and gastric acid (HCL). Stem (germinal) cells → differentiate in surface cells (migrate upward) or glandular cells (migrate downward).

In base (gastric gland) area: Chief cells secrete pepsinogen. Enterochromaffin-like (ECL) cells are dispersed among parietal and chief cells, ECL cells secrete histamine which regulate the functions of parietal and chief cells.

2)Endocrine region: <u>hormone-secreting</u> area.



Endocrine area is in the distal part (antrum and pylorus) of stomach, this area makes 25% of total glands in stomach.

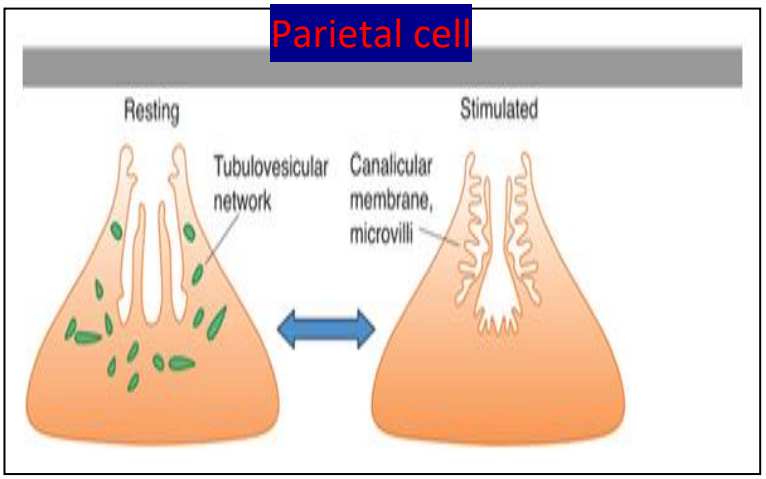
G cells secrete gastrin hormone → regulates secretion and motility in stomach. G cells are mostly present in the antrum and pylorus, but G cells also are present in the duodenum. G cells are pyramidal in shape, with narrow apical membrane and wide basolateral membrane.

D cells are also pyramidal in shape, these cells secrete somatostatin hormone. D cells are open cells in antrum (it has direct contact with lumen) and closed in body. Somatostatin acts as a paracrine agent → inhibits gastrin secretion from nearby G cells, so, it inhibits acid secretion. (gastrin stimulates acid secretion).

-Gastric acid secretion:

Parietal cells secrete intrinsic factor and gastric acid (HCL).

Resting parietal cells contain tubulovesicular network, this network contains proteins that change the shape of the apical membrane. When stimulated, tubulovesicular network translocate and fuse with the apical membrane and change its shape, resulting in a canicular membrane with microvilli, this increase surface area, so acid secretion is increased.

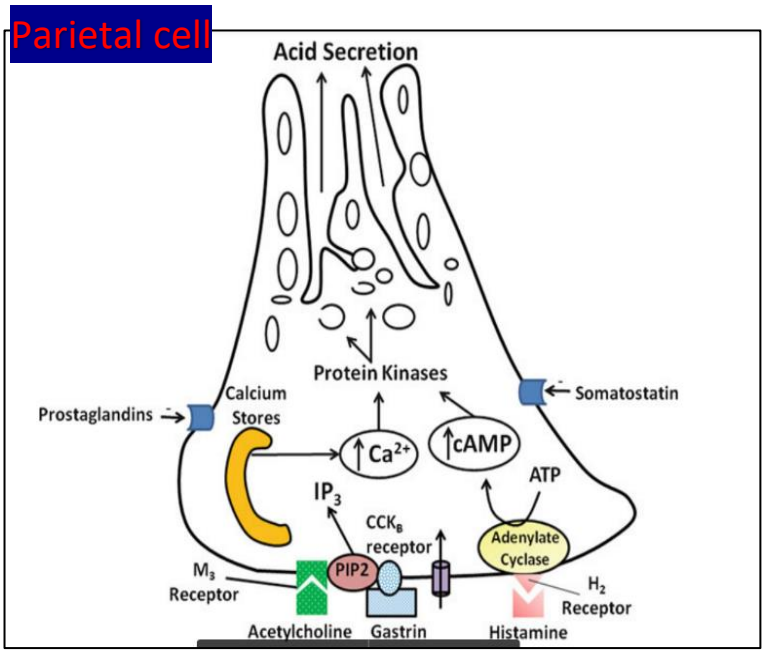


Parietal cells don't secrete HCL directly; these cells secrete the electrolytes which unite to form the gastric acid. This protects the inside of parietal cells from gastric acid.

Neural and Hormonal Regulation of Gastric Acid Secretion:

1)Acetylcholine (Ach): neural parasympathetic mechanism, Ach binds muscarinic (M3) receptors. Ach stimulates acid secretion.

2)Locally released histamine: paracrine mechanism, histamine binds histamine (H2) receptors. Histamine stimulates acid secretion.



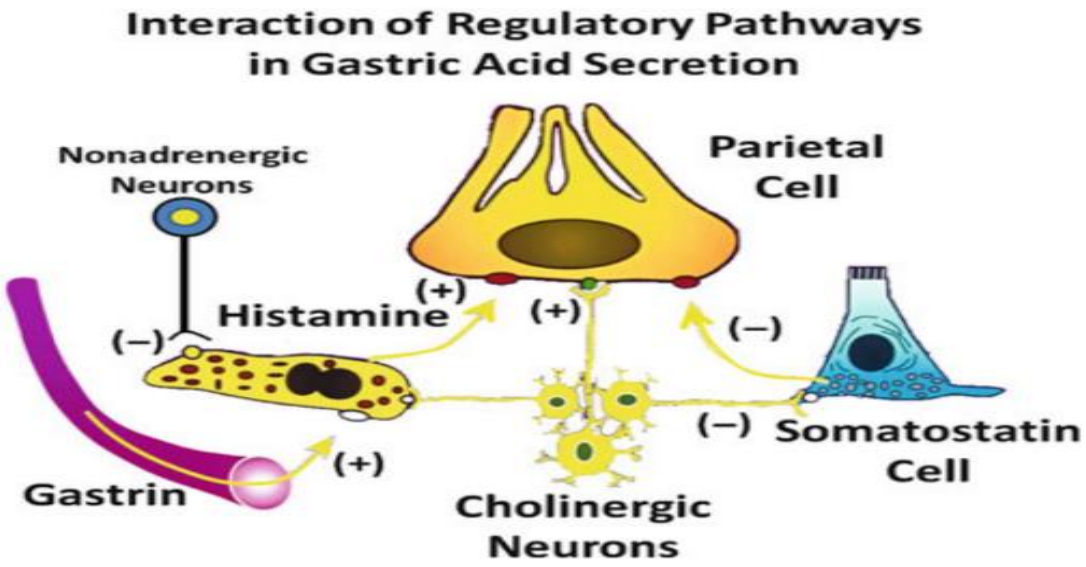
3)The hormone gastrin: endocrine mechanism, gastrin binds CCK_B receptors. Gastrin stimulates acid secretion.

Ach and gastrin have the same signaling pathway; they both stimulate phospholipase C → which stimulates PIP2 → which stimulates IP3 and DAG→ stimulation of Ca and protein kinase C, which stimulate vesicle (tubulovesicular network) translocation and fusion, this increases surface area → more electrolyte secretion.

Histamine stimulate adenylate cyclase which increases cAMP levels, cAMP is a signaling molecule that stimulate protein kinase A → vesicle translocation and fusion → more electrolyte secretion.

***somatostatin (secreted by D cells) and prostaglandins inhibit acid secretion. Closed D cells in body increase somatostatin secretion when stimulated by hormones, such as: VIP, CCK. Somatostatin inhibition of acid secretion has two mechanisms: direct (inhibit parietal cells), or indirect (inhibit histamine secreting cells, like ECL cells and mast cells).**

-Interaction of regulatory pathways in gastric acid secretion:



In summary, the three mechanisms that stimulate gastric acid secretion potentiate each other.

***gastrin stimulates histamine secretion and parietal cells directly.**

***cholinergic neurons secrete Ach which directly stimulate parietal cells and stimulate histamine secretion, and inhibit somatostatin secreting cells.**

***somatostatin secreting cells inhibit acid secretion directly or indirectly (we explained it before). It is mostly from closed somatostatin secreting cells (D cells) in body.**

Previous interactions are of potentiation. Potentiation is an interaction between two or more agents resulting in increased response, a response that is greater than the sum of individual responses of each agent. (1+1=3)

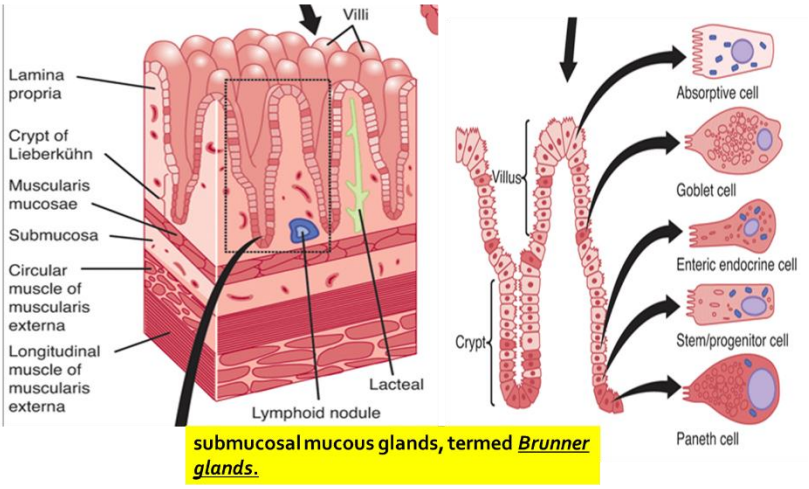
The most important agent that stimulate acid secretion is histamine, because it directly stimulates parietal cells to secrete acid, and also due to its potentiation effects on Ach and gastrin.

-Cimetidine is an effective drug that inhibits gastric acid secretion, because it inhibits histamine (H2) receptors. Inhibition of histamine decreases acid secretion significantly.

*****we will continue gastric secretion in the next lecture. Intestinal secretion is for self-reading, I'm gonna leave the slides below.**

Intestinal Secretions

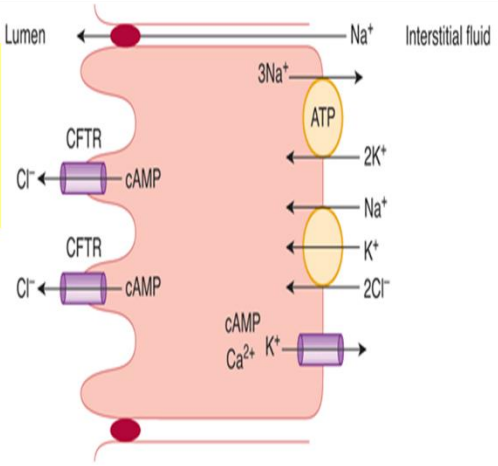
1 SECRETIONS OF THE SMALL INTESTINE



submucosal mucous glands, termed ***Brunner glands***.

2 Secretion of intestinal digestive juices by the crypts of lieberkühn

Secretagogues:
- **•Neurotransmitter: VIP, Ach**
- **•Paracrine:** bradykinin, serotonin, histamine, and prostaglandins
- **•Luminal**



3

Regulation of small intestine secretion

Local enteric nervous reflexes

Neural mechanisms: mediated by Ach and VIP.

Hormonal:

Secretin: increases duodenal secretion.

4

SECRETION OF MUCUS BY THE LARGE INTESTINE

- The mucosa has many crypts of Lieberkühn; however, unlike the small intestine, there are no villi.
- The epithelial cells contain almost **no enzymes**; they consist mainly of mucous cells that secrete only mucus.
- This mucus contains moderate amounts of bicarbonate ions.
- The rate of secretion of mucus is regulated principally **by direct**, tactile stimulation and **by local nervous reflexes.**