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Digestion & Absorption

Alimentary canal + associated glands
↓
mouth
↓
Oesophagus
↓
Stomach – [cardiac, Fundic, Pyloric]
↓ → Chyme (partially digested food)
Intestine [small & large]
↓
anus

Small Intestine [duodenum, Jejunum, ileum]

Large Intestine [Caecum, Colon, Rectum]

Lumen — muscular mucosa

Layers – (1) mucosa – mucosal epi^m, Lamina properia, ..
(2) Sub-mucosa – C.T, B.V, nerves
(3) muscle layer
(4) serosa – Inner circular mus. / outer longitudinal

- mucosal epithelium – formed of columnar ep^m
- Lamina properia – C.T, B.V
- muscularis mucosa – muscul.

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Serosa — Inner C.T
└ mesothelium (Squamous epm)

- mucosal epm its provide selectively permeable barrier b/w the contents of tract and tissue of body. It facilitates, transport and digest of food, promotes the absorpn for the products of digestn.

- Lamina propria: made up of connective tissue, rich in BV, nerve fibres and smooth muscle cells. Sometimes it may also contain glands and lymphoid tissue.

- muscularis mucosa: Continous thin layer of smooth muscles seperating mucosa from Sub mucosa. It promoted movement of mucus layer independent of other movement of the digestive tract and thus, it uses its contact with the food. The contraction of the muscle layer propels and mixes the food in the digestive tract.

- Submucosa: Consist of loose connective tissue and richly supplied with blood and lymph vessels and may also contain some glands. It contain

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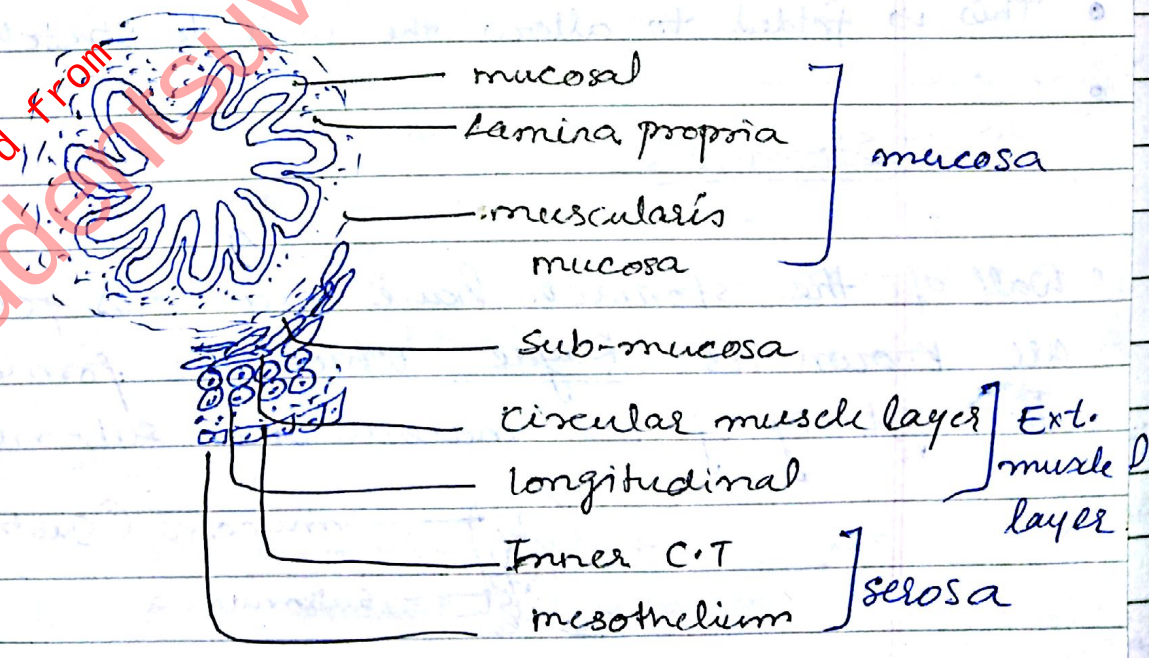
Meissner Plexus (gp. of ganglion and fibres)

- Muscle layer: It consist of smooth muscle arranged in 2 layers inner circular and outer longitudinal b/w which is present the myentric plexus of Auerbach. It helps in peristaltic movement.

- Serosa or Visceral peretorium: Thin layer composed of inner loose connective tissue layer rich in blood vessels, lymph vessels and the edipose tissue.
- Outer mesothelium consist of simple squamous epn which may have micro-villi on their free surface.



T.S of Alimentary canal

- Stratified means – several layers of cell
- Non keratinized means – no dead

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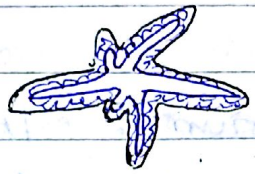
Oesophagus

- In oesophagus, mucosal epithelium is made up of stratified nonkeratinized squamous epithelium.

as in oesophagus lumen is collapsed



- In case of oesophagus; serosa is absent and we have adventitia (tunica adventitia)
  ↳ [mesothelium is not there, they formed only of connective tissue]

- This is folded to allow the wall to stretch.
- .

Stomach

- Wall of the stomach have numerous fold which are known as Rugae which are formed by the folding of the mucosa and sub-mucosa.

- mucosa also has numerous gland
- muscularis mucosa is a layer which seperate mucosa from sub-mucosa

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- Glands do not penetrate muscularis mucosa. [Except in case of duodenum where they penetrate to form Brunner's gland → submucosal layer of duodenum and they produce alkaline secretion of mucus]

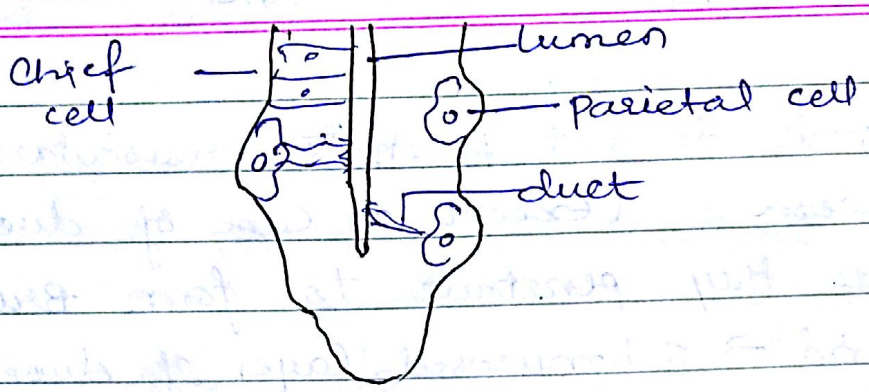
– mammulated or gastric areas

- In case of fundic – Gland pit are smaller than glands
- In cardiac – pits are longer than gland
- They have two types of cells

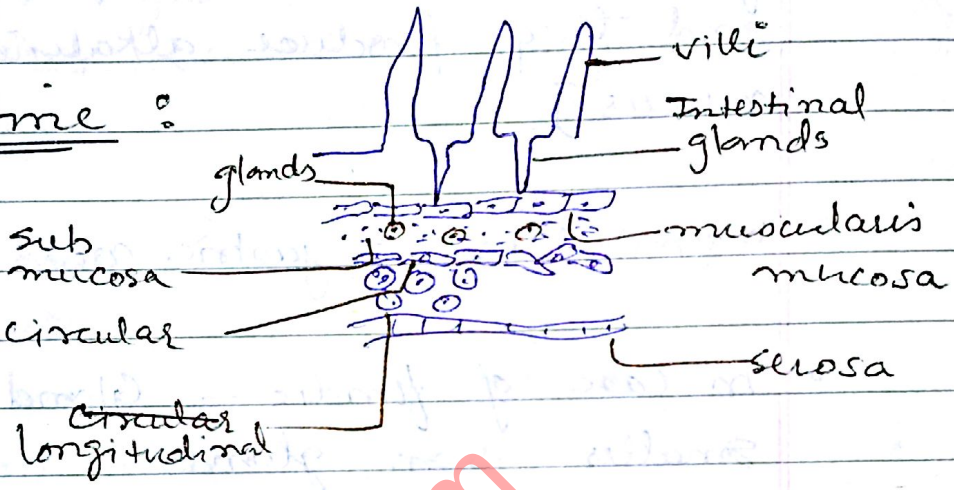
Chief cells	and parietal cells
also known as Zymogenic cell	also known as oxyntic cells
↓	↓
Produce enzyme known as pepsinogen [columnar cells]	produce HCl
↓	↓
Extend from base to the lumen [tall columnar cells]	Pyramidal-shaped cells
	↓
	do not extend to lumen

↓

Pepsinogen is inactive and in presence of HCl it change into active enzyme called pepsin. It acts on protein to convert it into proteoses & peptones

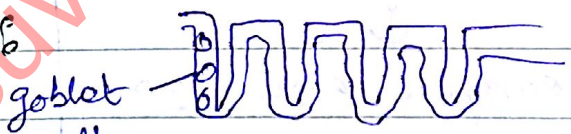


Intestine :



Ileum : It has lymphoid nodules and group of lymphoid nodules are known as peyer's patches.

Large Intestine :



Intestinal glands are rich in goblet cells to lubricate lining of intestine.

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• Stomach is the dilated segment of digestive tract. The main functions are

(i) To add fluid to undigested food transforming it into pulp and continuing with the process of digestion.

The surface of stomach is characterised by the presence of mucosal ridges or folds called rugae. These ht and no. depends upon degree of . The most prominent in the empty stomach and disappears when stomach is distendency. There are numerous gastric areas present on the surface known as mamillated areas. They have numerous depression known as gastric pits, no. of gastric glands situated in lamina propria open at the bottom of these pits.

There are three regions cardiac, fundic and pyloric vary from each other in the proportion of the pit to the gland. These glands are simple, branched coiled and tubular with the wide lumen. mucosal epm of stomach is characterised by the presence of only one type of cells i.e tall columnar cells which produce mucus that provide a protective coat for the stomach epm.

The lamina propria is same i.e connective tissue containg gastric glands which sometyms may be so numerous that connective tissue fibres are reduced to thin strands.

The external muscle layer has three layers instead of two.

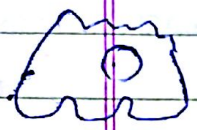
- External
- middle circular
- Internal oblique.

The outermost layer is serosa. fundic region occupy largest region of the stomach where pits are shorter, glands are longer.

- The diff. types of the cell found are chief cells and zymogenic cells present mainly on the lower region of the gland. They synthesize the enzyme pepsinogen which is a protein hence they have characteristic of protein synthesing cell. These enzyme stain blue in haematoxylin ~~Stain~~ eosin stain. When the inactive precursor pepsinogen granule is released into the acid envir. of stomach, the enzy. is converted into highly active proteolytic enzyme pepsin which acts on proteins and partially digest them into proteoses & peptons These cells also hv lipolytic activity. i.e they also produce lipase for the digestn of lipids. Pepsin content of stomach mucosa is ∝ to granular content of chief cells - the region containing greater no. of

chief cells always produce the highest conc^{n} of the enzyme.

Parietal cells also known oxyntic cells These cells produce HCl and an intrinsic factor. They predominate in the upper part of the ~~gas~~ gland and stain pink in color. They are triangular or pyramidal shaped cells.



Parietal cells.

They have spherical nucleus. These cells are larger than chief cells and have intercellular canaliculi which connect the parietal cells to the lumen of the gland and ~~pass~~ These cells are pushed away from the lumen by crowding chief cells. They hv greater no. of mito. In certain human disease the no. of Parietal cells is correlated with acid-producing capacity of the stomach. In case of ~~A~~ Atrophic gastrisis, both chief and parietal cells are less numerous, and gastric juice has little or no acid or pepsin activity. The acid secreted by the Parietal cell originate from the Cl^{-} ions present in the blood and the H^{+} ions ~~rate~~ resulting of the action of Carbonic anhydrase

It acts on CO_2 to produce carbonic acid which dissociates to form H^+ and HCO_3^- ions. Both cations and Cl^- ions are actively transported across the cell mem. whereas H_2O will diffuse passively along osmotic gradient. Energy needed for ~~H~~ mem comes from mito. Hence Secretion of HCl into the lumen of the Stomach is accompanied by an equivalent release of bicarbonate ion (HCO_3^-) into the blood and is responsible for a measurable rise in blood pH during digestion.

Parietal cells in lumen is also the site of production of intrinsic factor which is responsible for absorption of vit B_{12}. It binds strongly with B_{12} in Stomach and the complex is absorbed in the ileum. that is why the lack of the factor can lead to vit B_{12} deficiency resulting in pernicious anemia caused by Atrophic gastritis. The secretion of parietal cell may be activated by acetylcholine, Histamine and gastrin.

- Mucus cells - produce neutral mucus that lines and protects the surface from the secreted acid.

There are Argentaffin cells or enterochromaffin cells

Values of kerckering → villi → microvilli
↓
glycocalyx

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Intestine : Intestine is characterised by the presence of permanent folds known as Plicae circularis (valves of kerckering) formed of mucosa and submucosa.

*[Brush border is formed by numerous microvilli] They are similar to rugae but formed by rather than longitudinal folds. They are most developed in jejunum and characterised of this part. They cannot be completely flattened out by distention of intestine unlike stomach. In addn, small leaf like or finger like villi are seen which are projections of mucous membrane villi are covered with the epn and hv central core of lamina propria. They are leaf-shaped in duodenum, Clubed-shaped in jejunum and finger-like in ileum. B/w the bases of villi are small opening of intestinal glands also cld crypts of Lieberkuhn. These glands extend through the thickness of muscular ineth. almost reach the each of muscularis mucosa but do not penetrate it except duodenum where they extend to submucosa to form submucosal glands known as Brunner's gland. These glands not so closely packed as gastric gland. To further use S.A, microvilli are present, forming a brush or striated border on the apical region of individual columnar cells. Each microvilli has dense glycocalyx that contain several enzymes for the final process of digestion.