

HISTOLOGY OF DIGESTIVE SYSTEM

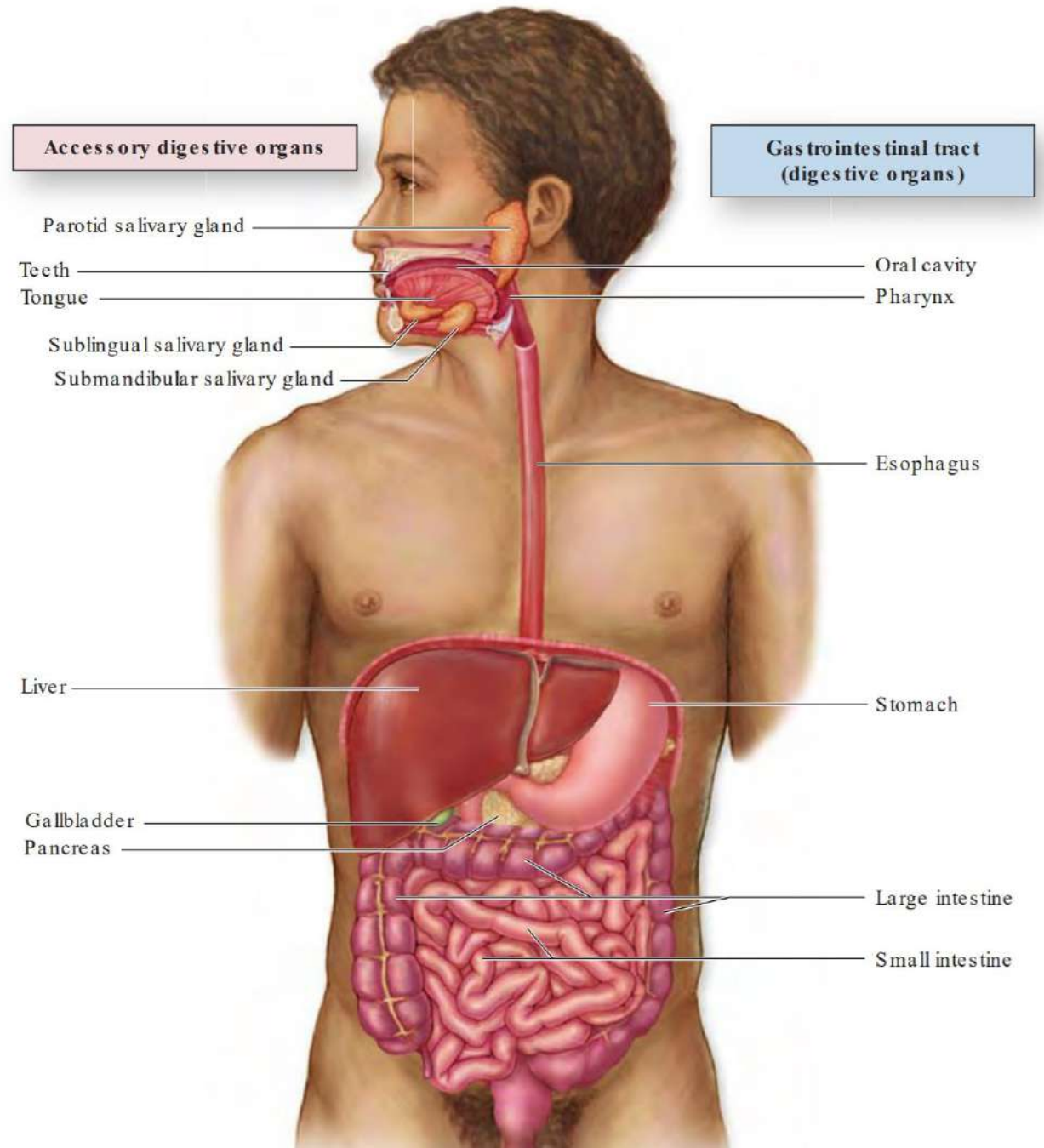
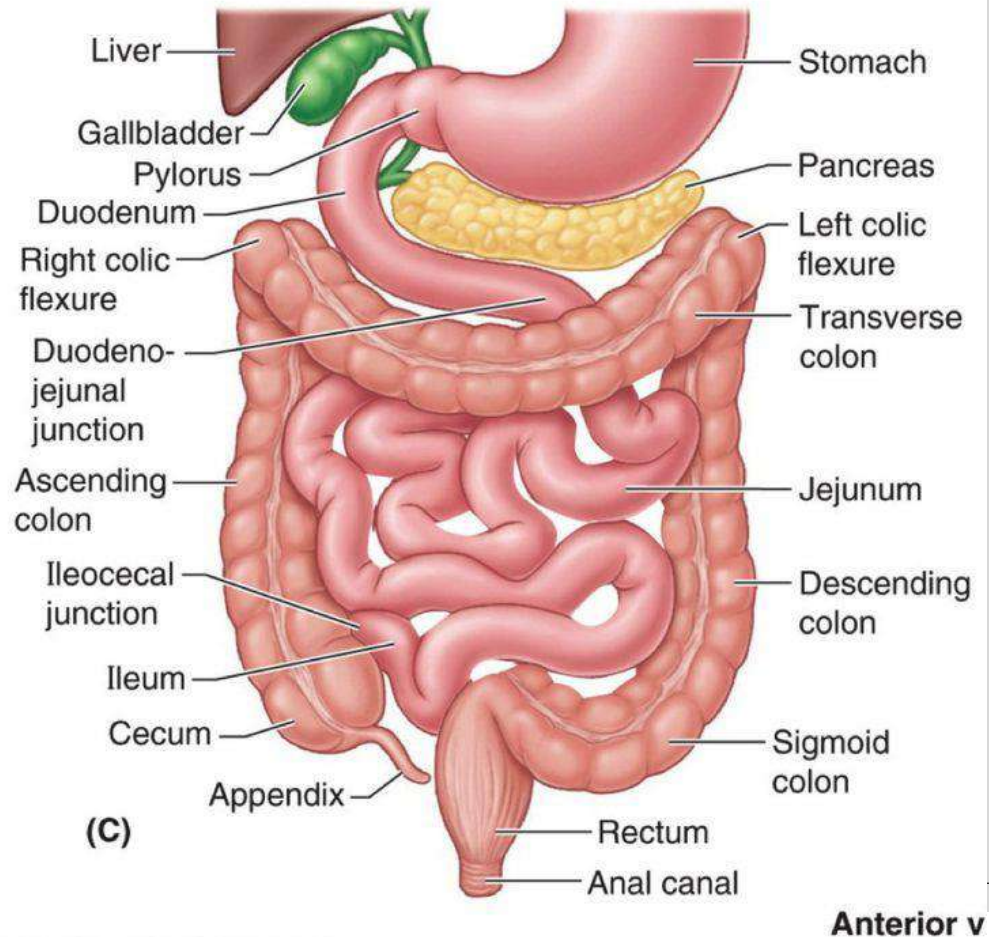
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FIGURE 15-1 The digestive system.

Digestive System



Tooth

- Bagian atas: **crown(mahkota)** (*terlihat di dlm mulut*); dengan ≥ 1 akar yang tertanam di soket pd tulang rahang (mandibula/maksila).
- Gigi tdd dari 3 jaringan terkalsifikasi: **enamel, dentin dan pulp** .
- Dentin yg dominan: bone-like material.
- Pada crown, dentine dilapisi material yg lebih keras: **enamel**.
- Pada akar dentin dilapisi **cementum** yang tipis.
- Cementum Bersatu dgn dinding soket tulang pada rahang, dgn selapis jar ikat fibrous ➔ **periodontal ligament**.
- Pada dentine :**pulp canal** (or **pulp cavity**) tdd: a mass of cells, blood vessels, and nerves
- The blood vessels and nerves enter the pulp canal through the **apical foramen** which is located at the apex of the root.

The Tooth

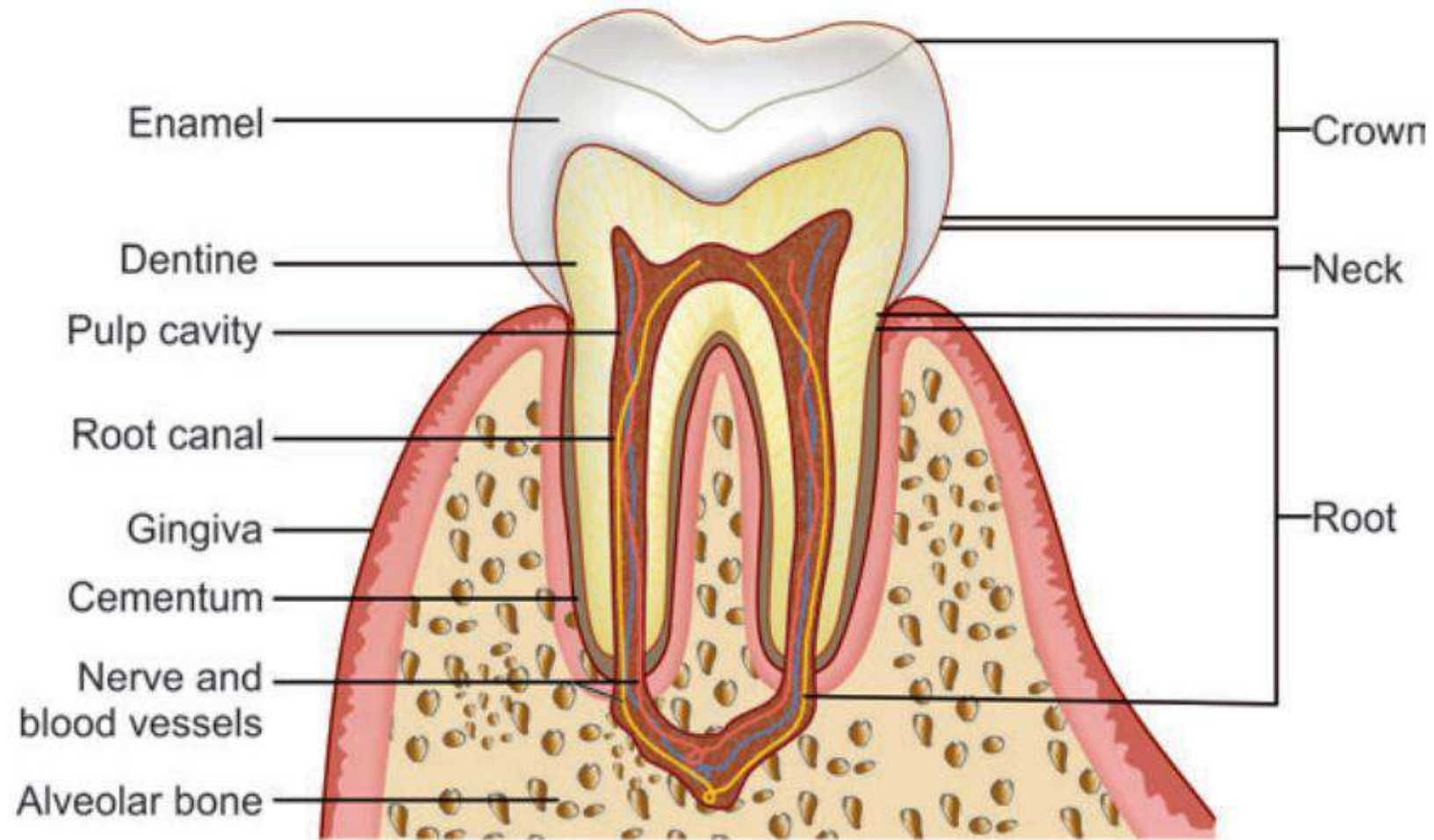
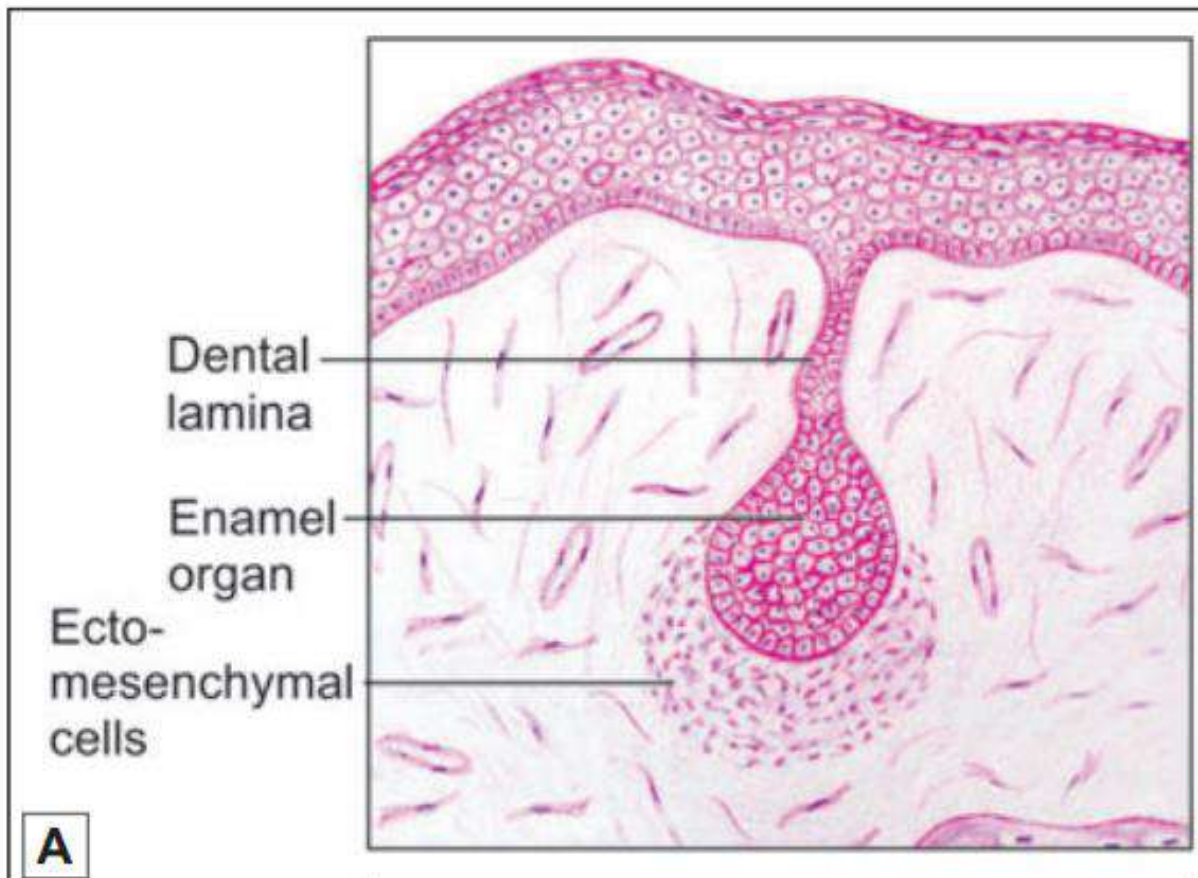


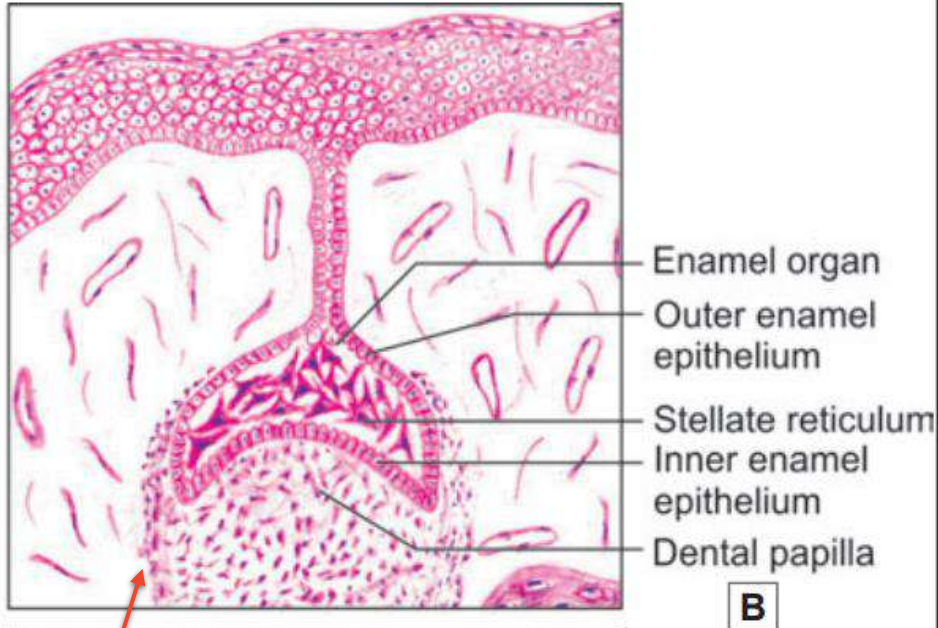
Fig. 15.2: Vertical section through a tooth (Schematic representation)

Stages in Tooth Development



- Gigi adalah epitel skuamous yang bermodifikasi.
- Epitel tumbuh kedalam jaringan ikat dan membesar untuk membentuk **enamel organ** (Fig. 15.4).
- **Bud Stage (Fig. 15.4A)**
- Enamel organ menyerupai : small bud (kuncup kecil), dikelilingi sel ektomesenkimal
- Enamel organ tdd sel kolumnar pendek yang tersusun perifer dan sel polygonal pada bagian sentral

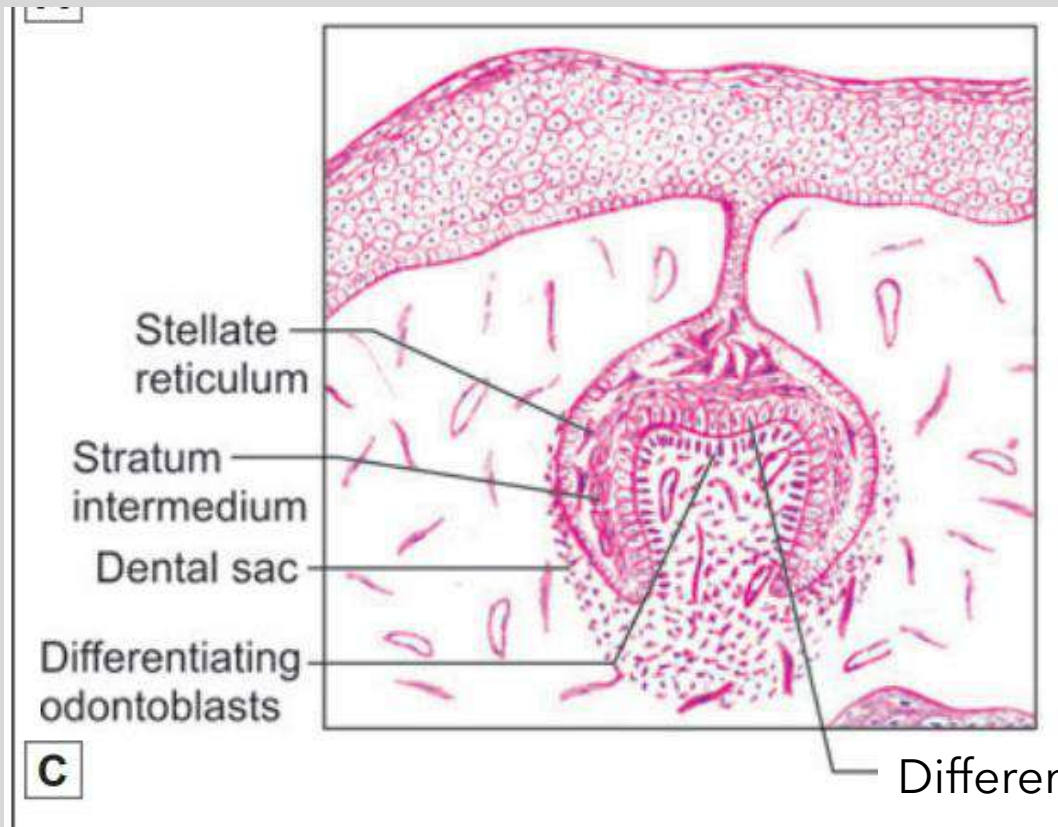
Stages in Tooth Development



Dental Sac

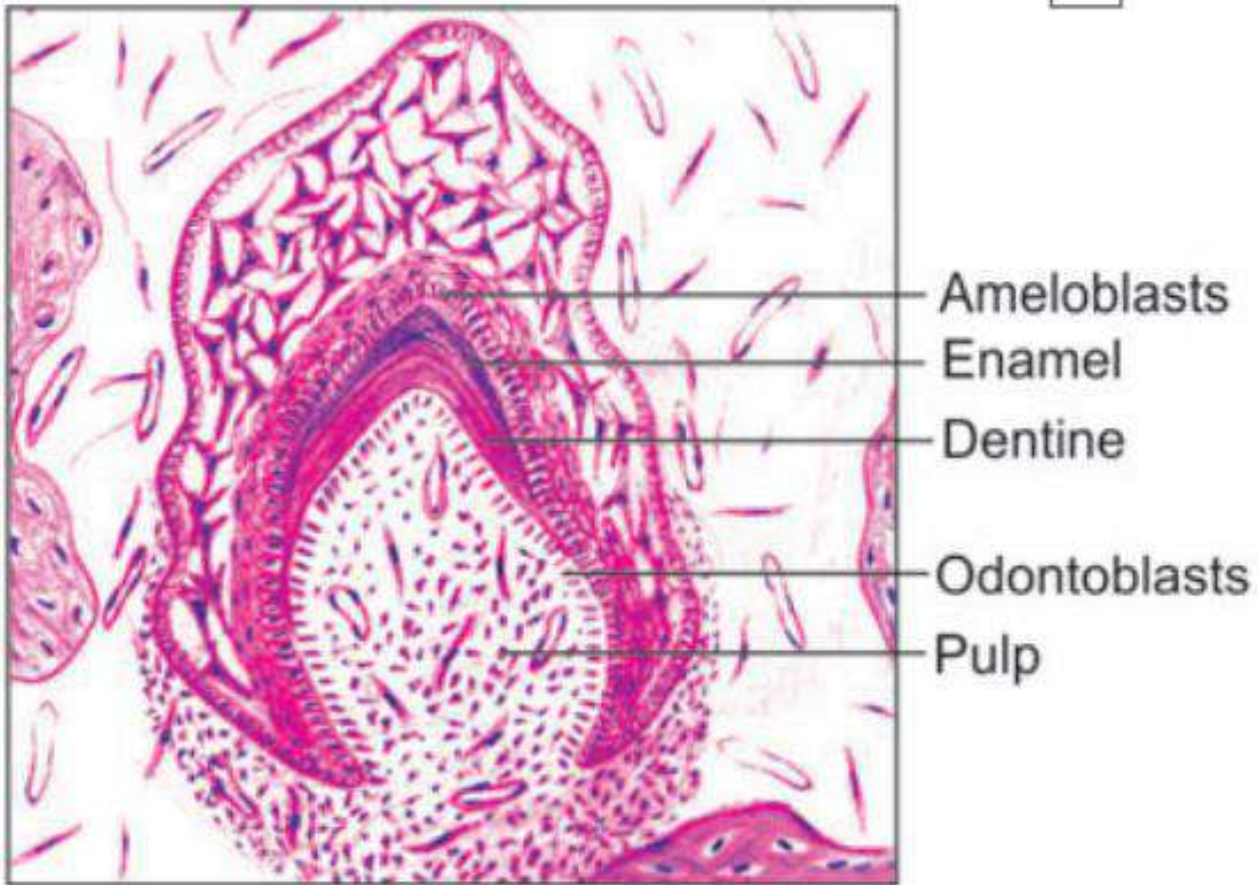
- **Cap Stage (Fig. 15.4B)**
 - Enamel organ berproliferasi membentuk topi (cap) diatas kelompokan sel ektomesenkimal yang disebut dental papilla.
 - Dental papilla dan dental sac berbatas jelas.
- 3 lapisan terbentuk dari enamel organ:
- %Inner dental/inner enamel epithelium
 - %Stellate reticulum
 - %Outer dental/outer enamel epithelium

Stages in Tooth Development



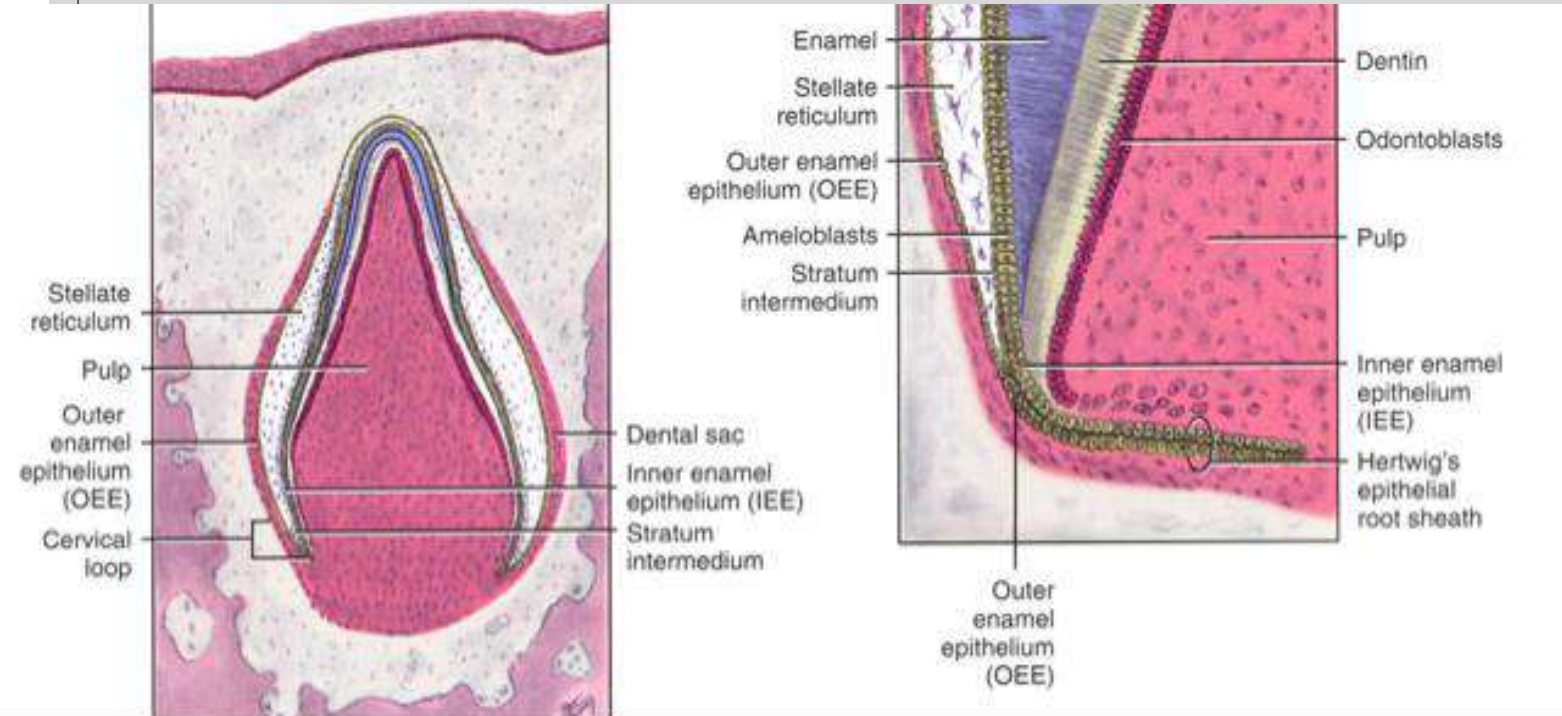
- **Early Bell Stage (Fig. 15.4C)**
- Enamel organ membentuk gambaran lonceng karena invaginasi permukaan bawah epithelial Cap.
- Selapis sel terbentuk diantara epitel inner dental dan stelat reticulum ➔ **stratum intermedium**.
- Inner dental epithelium berdiferensiasi menjadi sel kolumnar tinggi ➔ **ameloblasts**.
- Sel peripheral dari dental papilla berdiferensiasi ➔ **odontoblasts**

Stages in Tooth Development



- **Advance Bell Stage (Fig. 15.4D)**
- Odontoblasts membentuk dentine
- Ameloblasts membentuk enamel
- Ameloblasts dan odontoblasts memiliki perilaku mirip dengan osteoblasts berada dibawah lapisan enamel/dentin.
- Deposit enamel dan dentine membentuk mahkota gigi
- Odontoblasts akan melapisi kavum pulpa

Stages in Tooth Development



- **Root Formation**

- Pembentukan akar gigi berasal dari **Hertwig's epithelial root sheath** yang dibentuk bagian servikal enamel organ ➡ membentuk akar gigi dan memicu pembentukan dentin pada akar gigi.
- dentin **akar** berdiferensiasi menjadi sementoblas yang kemudian menjadi sementum.

Tongue

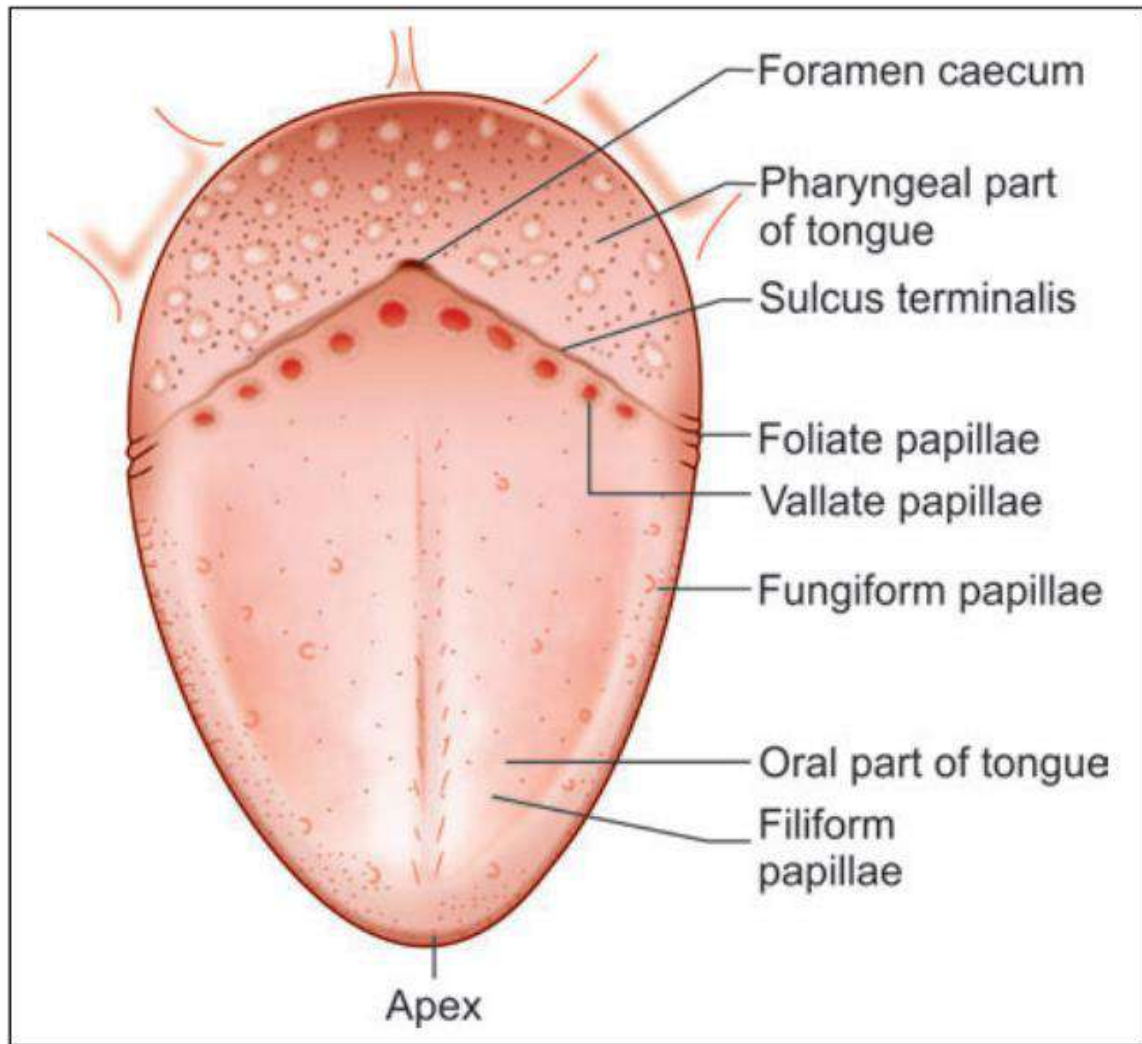
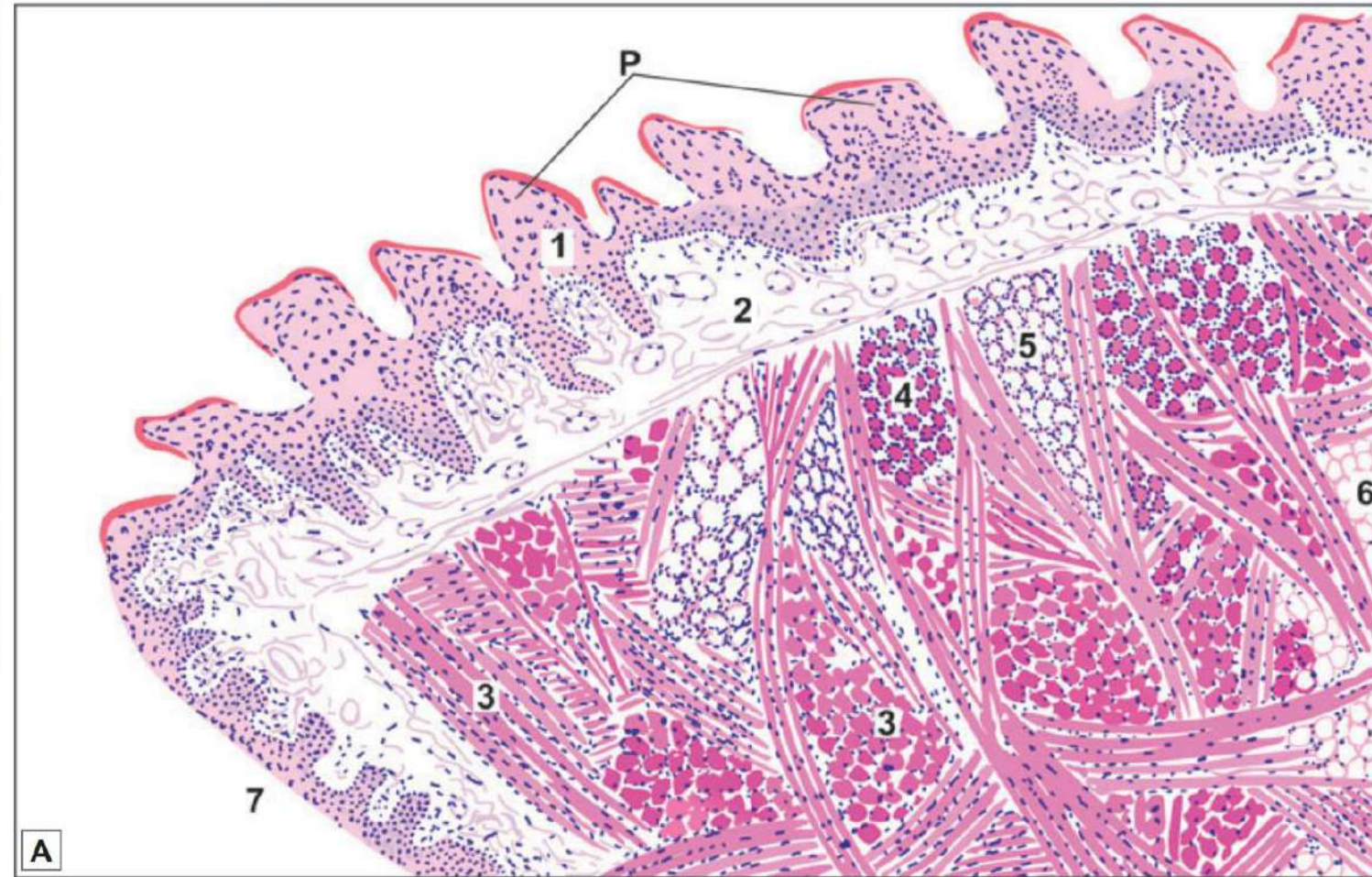
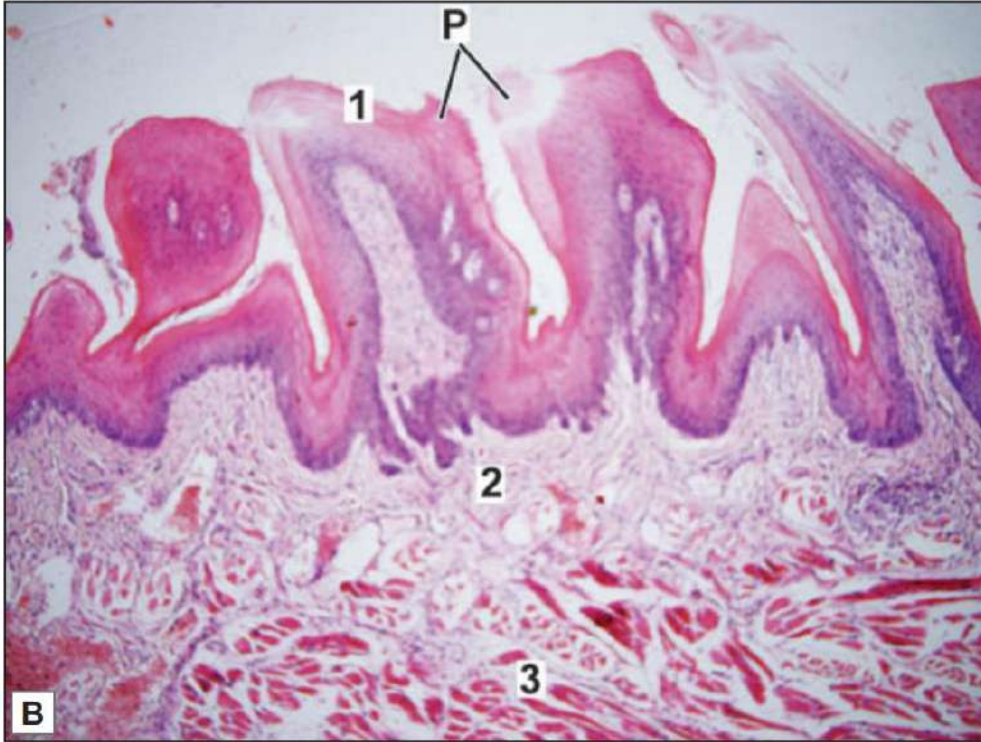


Fig. 15.5: Dorsal surface of the tongue
(Schematic representation)

- Lekukan V shape pada posterior dorsum lidah ➔ **sulcus terminalis**
- Apex of the 'V' ➔ **foramen caecum**.
- Sulcus terminalis membagi lidah menjadi (2/3) anterior/oral part; dan (1/3) posterior/pharyngeal part.
- Lidah tdd otot skelet yang ditunjang jaringan ikat. Otot terusun vertical, transverse dan longitudinal.
- Permukaan lidah tdd membrane mukosa dilapisi epitel gepeng berlapis dan ditunjang jaringan ikat.
- Bagian didepan sulcus terminalis terdapat byk **papillae**.

Tongue

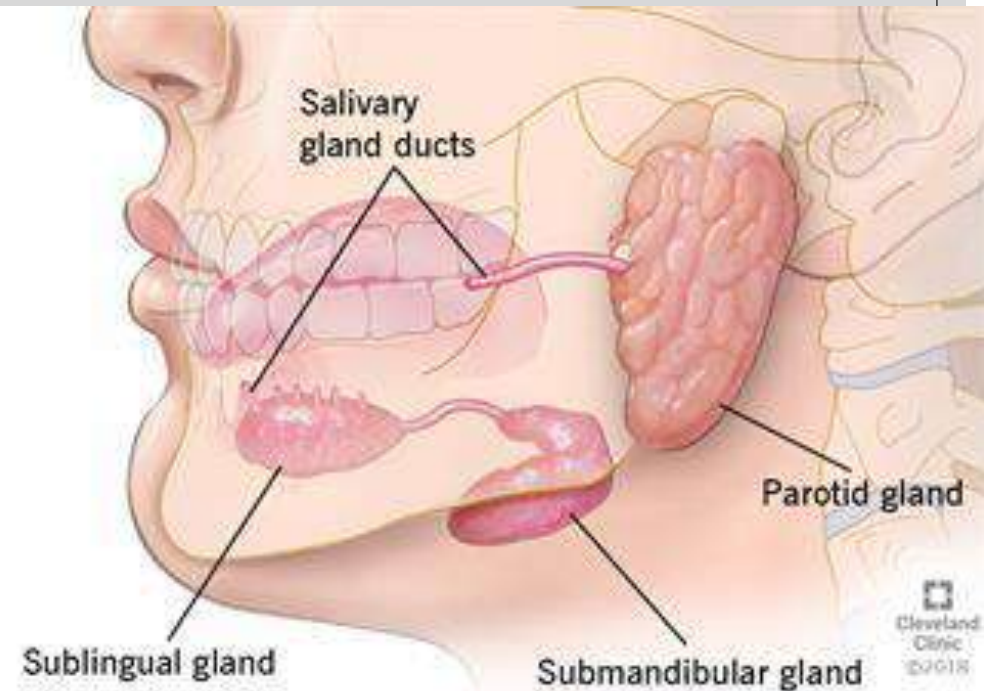
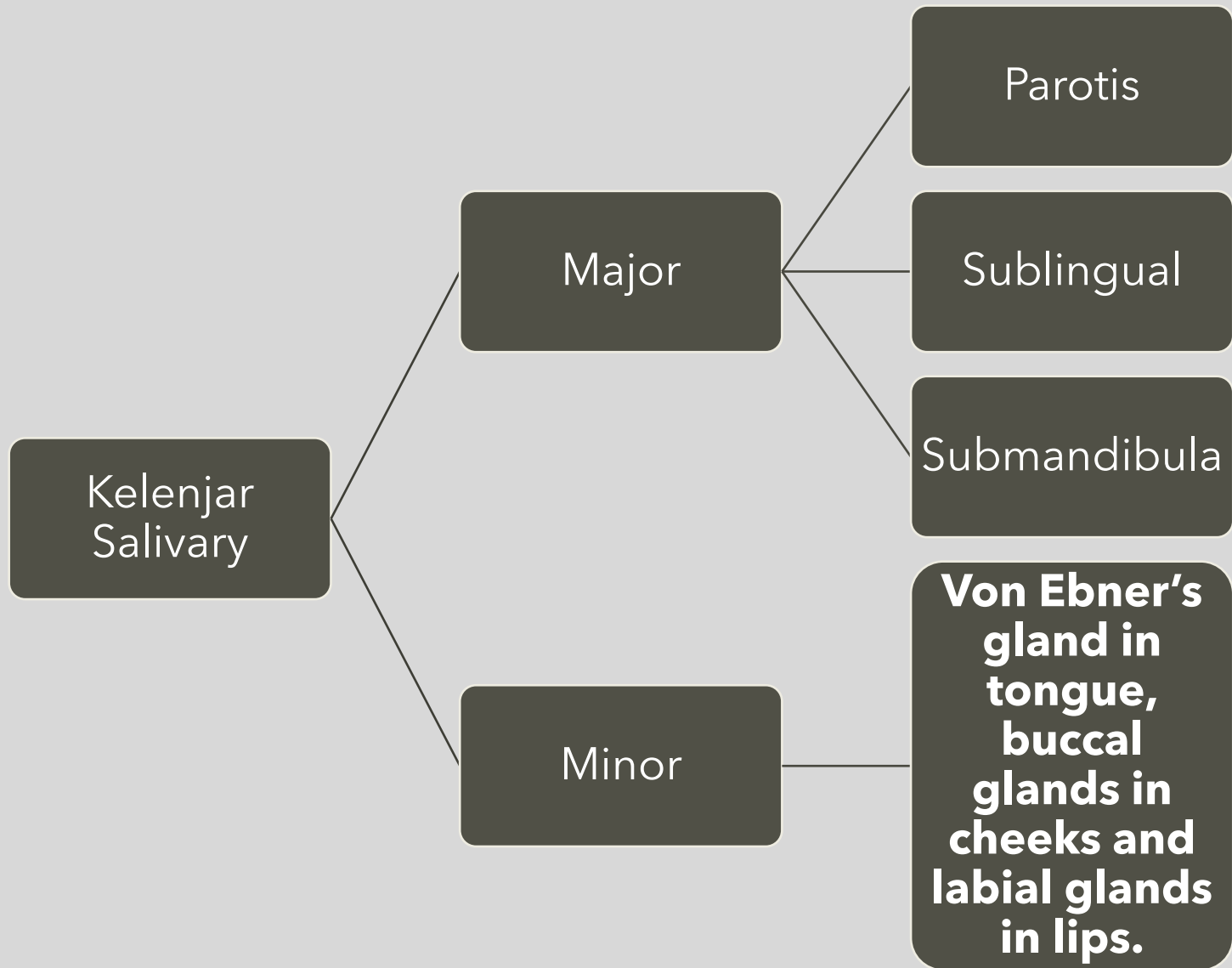


Tongue. A. As seen in drawing; B. Photomicrograph

Key

- | | |
|-----------------------------------|-------------------------------------|
| 1. Stratified squamous epithelium | 5. Mucous gland |
| 2. Lamina propria | 6. Adipose tissue |
| 3. Skeletal muscle | 7. Smooth ventral surface of tongue |
| 4. Serous gland | P. Papillae |

Salivary GlanDS



Salivary Glands

- The parotid glands are located laterally to the mandibular ramus
- The submandibular glands are present in the floor of the mouth, superior to digastric muscles.
- The sublingual gland lie anterior to submandibular glands.

Salivary Glands

- Fungsi: **melembapkan, proteksi dan lubrikasi mukosa**
- **Menghasilkan enzim (amylase, lysozyme), and IgA**

Structural organisation

- Tdd **stroma, parenchyma and a duct system**

Stroma

- Jaringan ikat kapsul dan septa
- Septa terbentuk dari kapsul, membagi kelenjar menjadi lobulus
- Septa membawa **pembuluh darah dan saraf** ke kelenjar.
- Dapat ditemukan kelenjar yang besar

Parenchyma

- Parenchyma has two components: **the secretory part and conducting part.**

Salivary Glands

- **Secretory Part**

- **Salivary glands are compound tubuloalveolar glands** (racemose glands). **Elemen sekretori** (disebut juga ***portio terminalis***) bisa bulat (**acini**), pear shaped (**alveoli**), **tubular**, atau **mix** (tubuloacinar, tubuloalveolar).

- Acini tdd sel ***serous*** / ***mucous***

- Kel. Salivari bs memiliki 1 atau lebih jenis acini (mix serous dan mucous)

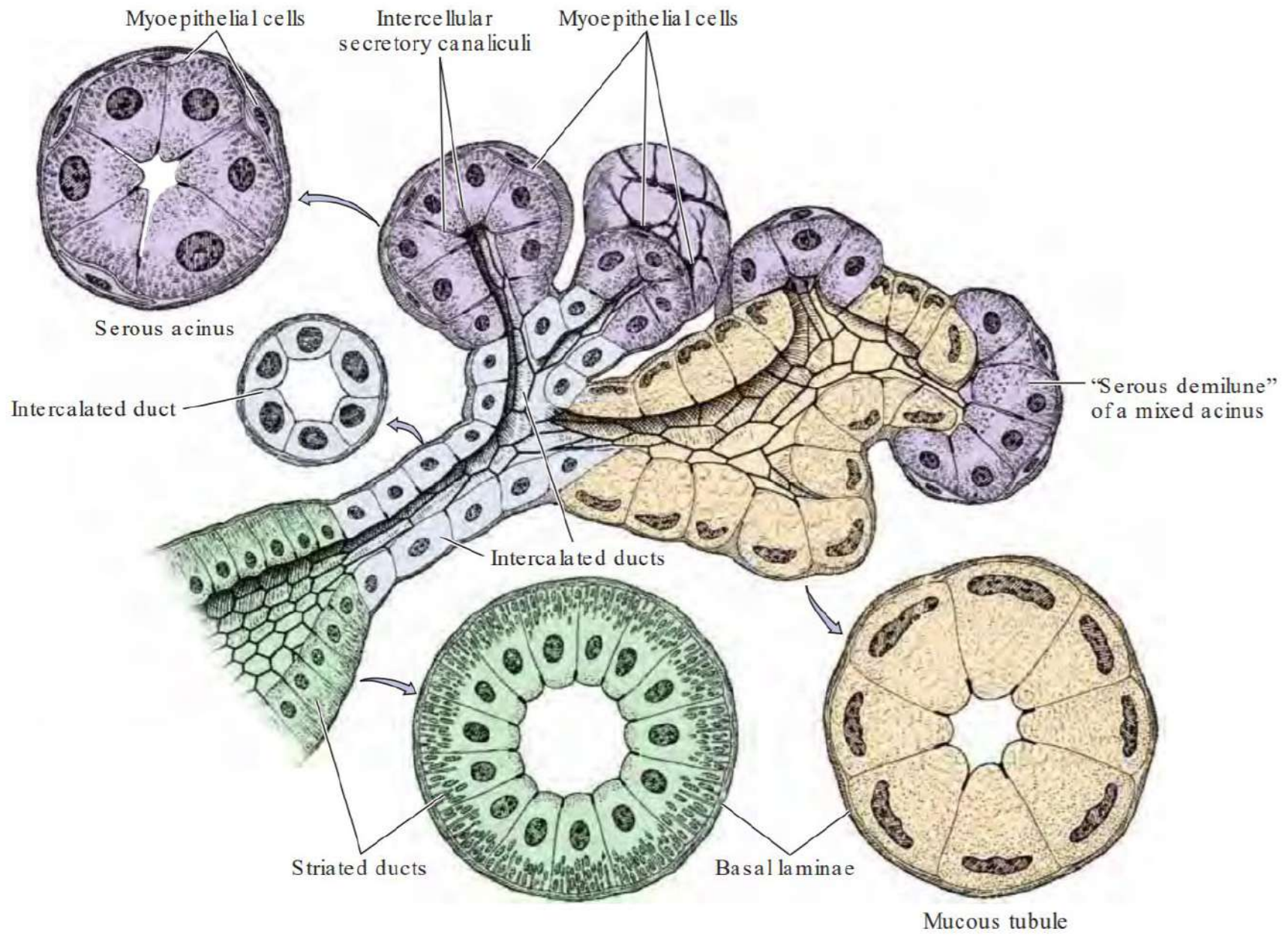
- Unit sekretori/kelenjar dengan 1 tipe sel (mucous/serous saja) ➔ **homocrine**. Jika tdd bbrp jenis sel ➔ **heterocrine**.

Salivary Glands

Duct System

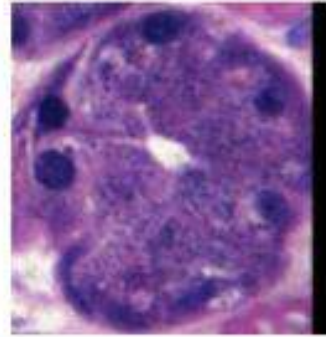
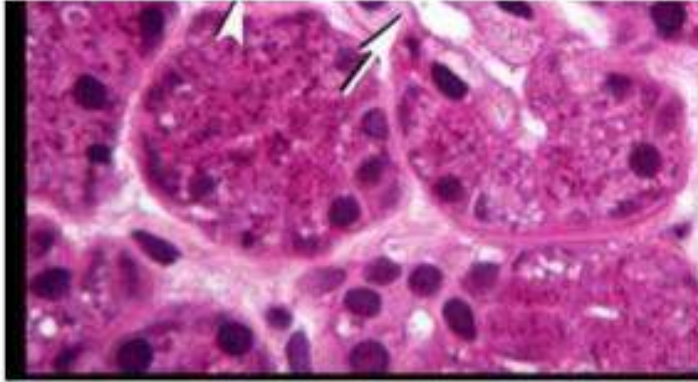
- Sekret yang diproduksi asini akan melewati sistem duktal
- Duktus paling kecil disebut: **intercalated ducts**. Dilapisi **epitel gepeng/kuboid**
- Intercalated ducts mengalir ke **striated ducts** yg dilapisi **epitel kolumnar**. Disebut striated ducts karena memiliki garis2 vertikal di basal.
- **Intercalated dan striated ducts** ➔ **intralobular ducts**.
- Striated ducts mengalir ke **excretory ducts** (interlobular) yg dilapisi **epitel kolumnar**
- Acini ➔ intercalated ducts ➔ striated ducts ➔ excretory ducts

FIGURE 16-2 Epithelial components of a submandibular gland lobule.

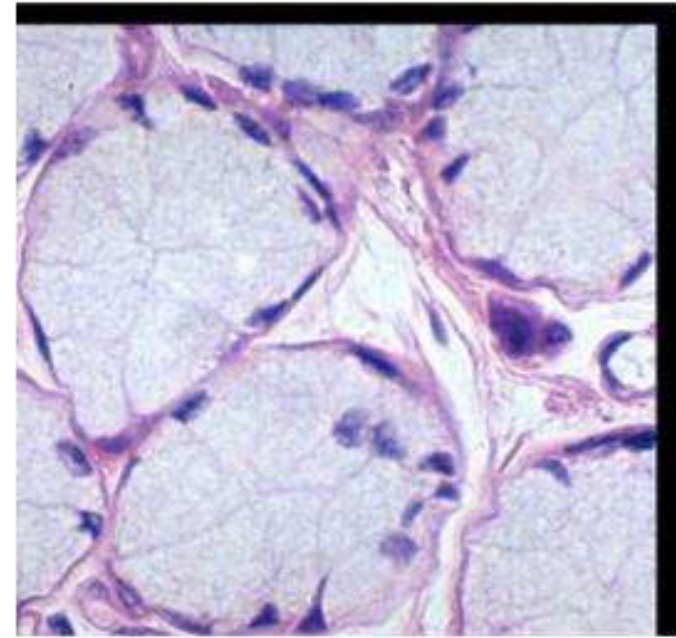


Types of Acini in Salivary Glands

1) Serous



2) Mucous



3) Mucoserous

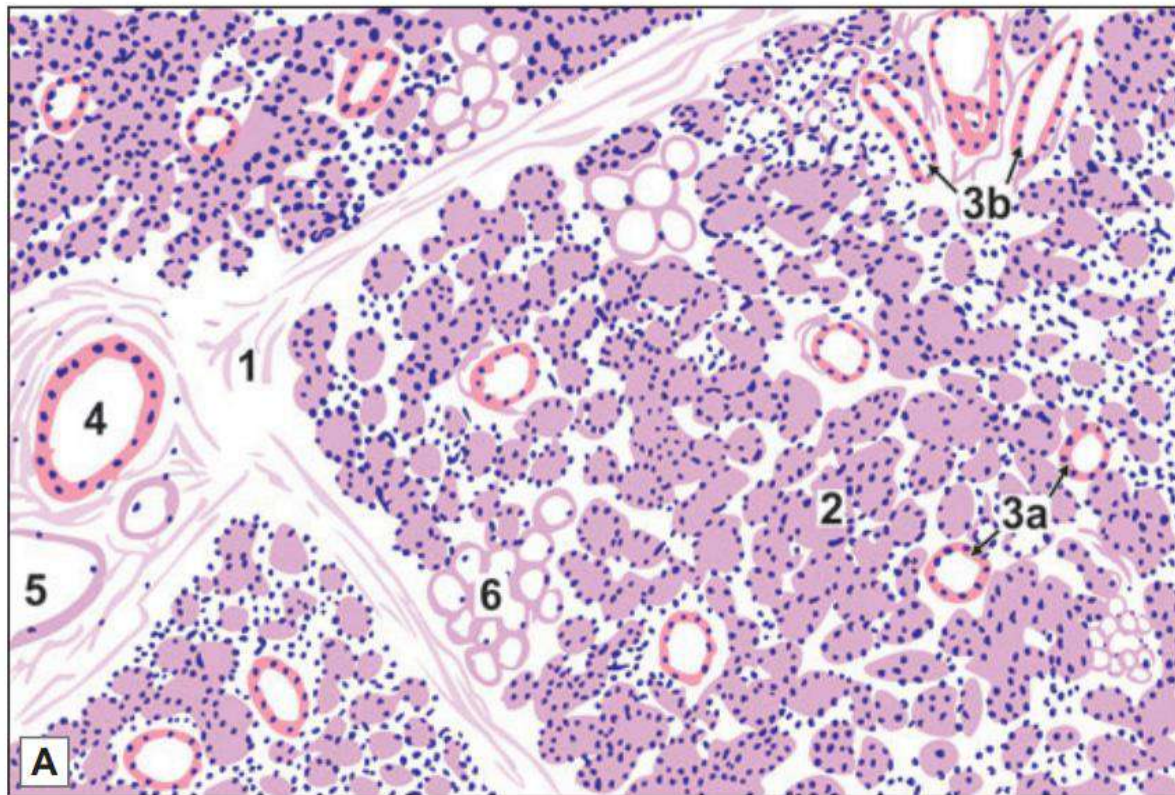


Serous demilune
Crescent of Gianuzzi

Parotid Gland



PLATE 15.4: Parotid Gland



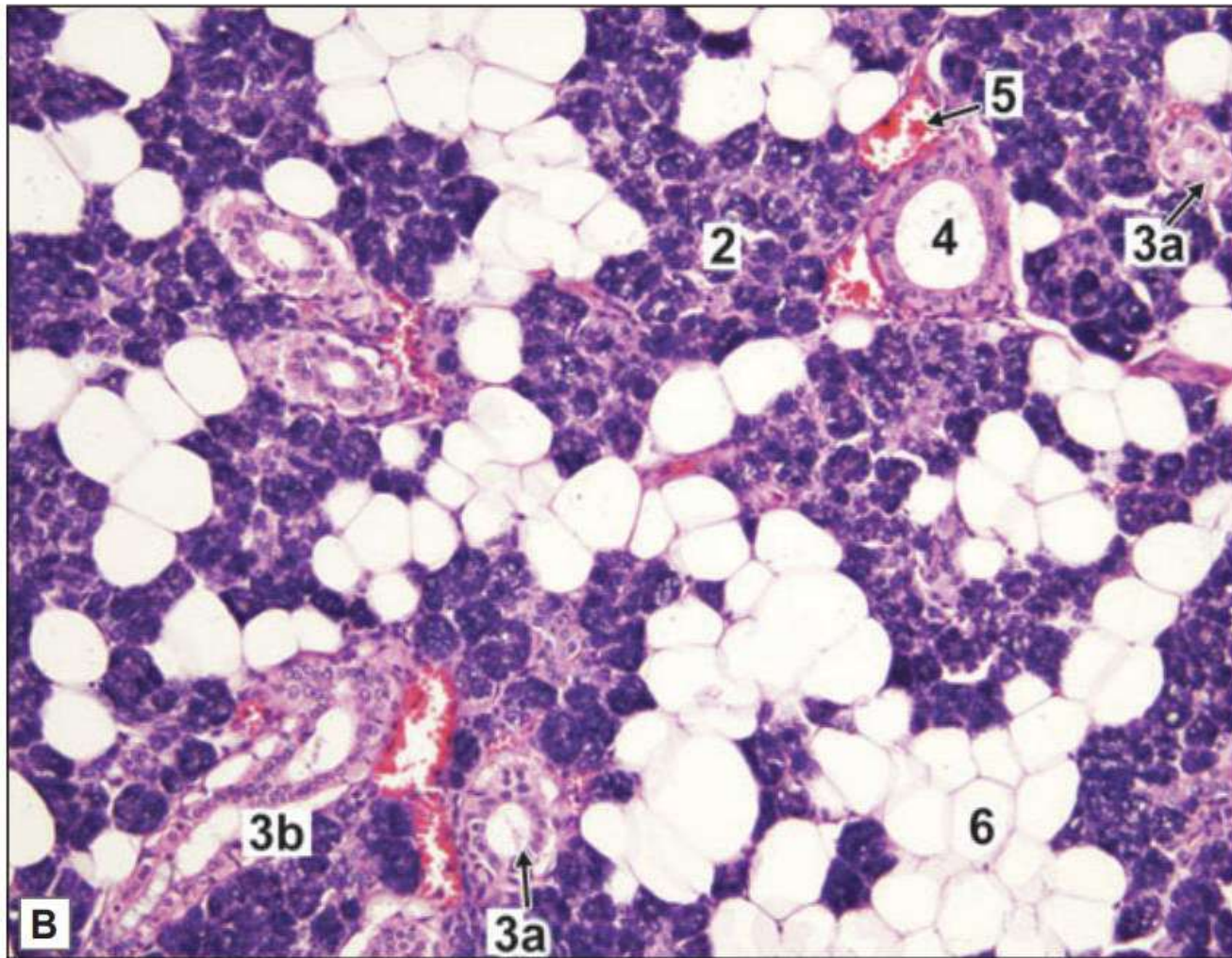
The parotid gland is a serous salivary gland. The characteristic features are:

- Only serous acini are present which contain basophilic zymogen granules and are darkly stained
- Intercalated and striated (Intralobular) ducts are seen
- Interlobular duct can be seen
- It also contains adipocytes.

Key

1. Interlobular connective tissue septum
2. Serous acini
3. Intralobular duct
 - a. Intercalated duct
 - b. Striated duct
4. Interlobular duct
5. Blood vessel
6. Adipose tissue

parotid gland



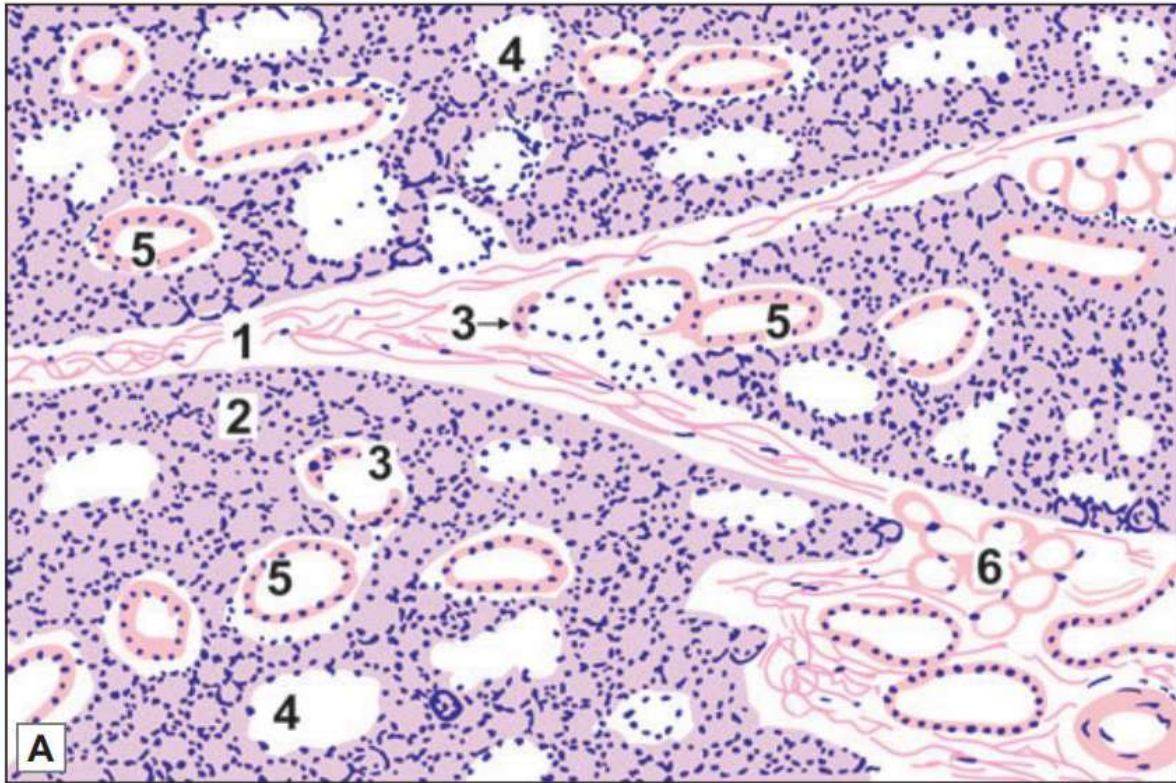
Key

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2. Serous acini
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 - a. Intercalated duct
 - b. Striated duct
4. Interlobular duct
5. Blood vessel
6. Adipose tissue

Parotid gland. A. As seen in drawing; B. Photomicrograph



PLATE 15.5: Submandibular Gland

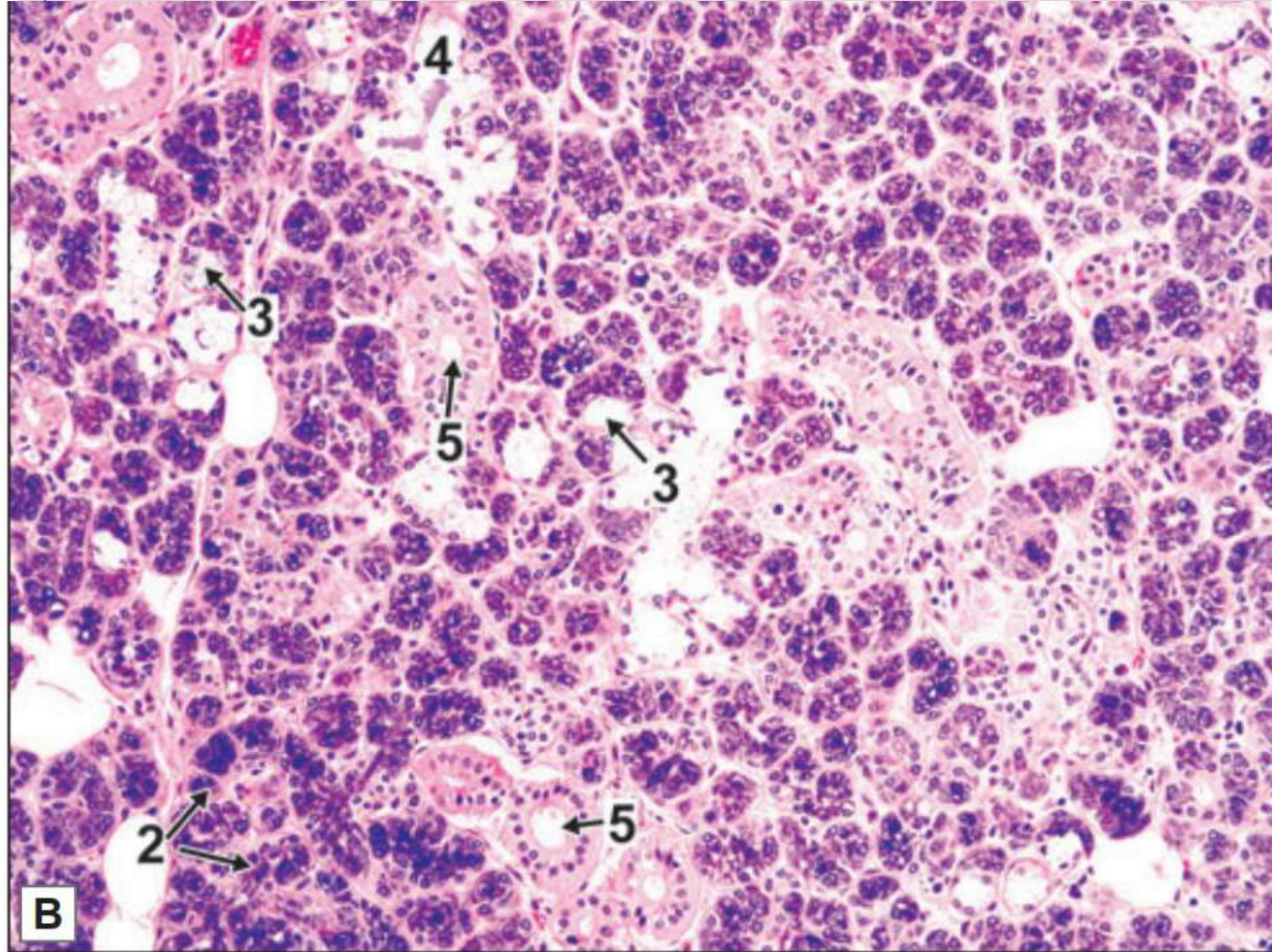


- The submandibular gland is a mixed salivary gland, predominantly serous with a few mucous acini
- Serous cells are frequently located at the periphery of mucous acini in the form of a crescent and called as demilunes
- Striated ducts are more prominent than those in parotid gland.

Key

1. Interlobular connective tissue septum
2. Serous acini
3. Mucous acini with serous demilune
4. Mucous acini
5. Intralobular duct
6. Adipose tissue

Submandibular gland



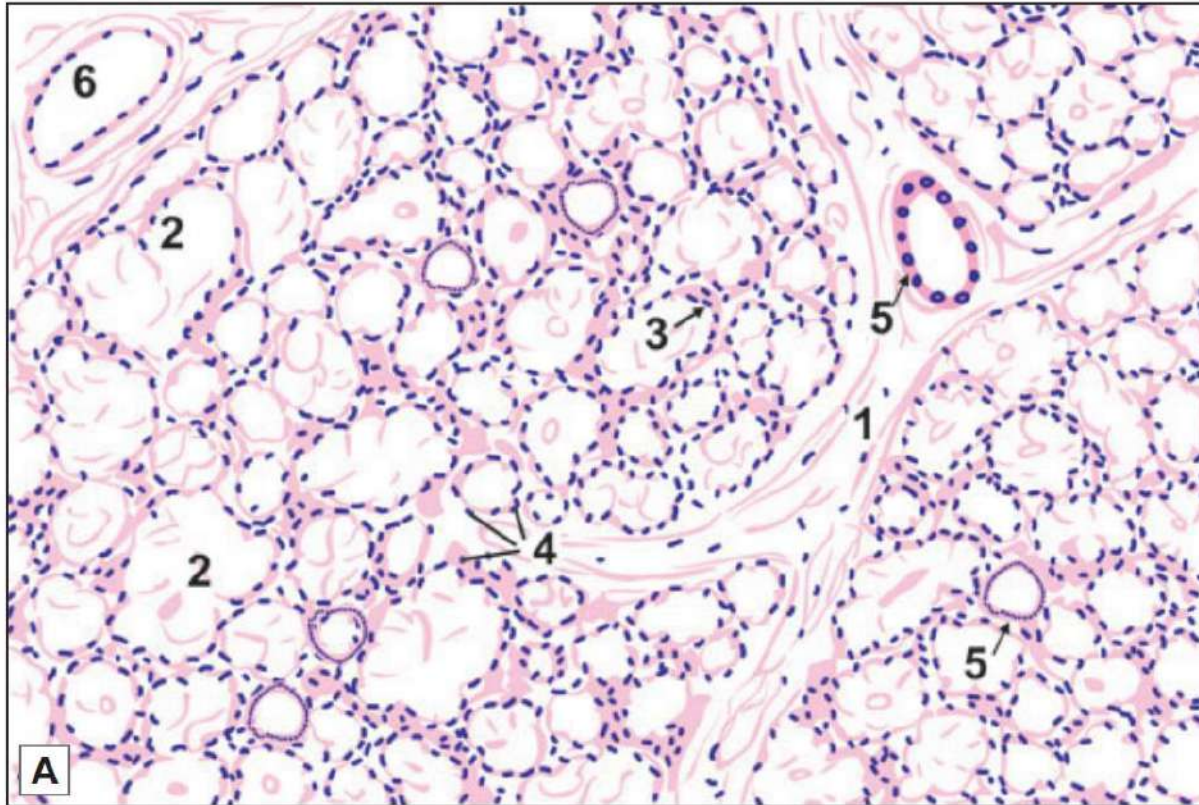
Key

1. Interlobular connective tissue septum
2. Serous acini
3. Mucous acini with serous demilune
4. Mucous acini
5. Intralobular duct
6. Adipose tissue

B
Submandibular gland (low magnification). A. As seen in drawing;
B. Photomicrograph



PLATE 15.7: Sublingual Gland

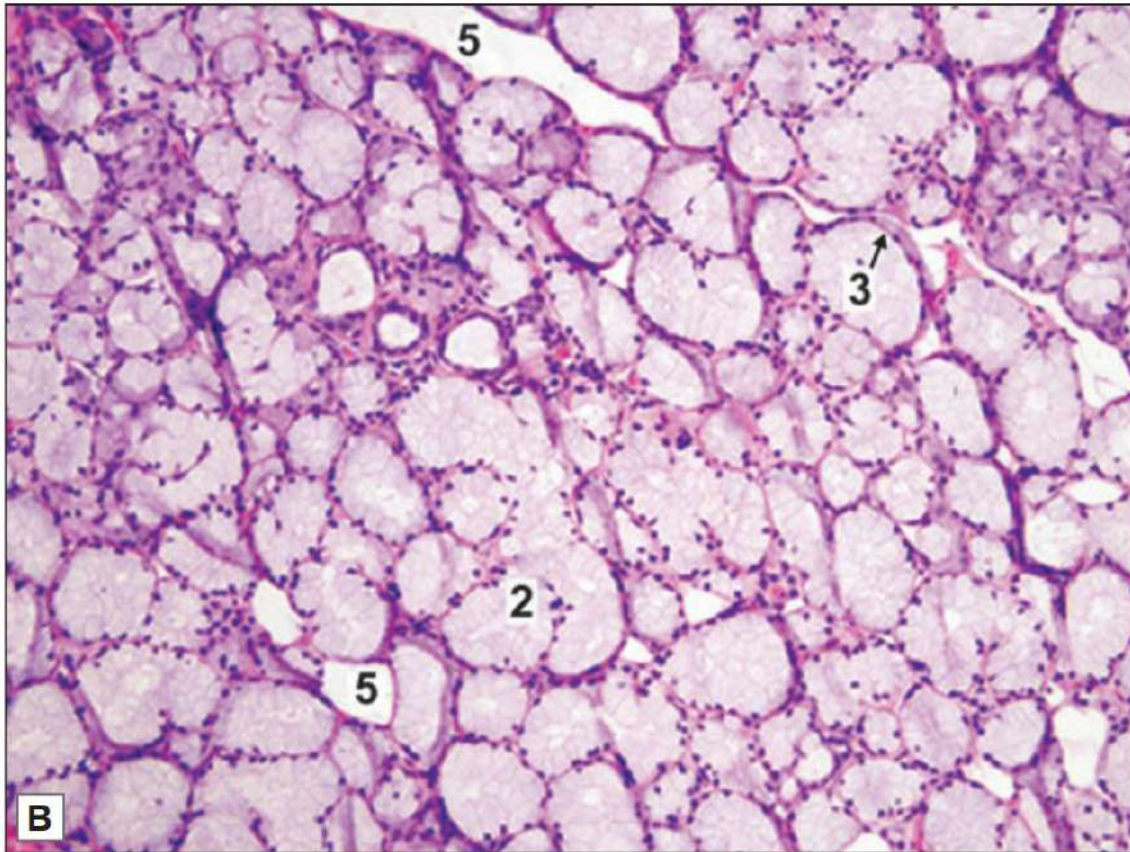


- The sublingual gland is predominantly a mucous gland but few serous acini may also be seen
- Serous demilunes may be present

Key

1. Interlobular septum
2. Mucous acini
3. Serous demilune
4. Serous acini
5. Duct
6. Capillary

Sublingual Gland



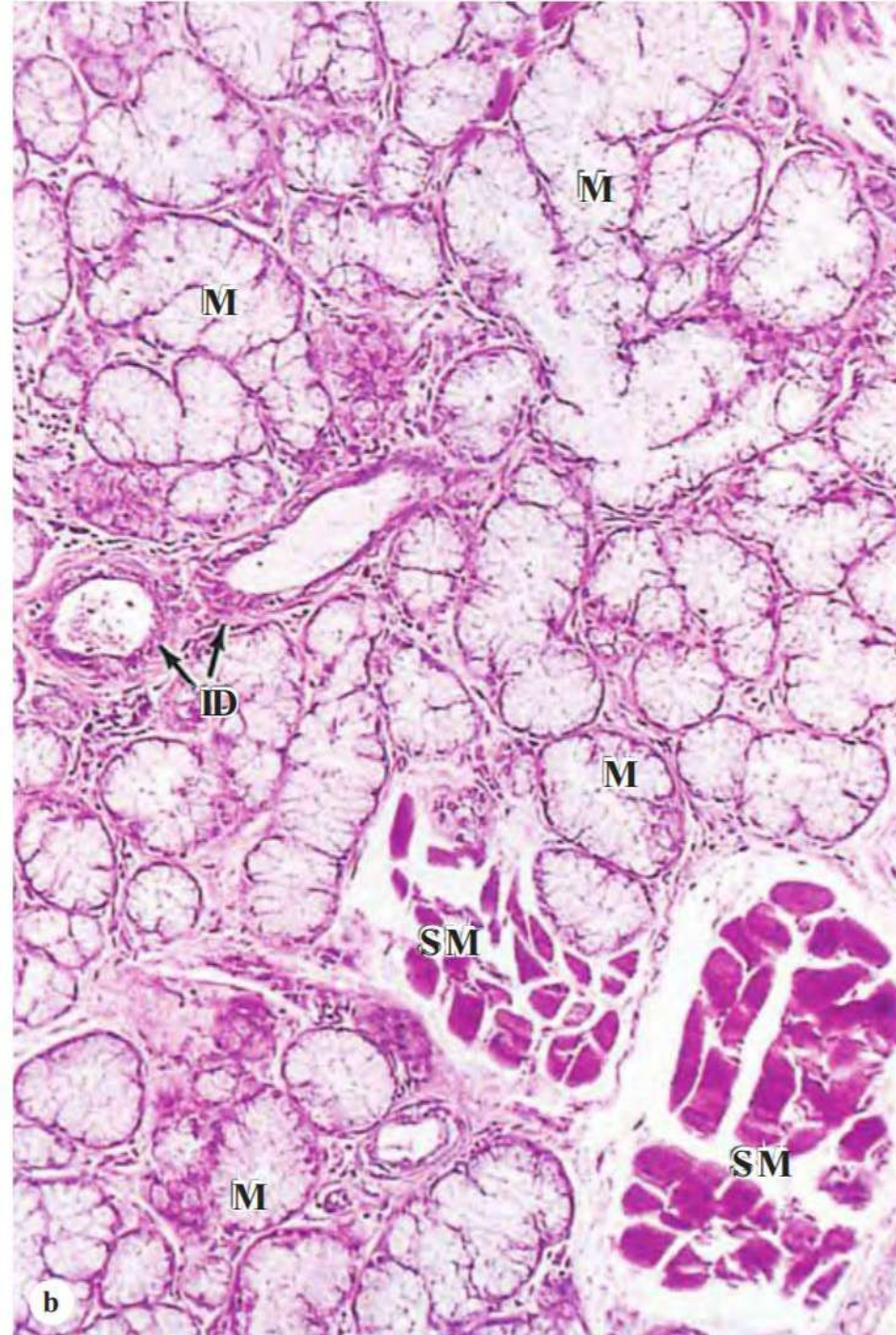
Key

1. Interlobular septum
2. Mucous acini
3. Serous demilune
4. Serous acini
5. Duct
6. Capillary

Sublingual gland. A. As seen in drawing; B. Photomicrograph

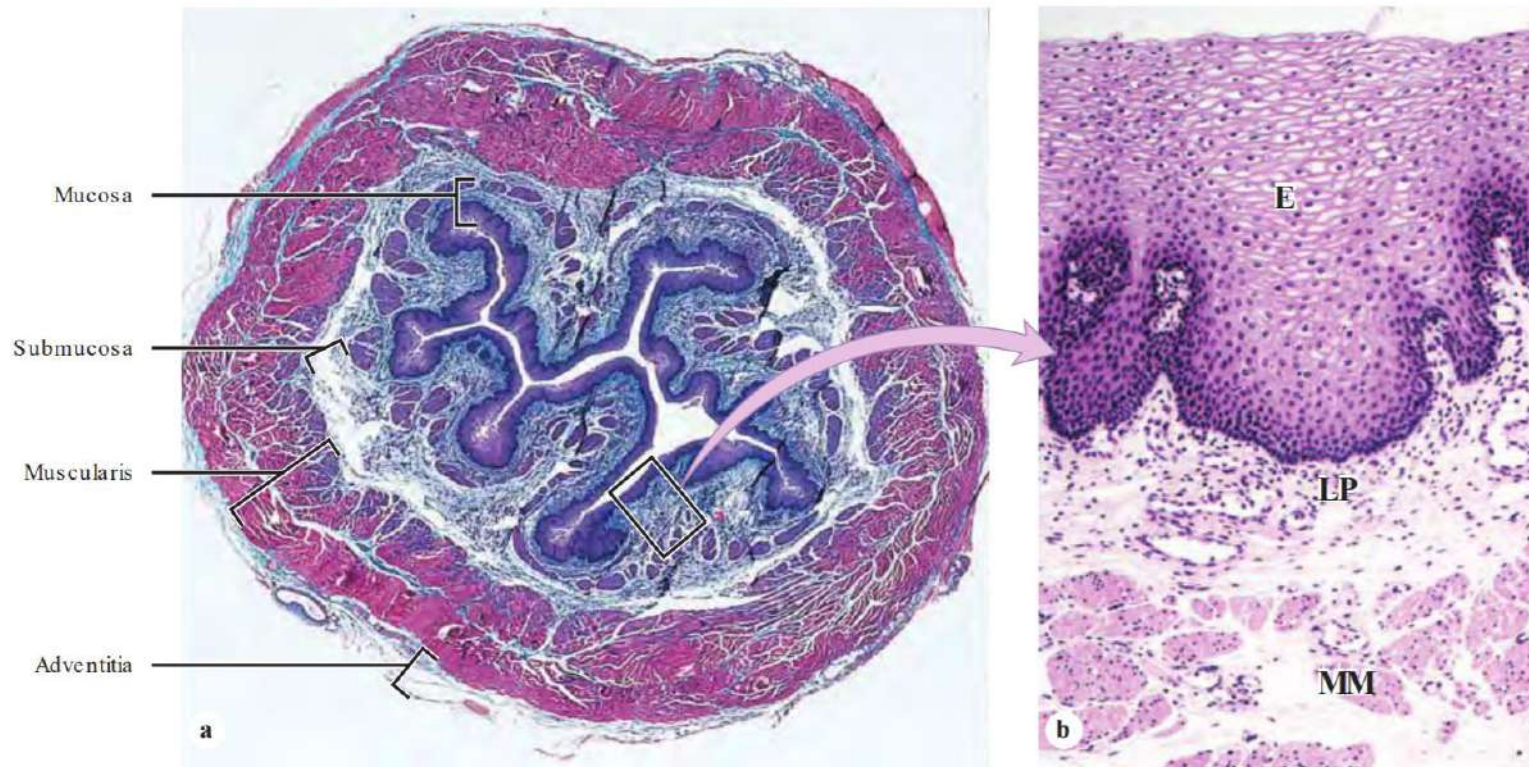
Sublingual Gland

- (b) The sublingual gland is a mixed but largely mucous gland with a tubuloacinar arrangement of poorly stained **mucous cells** (M).
- **Small intralobular ducts (ID)** are seen in connective tissue,
- as well as small fascicles of lingual striated muscle (SM).



Esophagus

FIGURE 15–12 Esophagus.



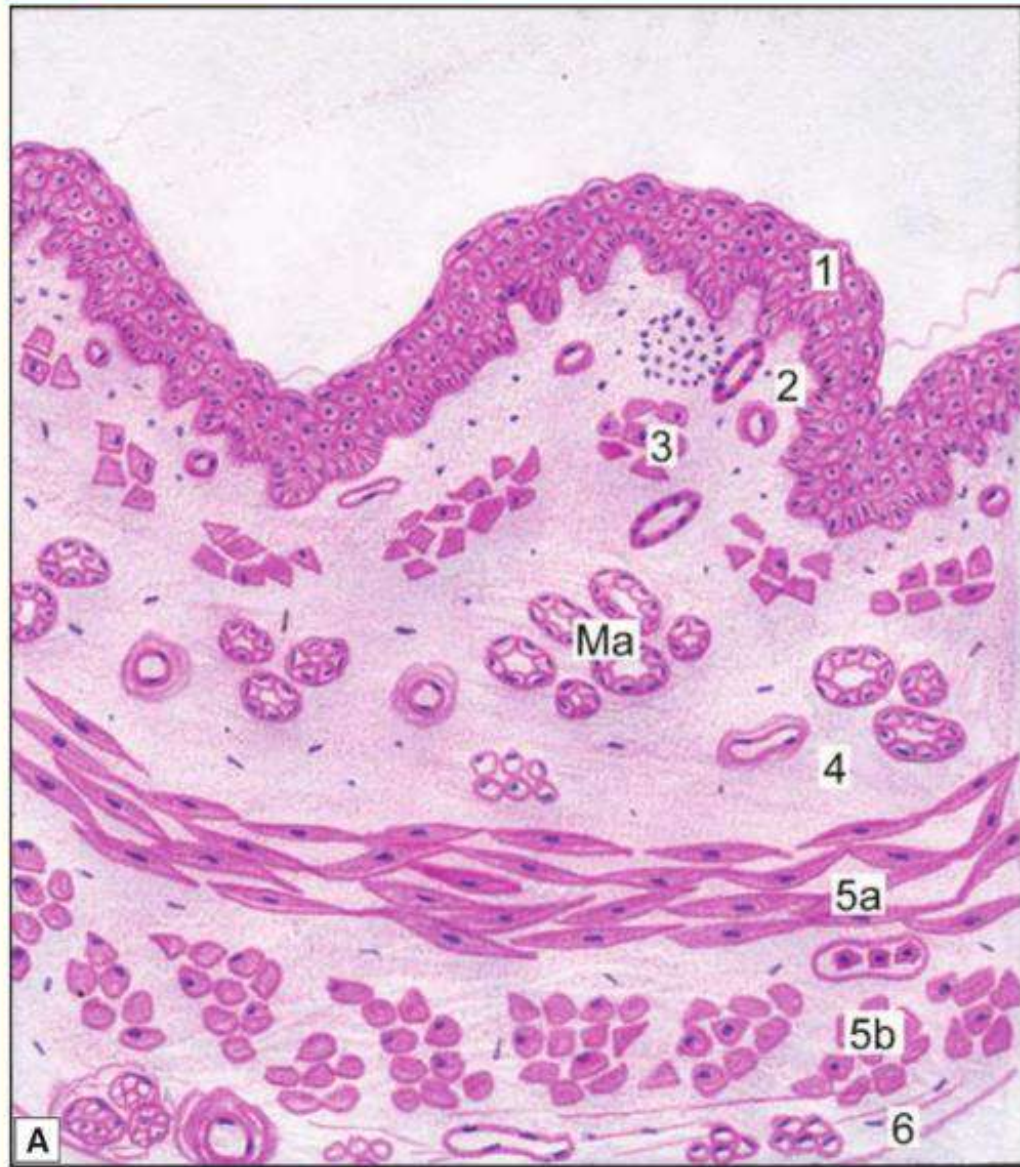
(a) In cross section the four major layers of the GI tract are clearly seen. The esophageal mucosa is folded longitudinally, with the lumen largely closed. (X10; H&E)

(b) Higher magnification of the mucosa shows the stratified squamous epithelium (**E**), the lamina propria (**LP**) with scattered lymphocytes, and strands of smooth muscle in the muscularis mucosae (**MM**). (X65; H&E)

The oesophagus is a long muscular tube beginning at the end of cricoid cartilage and opens into the cardiac end of stomach. It conducts chewed food (bolus) and liquids to stomach



PLATE 16.1: Oesophagus



In transverse section the oesophagus shows the following layers:

- ❑ Lining of non-keratinised stratified squamous epithelium
- ❑ The underlying connective tissue of the lamina propria
- ❑ The muscularis mucosae in which the muscle fibres are cut transversely
- ❑ The lining epithelium, lamina propria and muscularis mucosa collectively constitute the mucosa
- ❑ The submucosa having esophageal glands (mucous acini)
- ❑ The layer of circular muscle, and the layer of longitudinal muscle constituting the muscularis externa. In muscularis externa the muscle is of the striated variety in the upper one-third of the oesophagus, mixed in the middle one-third, and smooth in the lower one third.

Note: In the photomicrograph muscularis mucosa cannot be differentiated.

Key

1. Muscosa lined by stratified squamous epithelium
 2. Lamina propria
 3. Muscularis mucosa
 4. Submucosa displaying mucous acini.
 5. Muscularis externa
 - a. Inner circular layer
 - b. Outer circular layer
 6. Adventitia
- Ma. Mucous acini.

Esophagus



Oesophagus. A. As seen in drawing
[to be provided by author]; B. Photomicrograph

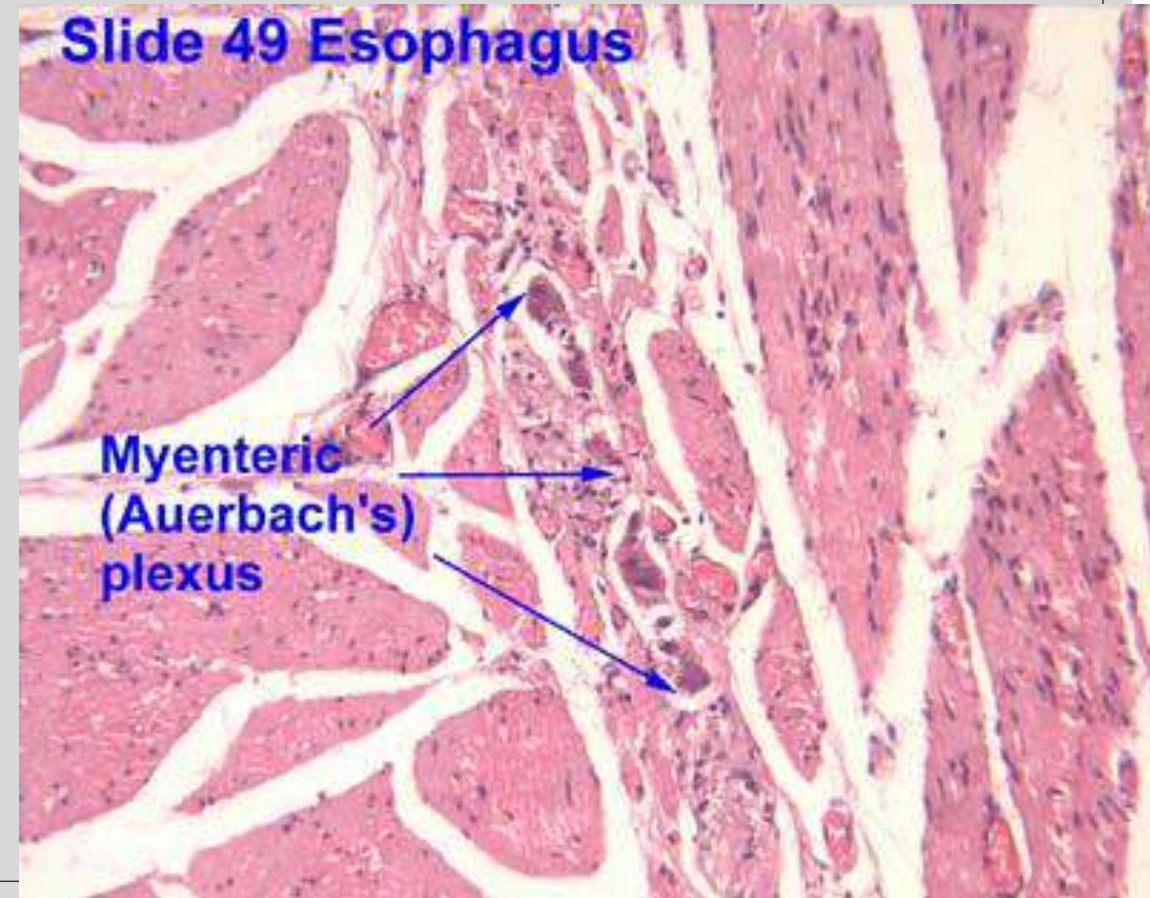
Key

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 5. Muscularis externa
 - a. Inner circular layer
 - b. Outer circular layer
 6. Adventitia
- Ma. Mucous acini.

Esophagus

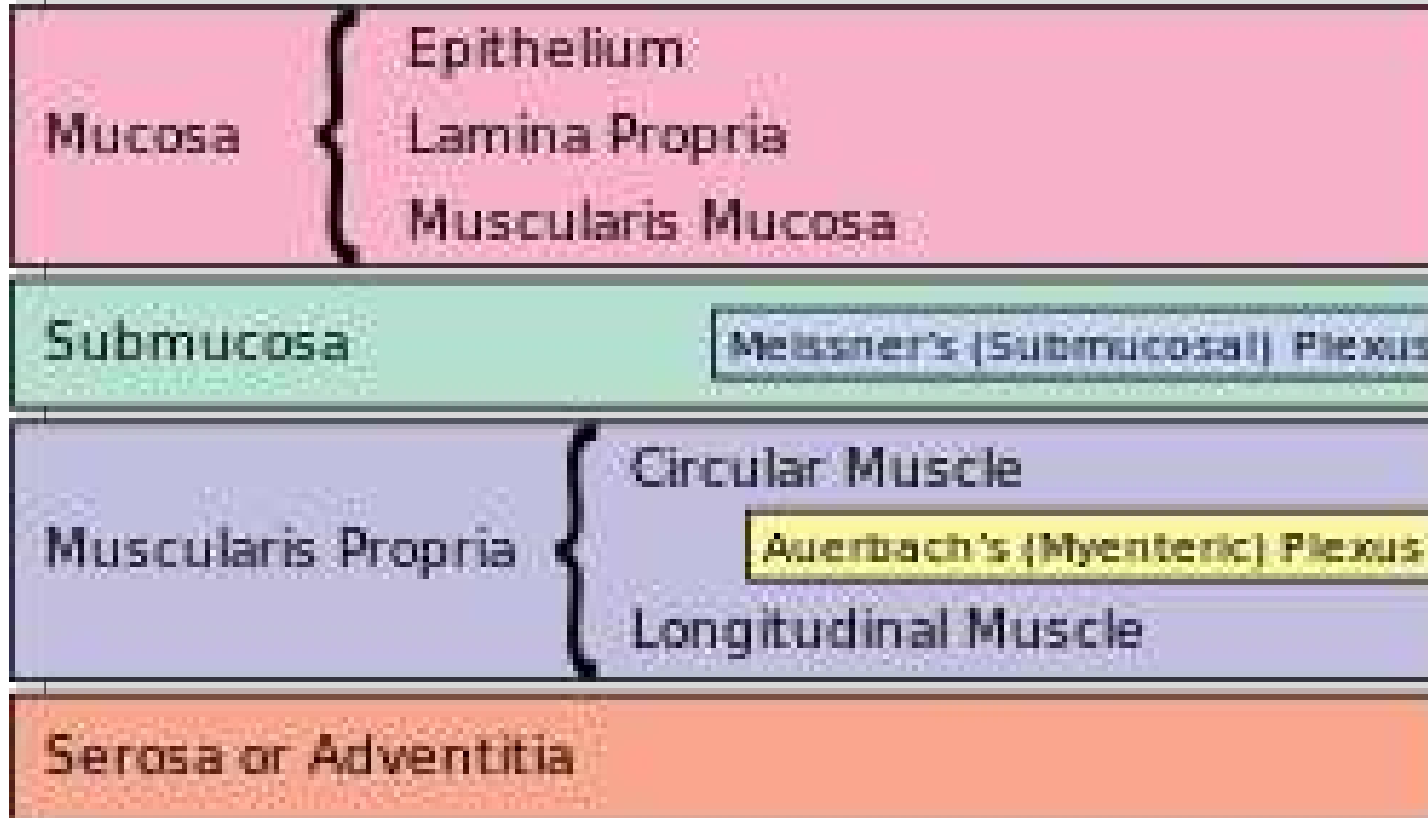
Nerve Plexuses

- The gut is richly supplied with nerves. A number of nerve plexuses are present as follows:
- %The **myenteric plexus (of Auerbach)** lies between the circular and longitudinal coats of **muscularis externa**.
- %The **submucosal plexus (of Meissner)** lies in the **submucosa** (near its **junction with the circular muscle layer**).
- %**A third plexus is present near the muscularis mucosae.**
- The nerve fibres in these plexuses are **both afferent and efferent**. The **efferent fibres supply smooth muscle and glands**.



Nerve Plexus

General Organization of the Gastrointestinal Tract



- Plexus saraf ini berada di sepanjang esophagus, gaster, dan intestine
- Contoh Penyakit yang berhubungan dengan persarafan: Achalasia Esophagus, Hirschprung's disease

TAKE NOTES

- Achalasia results from progressive degeneration of ganglion cells in the **myenteric plexus** in the esophageal wall, leading to failure of relaxation of the lower esophageal sphincter (LES), accompanied by a loss of peristalsis in the distal esophagus
- Gambaran klinis: Inability to swallow (dysphagia), which may feel like food or drink is stuck in your throat, Regurgitating food or saliva, Heartburn, Chest pain
- Pada gambaran radiologis, menggunakan kontras (Barium) ditemukan gambaran 'Bird's beak'



TAKE NOTES

- Neonatus tidak bisa BAB (mengeluarkan mekonium) pada 1-2 hari setelah lahir.
- Overall ~75% of cases present within six weeks of birth ⁴ and over 90% of cases present within the first five years of life.
- Pada rectal toucher: Feses menyemprot
- Radiologi: (Barium enema) Gambaran Saw toothed



Gaster

Tdd 4 lapisan:

1. Mukosa
2. Submukosa
3. Muskularis eksterna/muskularis propria/tunika muskularis
4. Serosa

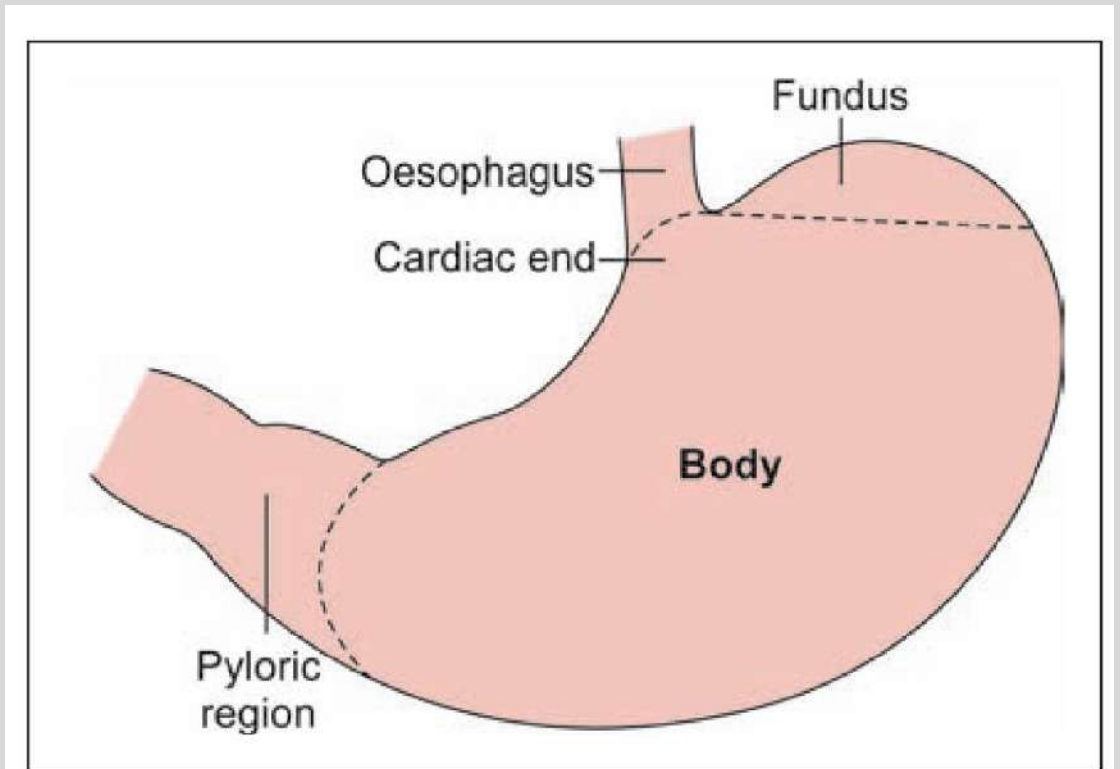
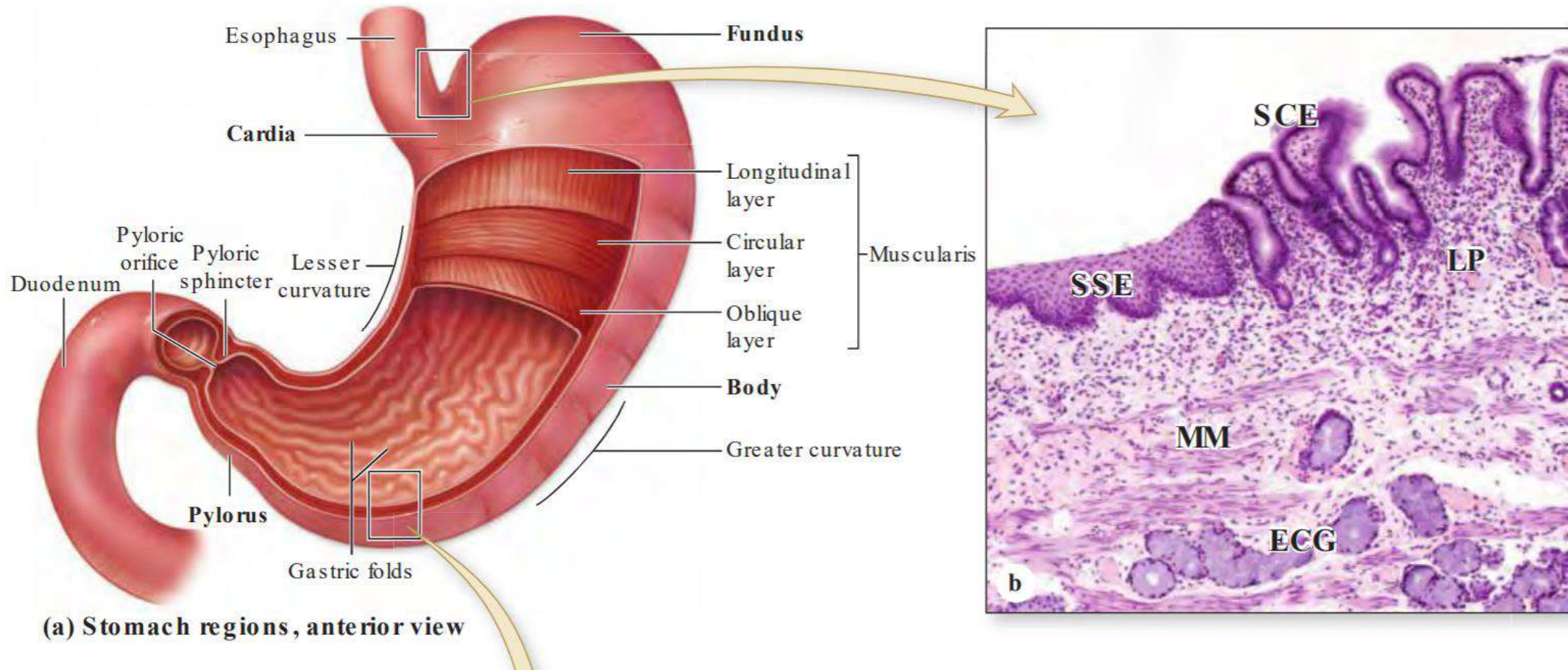


Fig. 16.3: Anatomical regions of stomach
(Schematic representation)

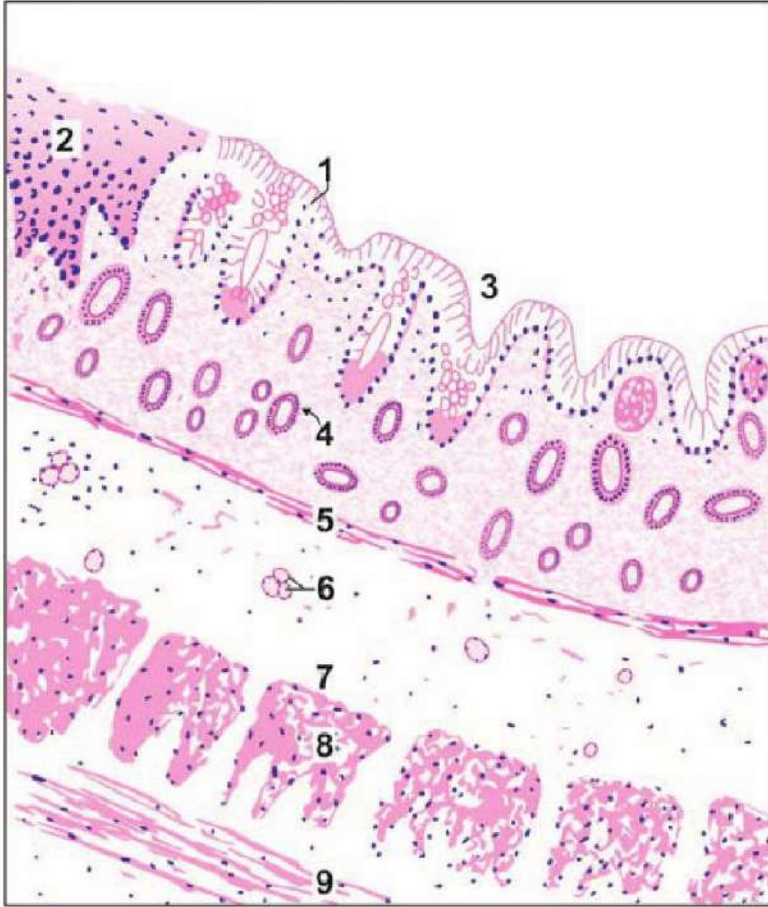
FIGURE 15–14 Stomach.



- At the esophagogastric junction, stratified squamous epithelium (SSE) lining the esophagus is abruptly replaced by simple columnar epithelium (SCE) of the stomach. Also seen here are the mucous esophageal cardiac glands (ECG) beneath the lamina propria (LP) and muscularis mucosae (MM). (X60; H&E)



PLATE 16.2: Stomach (Cardia)



Stomach (cardia). As seen in drawing

Key

- | | |
|--|-----------------------------------|
| 1. Columnar epithelium | 5. Muscularis mucosae |
| 2. Stratified squamous lining of lower end of oesophagus | 6. Oesophageal gland in submucosa |
| 3. Gastric pit | 7. Submucosa |
| 4. Cardiac gland in mucosa | 8. Circular muscle |
| | 9. Longitudinal muscle |

- At low magnification, the cardiac end of stomach shows all the four layers seen in stomach:
 - Mucosa
 - Submucosa
 - Muscularis externa
 - Serosa
- At its cardiac end the stomach is lined by simple columnar cells. The epithelium is sharply demarcated from the stratified squamous epithelium lining the lower end of the oesophagus
- Important distinguishing points of cardiac end of stomach are the columnar epithelium lining, the absence of goblet cells, and the simple tubular nature of cardiac glands. If the lower end of the oesophagus is included in the section, the diagnosis becomes obvious (as seen in the drawing).

Gaster

‰**Foveola cells**/surface mucous **cells** are mucus-producing **cells** which cover the inside of the stomach, protecting it from the corrosive nature of gastric acid.

- **Chief cells:** The most numerous cells are called **chief cells, peptic cells, or zymogen cells**. They are particularly numerous in **the basal parts of the glands**. The cells are **cuboidal or low columnar**. Their **cytoplasm is basophilic**. The granules contain pepsinogen that is a precursor of pepsin.

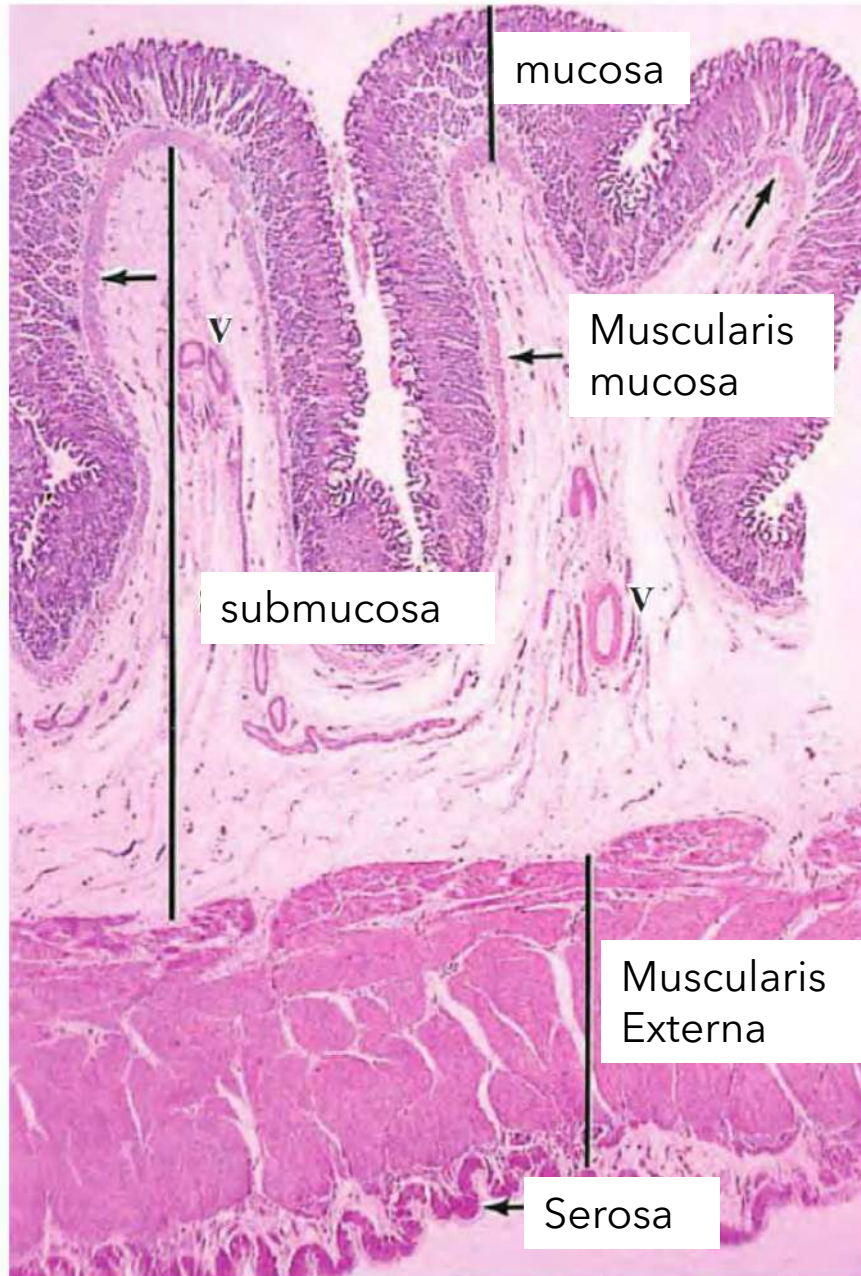
The luminal surfaces of the cells bear small irregular **microvilli**.

Note: **Chief cells secrete the digestive enzymes of the stomach including pepsin**. Pepsin breaks down proteins into small peptides.

‰**Oxyntic cells** or **parietal cells** are large, ovoid or polyhedral, with a large central nucleus. They are present **singly, amongst the peptic cells**. They are more numerous in the **upper half of the gland** than in its lower half.

- They are called **oxyntic cells** because they stain strongly with **eosin**.
- Parietal cells produce gastric acid (**hydrochloric acid**) in response to histamine (via H₂ receptors), acetylcholine (M₃ receptors) and gastrin (gastrin receptors).

FIGURE 15–15 Wall of the stomach with rugae.

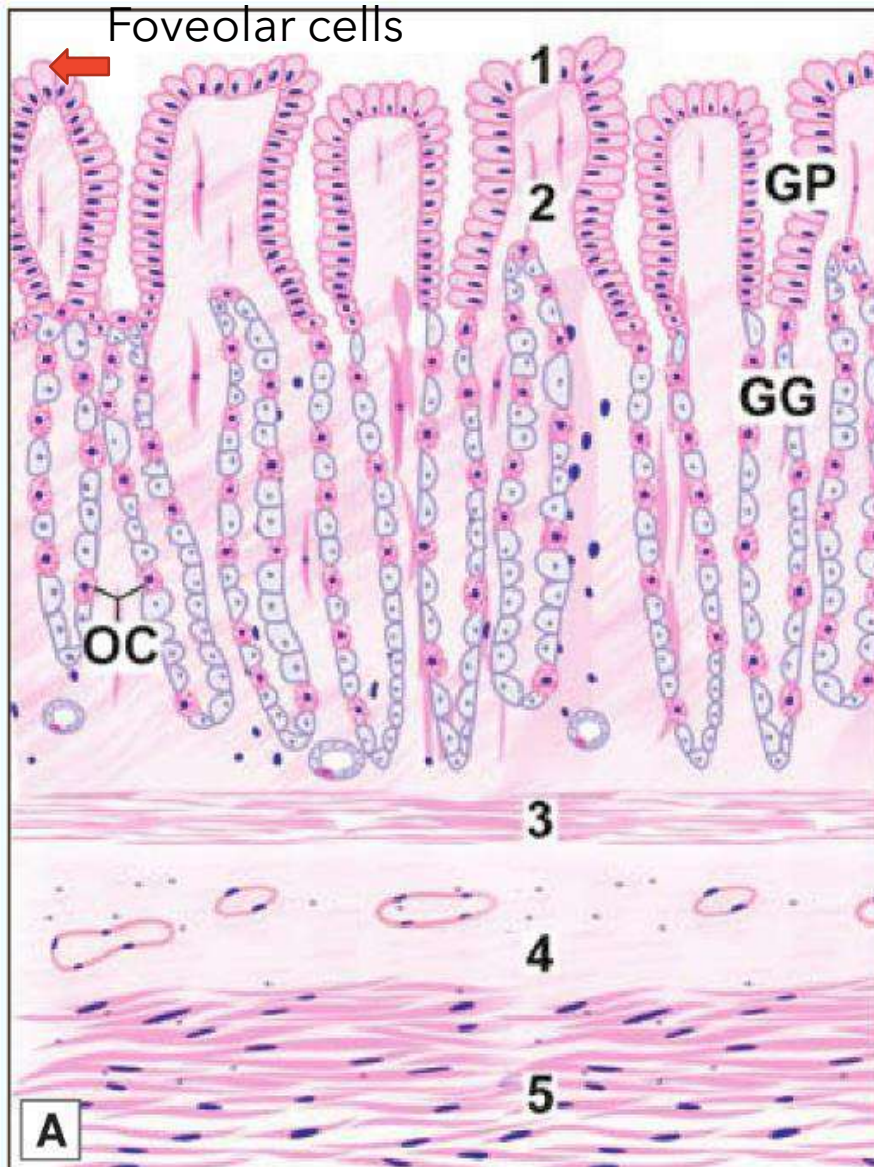


Fundus

- Mucosa dilapisi epitel kolumnar selapis **tidak bergoblet**
- Subepitelial tampak lamina proria tdd kelenjar seromukosa, dilapisi epitel kolumnar selapis tidak bergoblet.
- Dibawah muscularis mucosa adalah submucosa, dan dibawah submucosa adalah Tunika muscularis/muscularis externa
- Lapisan terluar adalah serosa

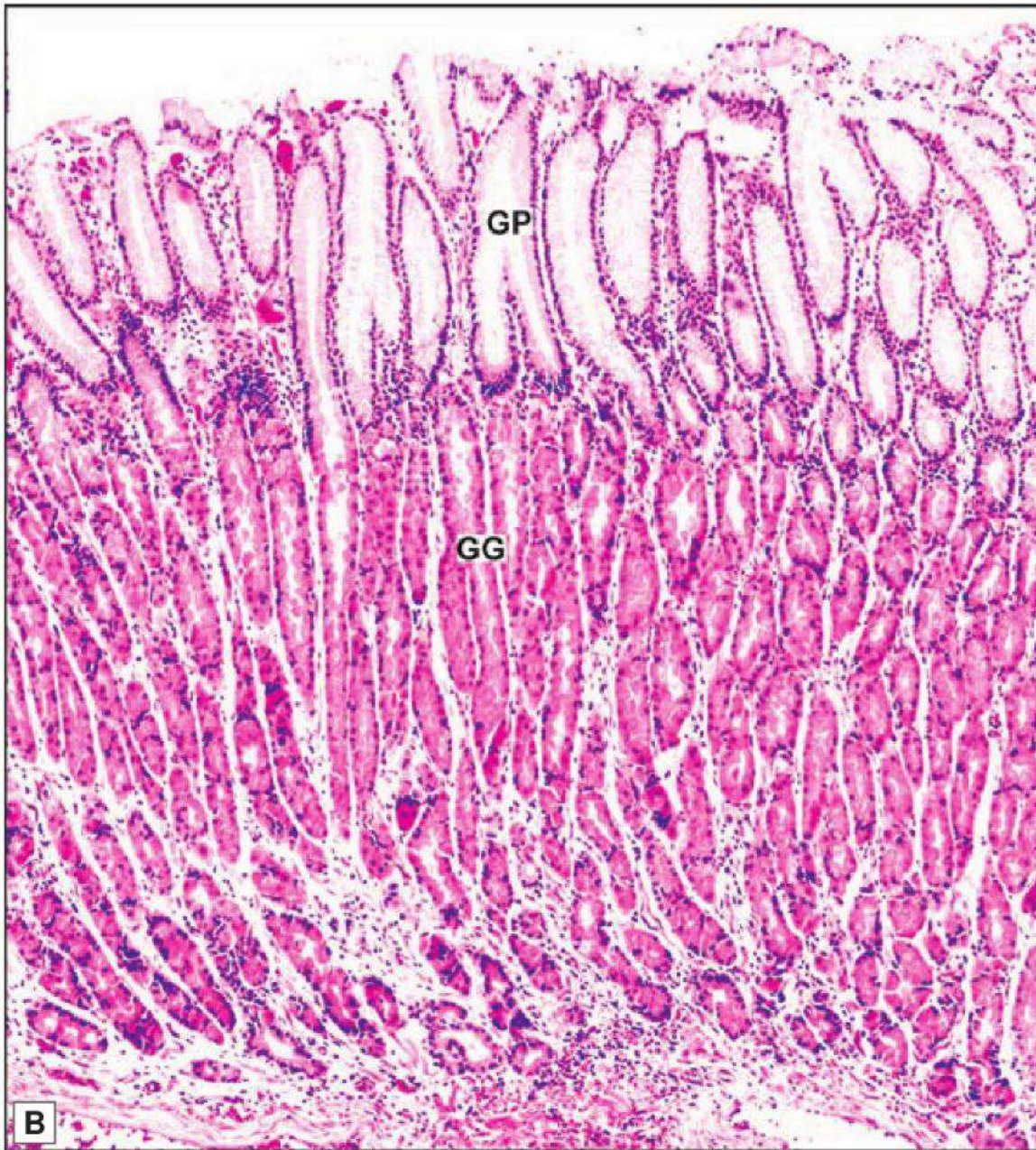


PLATE 16.3: Stomach (Body/Fundus)



The basic structure of stomach is similar to oesophagus i.e. it is composed of:

- Mucosa
 - Submucosa
 - Muscularis externa
 - Serosa
- Mucosa is lined by simple tall columnar epithelium. It shows invaginations called gastric pits that occupy the superficial one fourth of the mucosa
- The area between the pits and the muscularis mucosae is packed with tubular gastric glands. The glands are lined mainly by blue staining chief cells or peptic cells. Amongst these there are pink staining oxyntic cells. These are large cells that are placed peripherally in the wall of the gland. They are more numerous in the upper parts of the gastric glands. The main point to note is that in the region of the glands we see different types of cells that appear to be closely packed together



Stomach (body/fundus). A. As seen in drawing; B. Photomicrograph

□ Muscularis externa is composed of three layers of smooth muscle—inner oblique, middle circular and outer longitudinal.

A photomicrograph of the body of the stomach is shown in Plate 16.3B. The gastric pits and gastric glands can be distinguished. Observe that the gastric pits occupy the upper one fourth of the lamina propria of mucosa.

Key

1. Columnar epithelium lining
 2. Lamina propria
 3. Muscularis mucosa
 4. Submucosa
 5. Muscularis externa
- GP. Gastric pit
GG. Gastric gland
OC. Oxyntic cells

Stomach (corpus/ fundus)

- Muscularis Externa tdd: otot sirkular, oblique dan longitudinal
- Gastric Pit meliputi $\frac{1}{4}$ spf mucosa



PLATE 16.4: Stomach (Pylorus)



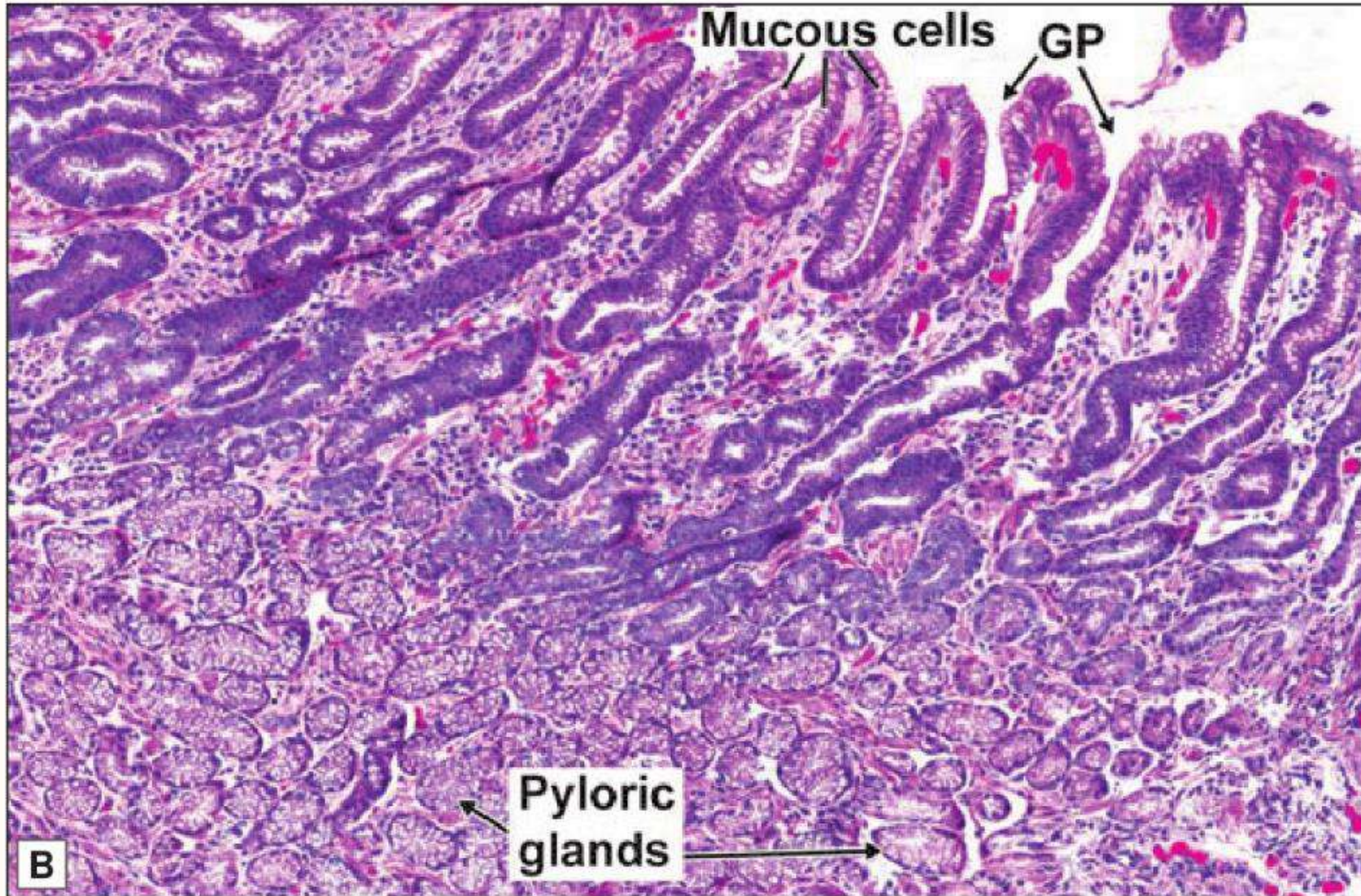
Pylorus

- Gastric Pit lebih dalam drpd corpus, meliputi 1/3 dari mucosa
- Bagian dalam pit, tampak mucous secreting cells
- Gaster tdk memiliki Villi seperti di Usus, Gaster memiliki lipatan gastric pit dengan bagian dasar yg berupa jaringan ikat yang berhubungan

Key

1. Columnar epithelium lining
 2. Lamina propria
 3. Muscularis mucosa
 4. Submucosa
 5. Muscularis externa
 6. Pyloric gland
- GP. Gastric pit

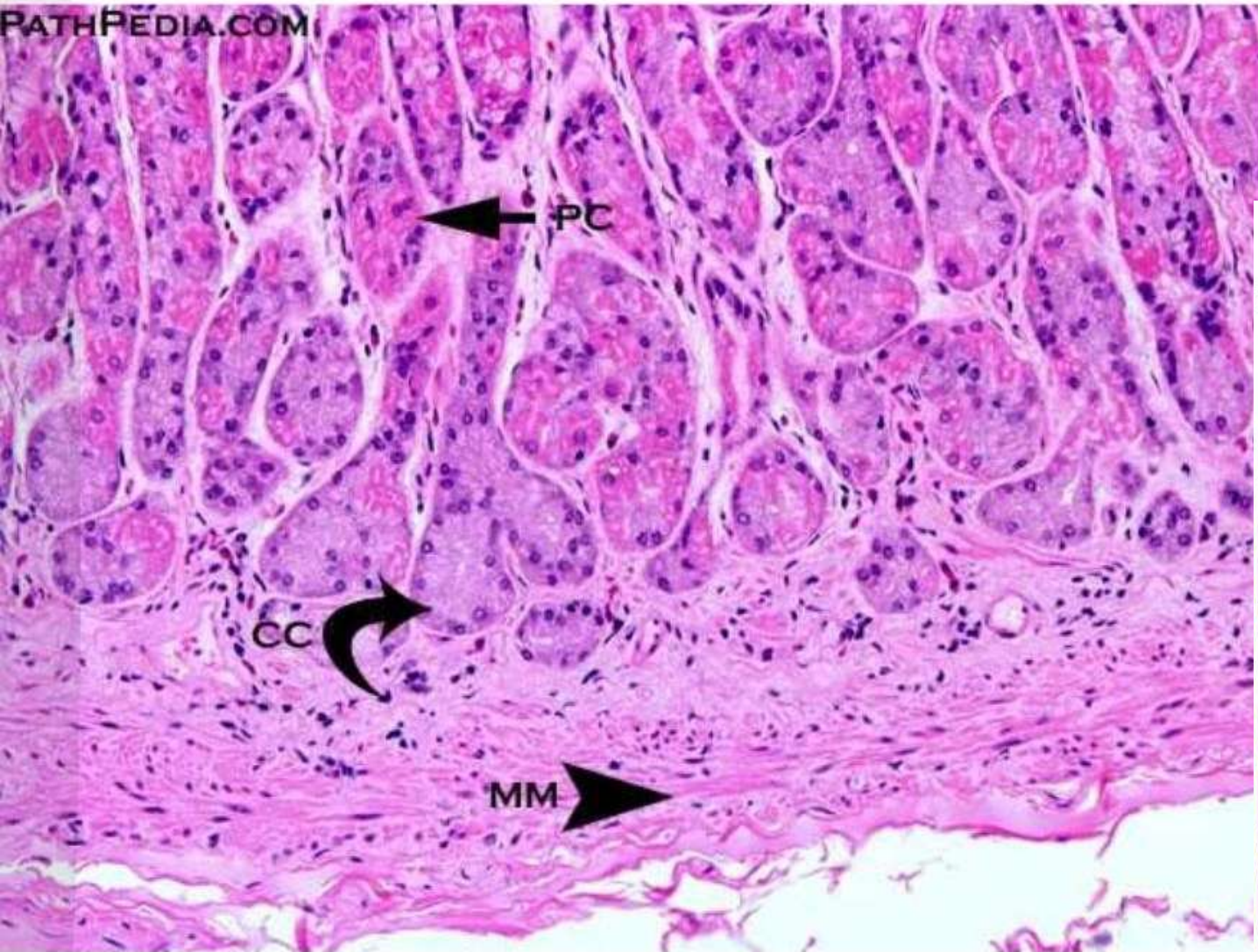
Gaster (pyloric)



Key

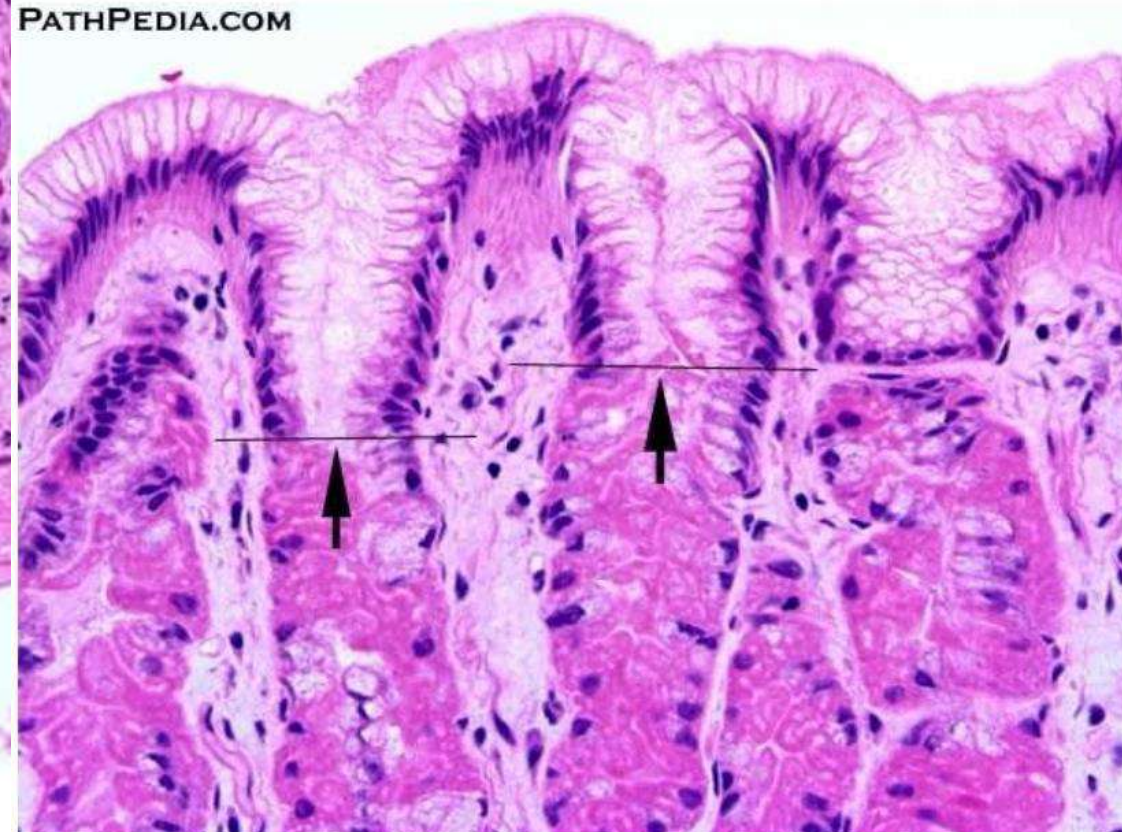
1. Columnar epithelium lining
 2. Lamina propria
 3. Muscularis mucosa
 4. Submucosa
 5. Muscularis externa
 6. Pyloric gland
- GP. Gastric pit

Stomach



[STOMACH HISTOLOGY]. Chief cells are mostly present in the lower half of gastric glands. The chief cells (CC, curved arrow) are characterized by basophilic / purple appearance due to the presence of abundant ribosomal RNA involved in pepsinogen synthesis. The parietal cells (PC, top arrow) appear eosinophilic because of numerous mitochondria and synthesize hydrochloric acid and lipase. The mucosa is separated from submucosa by muscularis mucosa (MM, bottom arrowhead).

Stomach

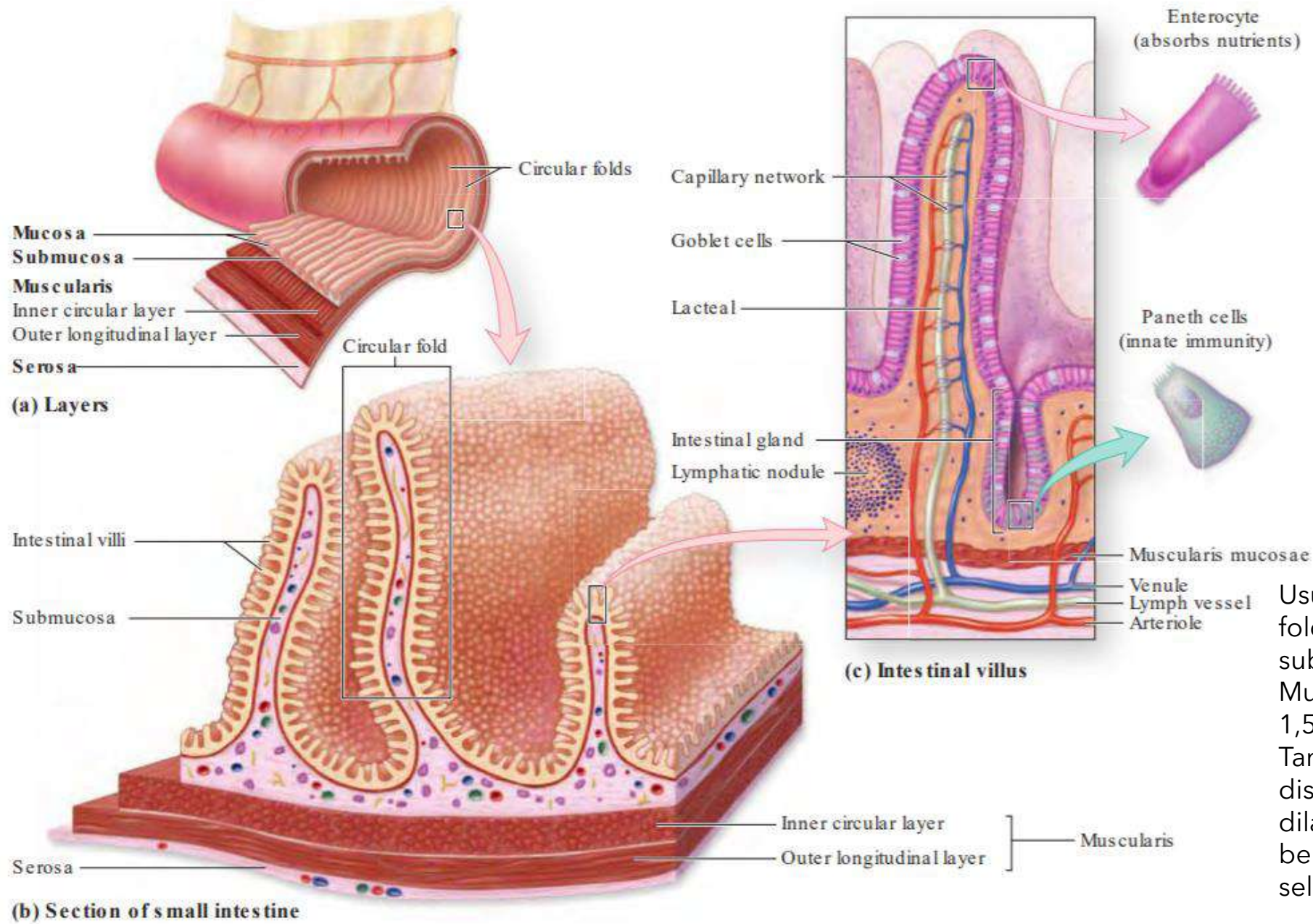


[STOMACH HISTOLOGY]. The parietal cells present just underneath the mucous neck cells show brightly eosinophilic cytoplasm. The mucous neck cells, present just above the upper portion of glands lined mostly by parietal cells (horizontal lines) contain lesser mucus and continuous above with foveolar cells. Note the presence of a layer of mucus on surface epithelium.

The SMALL iNTESTiNE

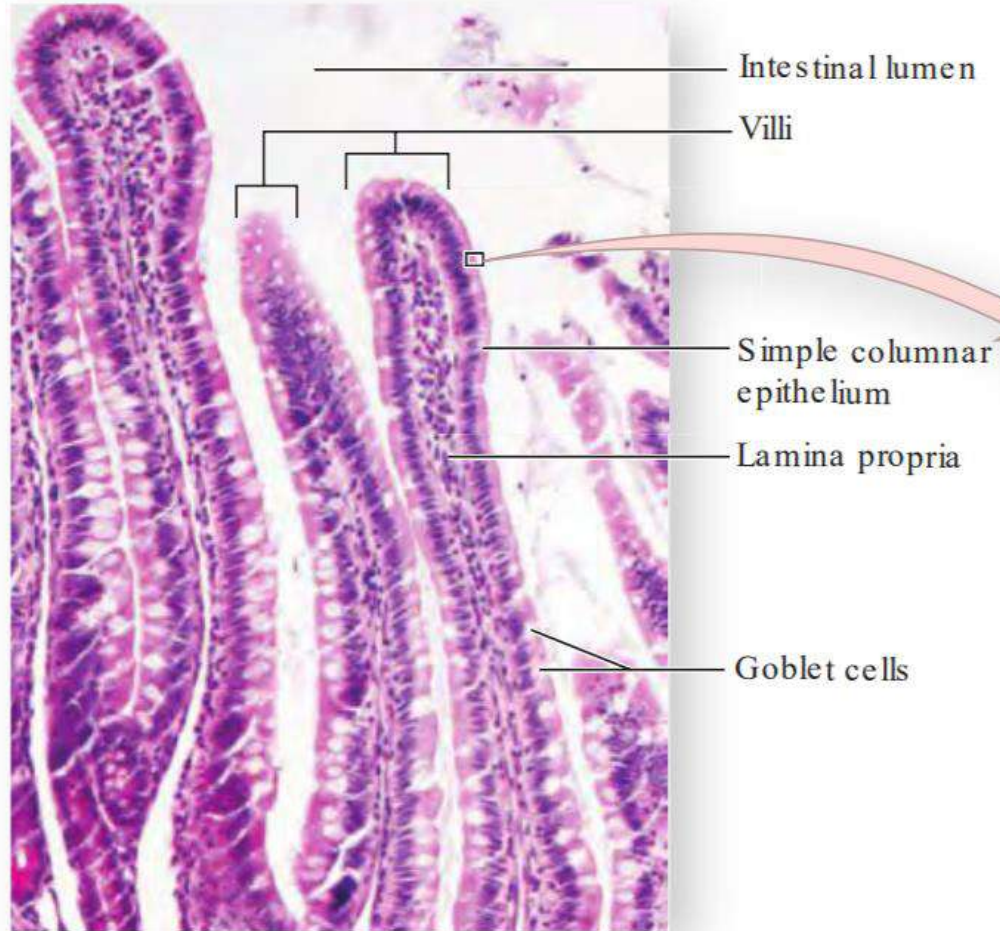
- The small intestine is a tube about **five meters long**. It is divided into three parts.
- These are (in craniocaudal sequence) the **duodenum** (about 25 cm long);
- **the jejunum** (about 2 meters long);
- **the ileum** (about 3 meters long).
- It is the principal site for **absorption** of products of digestion.
- **It also secretes some hormones through enteroendocrine cells.**
Digestion is completed in small intestine.

FIGURE 15–22 Absorptive surface of the small intestine.

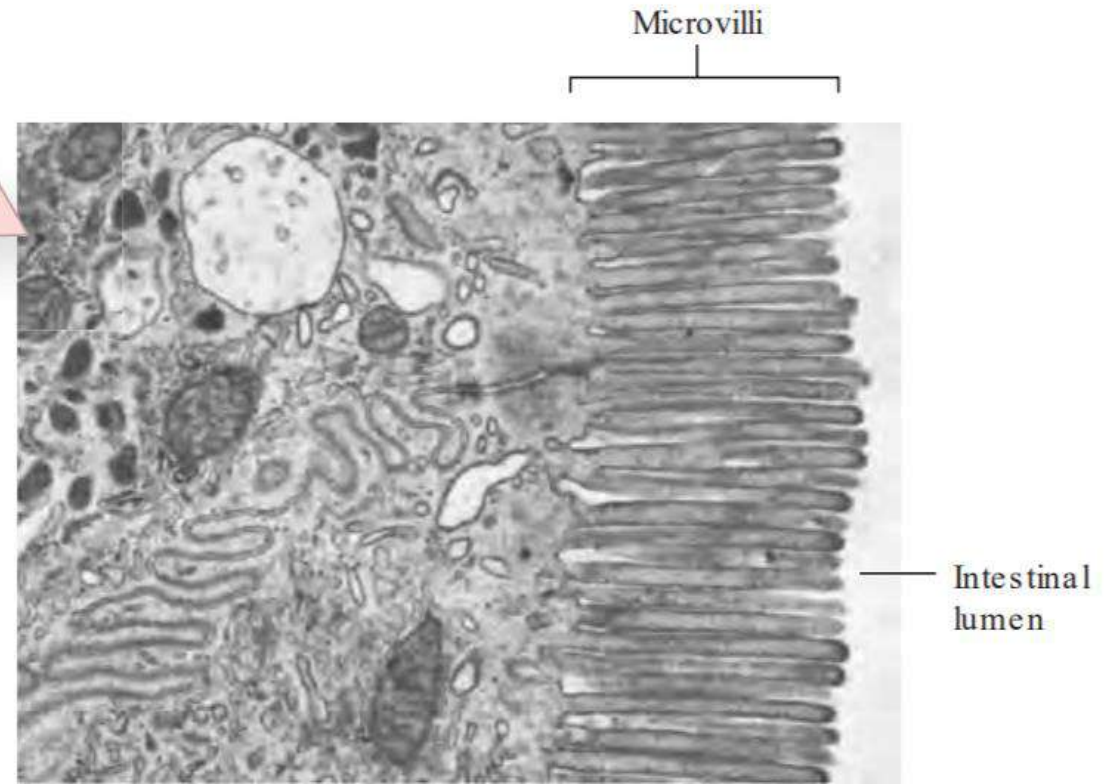


Usus halus terdiri dari semilunar fold/lipatan sirkular yg tdd mukosa dan submukosa.
 Mukosa usus halus sangat tipis (0,5-1,5mm)
 Tampak penonjolan mukosa yang disebut **villi (Finger-like projection)** dilapisi epitel kolumnar selapis bergoblet yang dilengkapi enterosit dan sel goblet

Usus Halus



(d) Intestinal villi

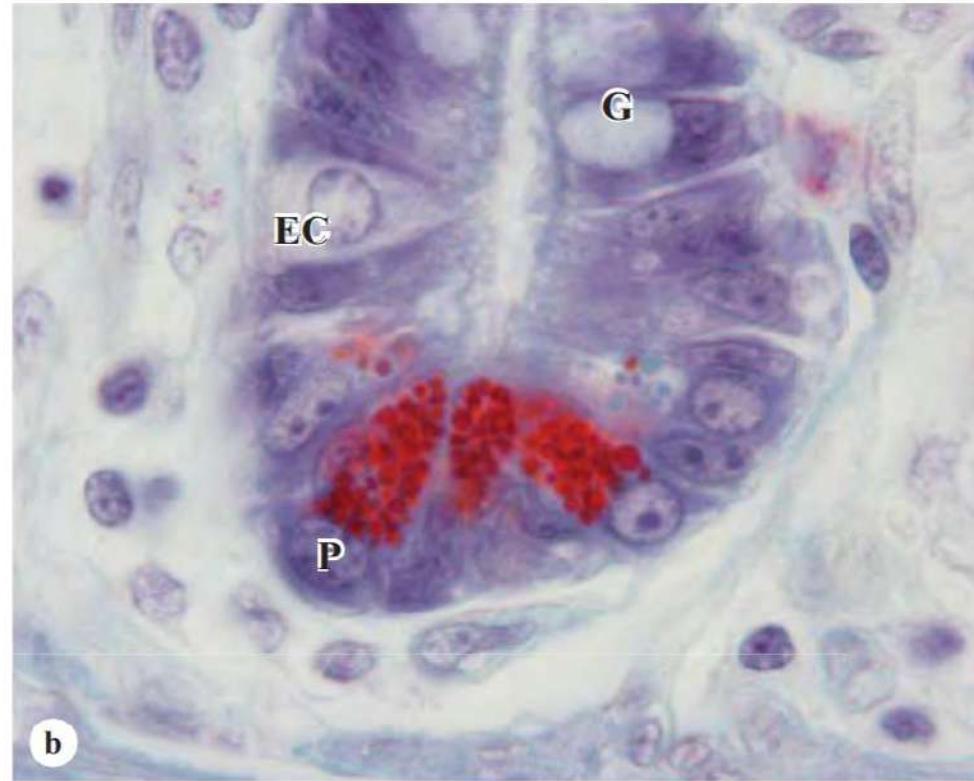
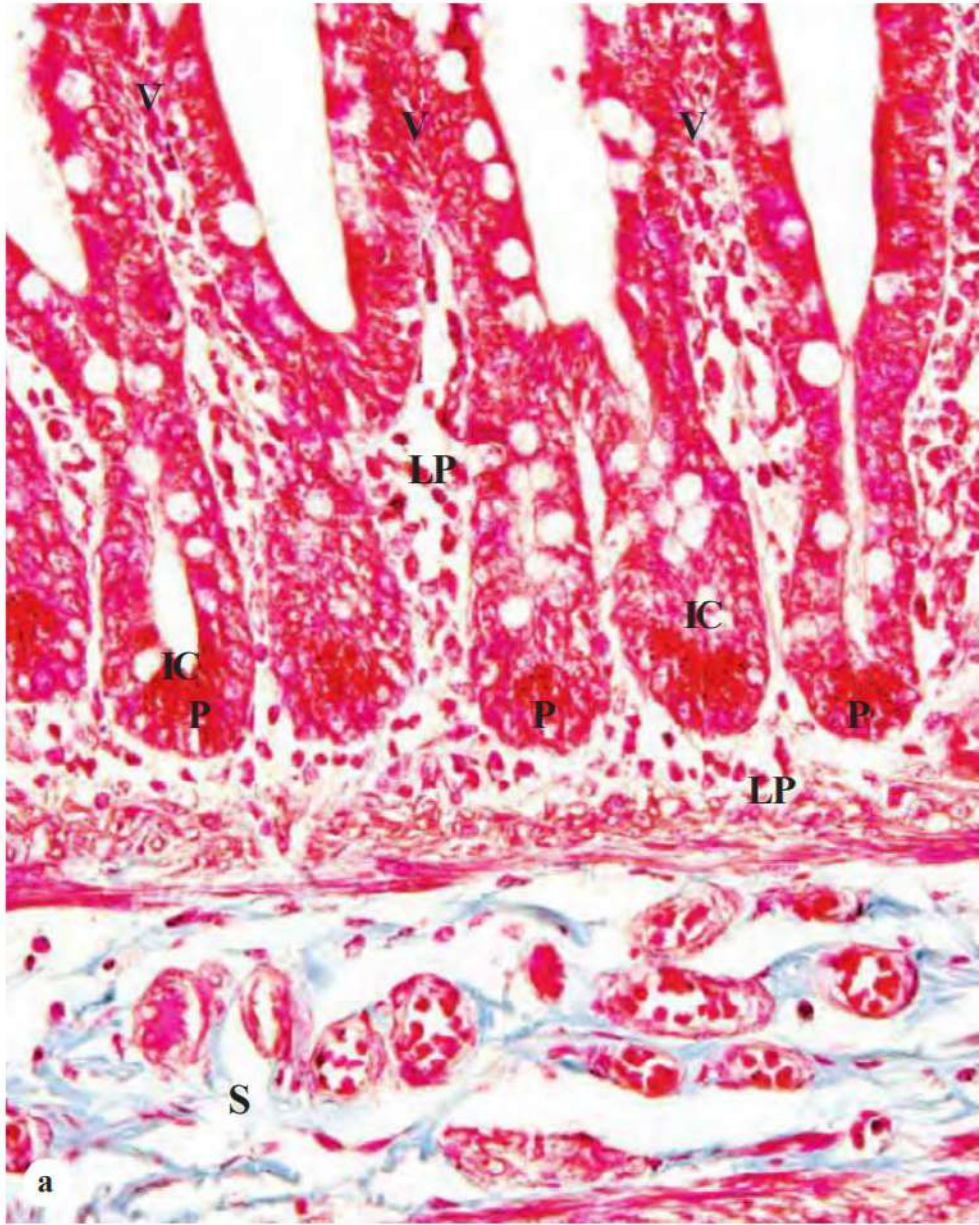


(e) Microvilli

Sel-sel pada Usus Halus

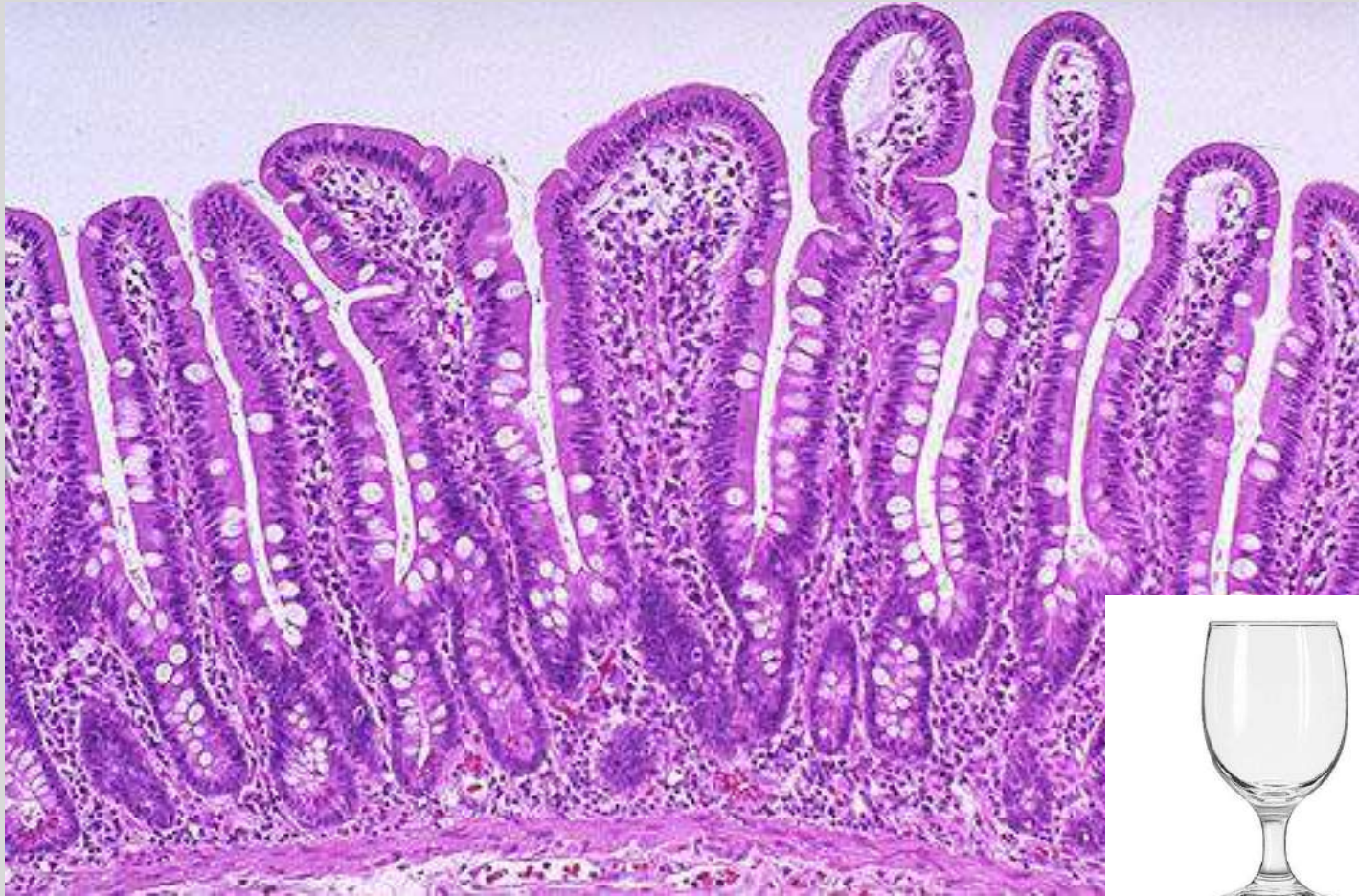
- **Enterosit**, the **absorptive** cells, sel kolumnar tinggi, dengan inti di basal. Apikal dari enterosit tampak brush border. Pada mikroskop electron: **brush border** adalah mikrovili dilapisi glycocalyx dimana nutrisi akan diambil kedalam sel
- **Sel Goblet** tersebar diantara enterosit ➔ **mensekresi musin glikoprotein** yang akan melubrikasi dan melindungi dinding usus
- **Sel Paneth** pada basal kriptus usus, adalah sel eksokrin dengan **granul eosinofilik pada apical sitoplasma.** ➔ menghasilkan lisozim, phospholipase A2 , dan hydrophobic peptides yang disebut **defensins** ➔ membunuh bakteri dan mikroorganisme : sistem imun bawaan
- **Sel Enteroendocrine** jumlahnya bervariasi tergantung Panjang usus halus ➔ **sekresi berbagai hormone peptide**

FIGURE 15–26 Intestinal crypts or glands, with Paneth cells.



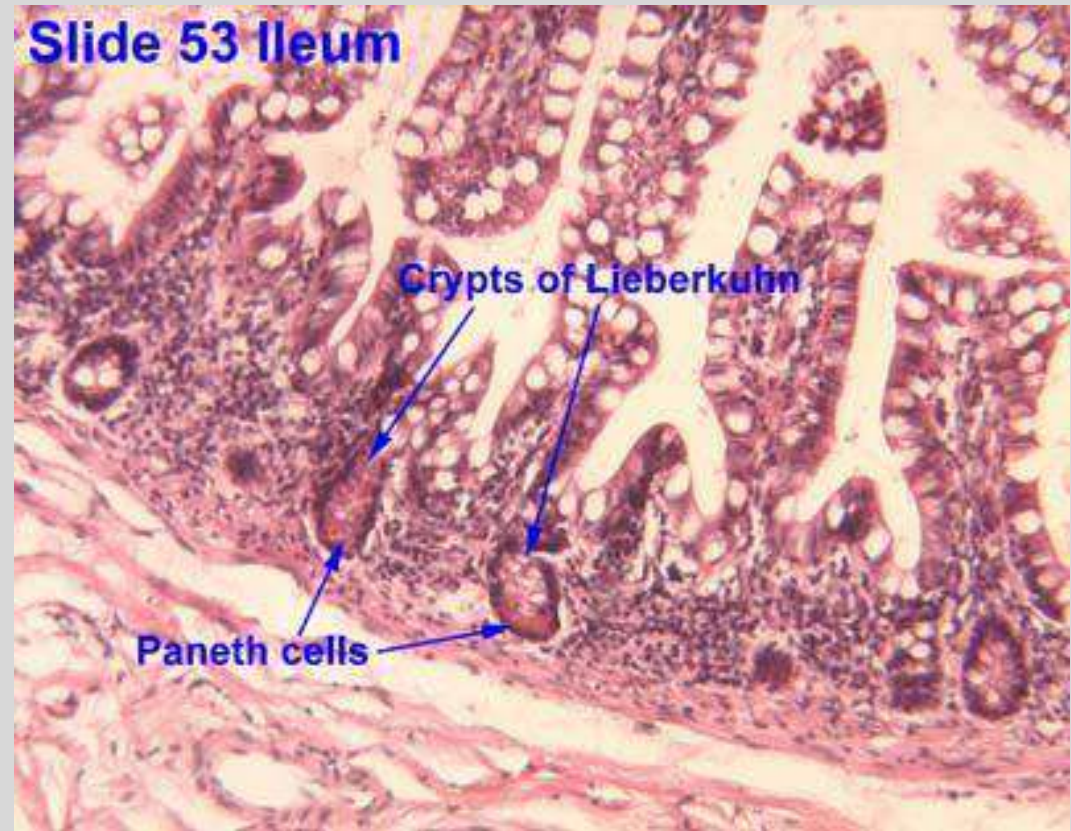
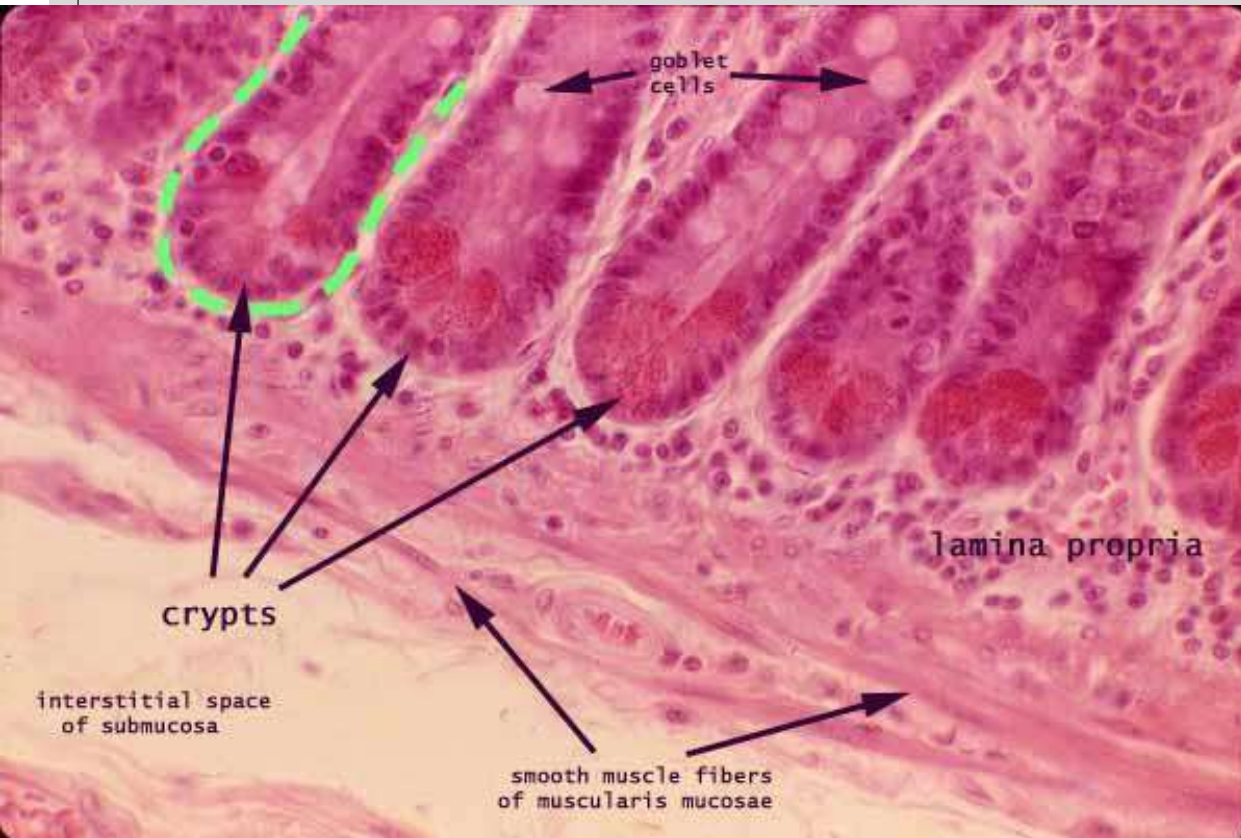
- P: Sel Paneth bergranul eosinofilik
- G: Sel Goblet
- EC: Sel Enteroendocrine
- IC: Intestinal Crypt, LP: Lamina Propria
- V: Vili, S: Submukosa

Goblet Cells



- Setiap sel goblet melebar pada bagian atas karena memiliki **mucin granules**
- Inti sel goblet flat pada bagian dasar.
- Sel goblet menghasilkan mukus
- Sel memiliki **microvilli** ireguler.
- **In haematoxylin and eosin stained preparations, the mucin content of goblet cells appears to be unstained.** It stains brightly with the PAS technique.
- **Mucous cells increase in number as we pass down the small intestine, being few in the duodenum and most numerous in the terminal ileum.**

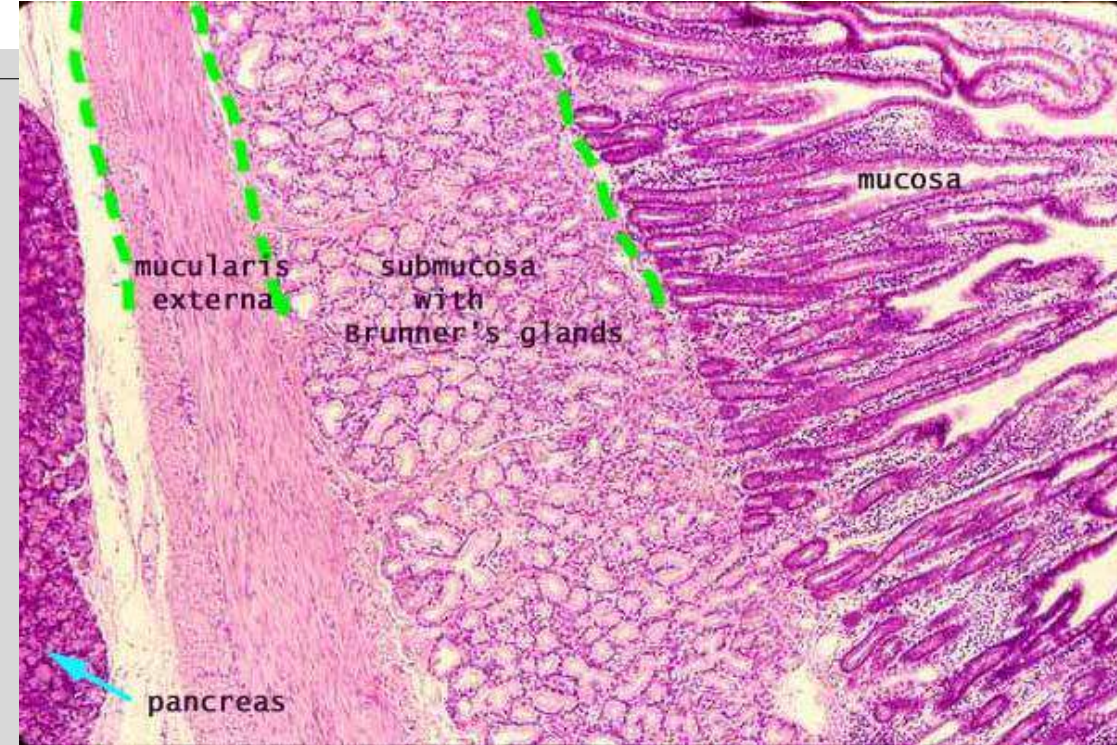
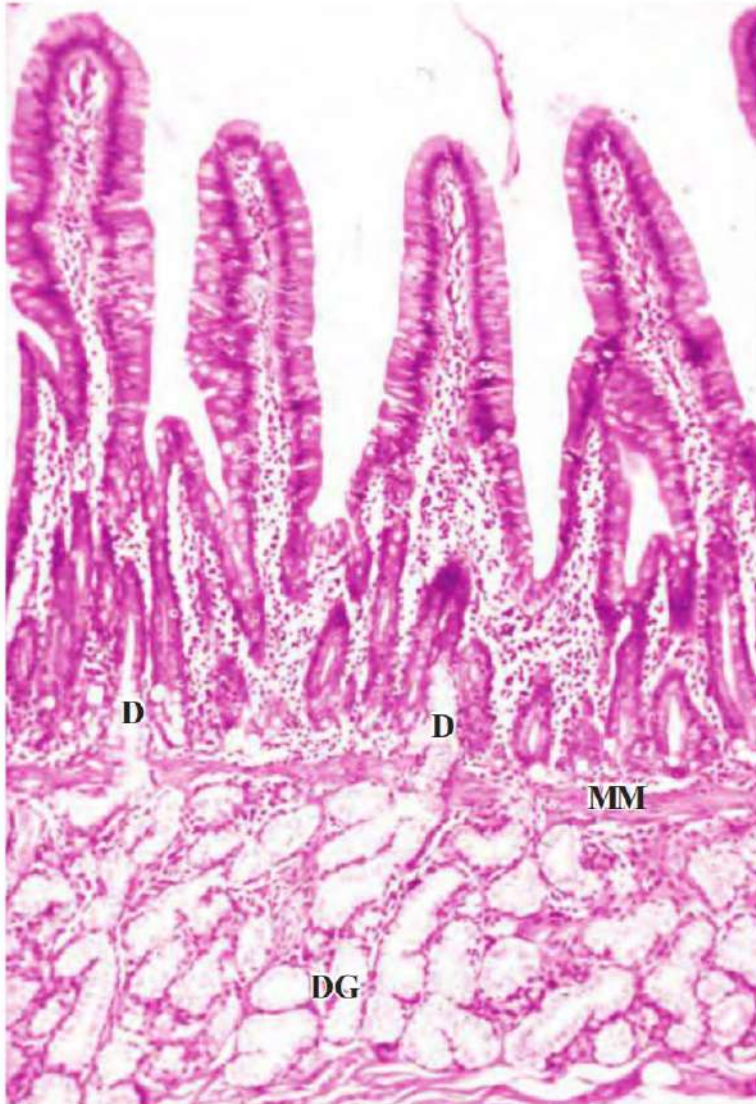
Crypts of Lieberkühn



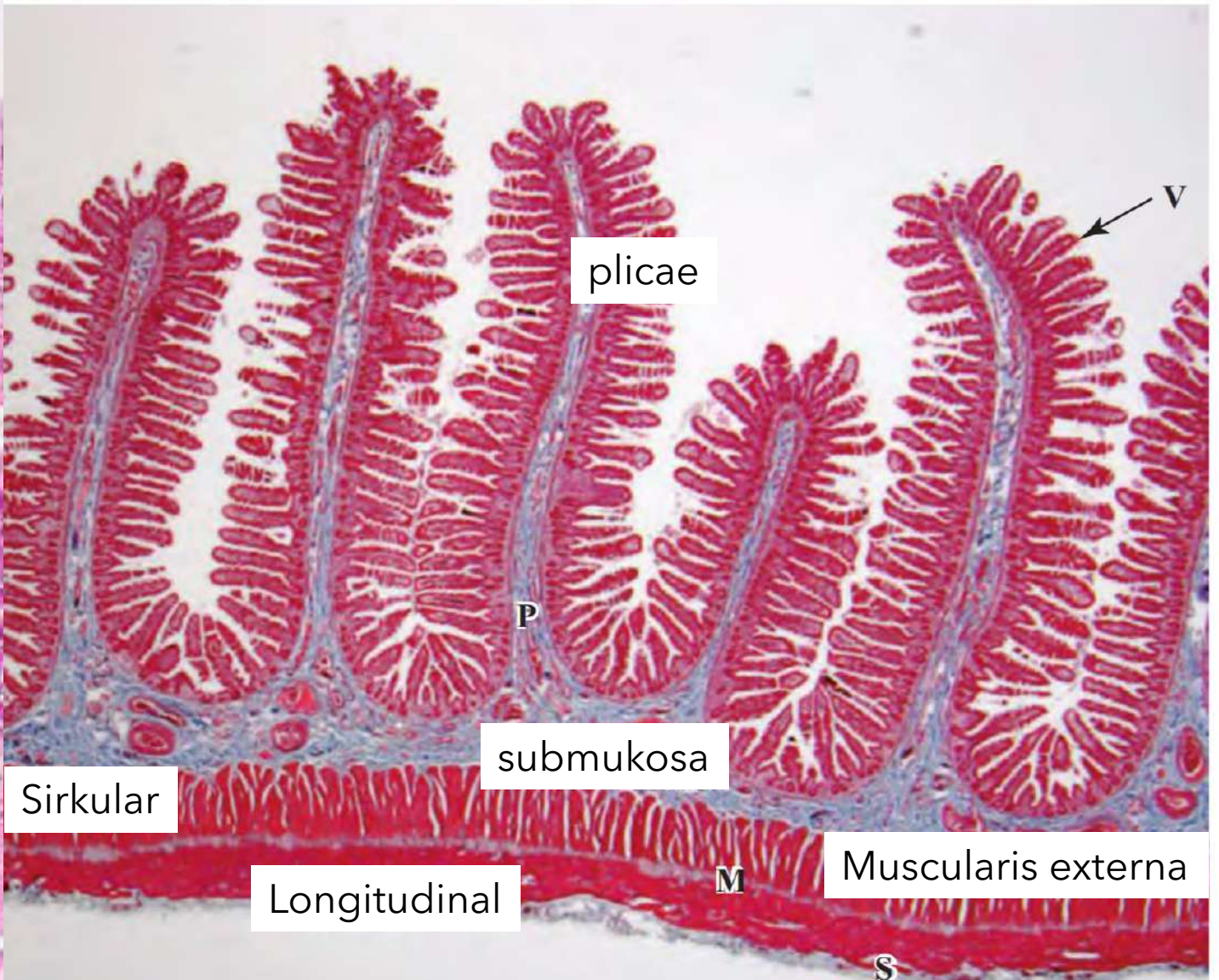
**Crypts of Lieberkühn: pit diantara vili, mengandung sel Paneth dan sel enteroendokrin
Bisa ditemukan dari usus halus sampai colon**

Duodenum

FIGURE 15-29 Duodenal (Brunner) glands.



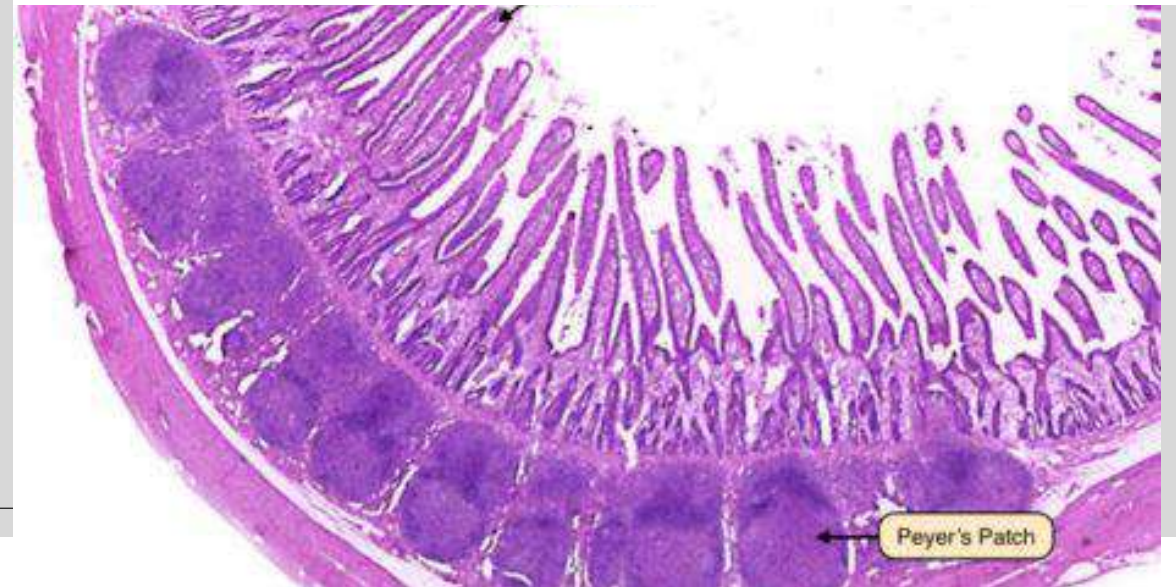
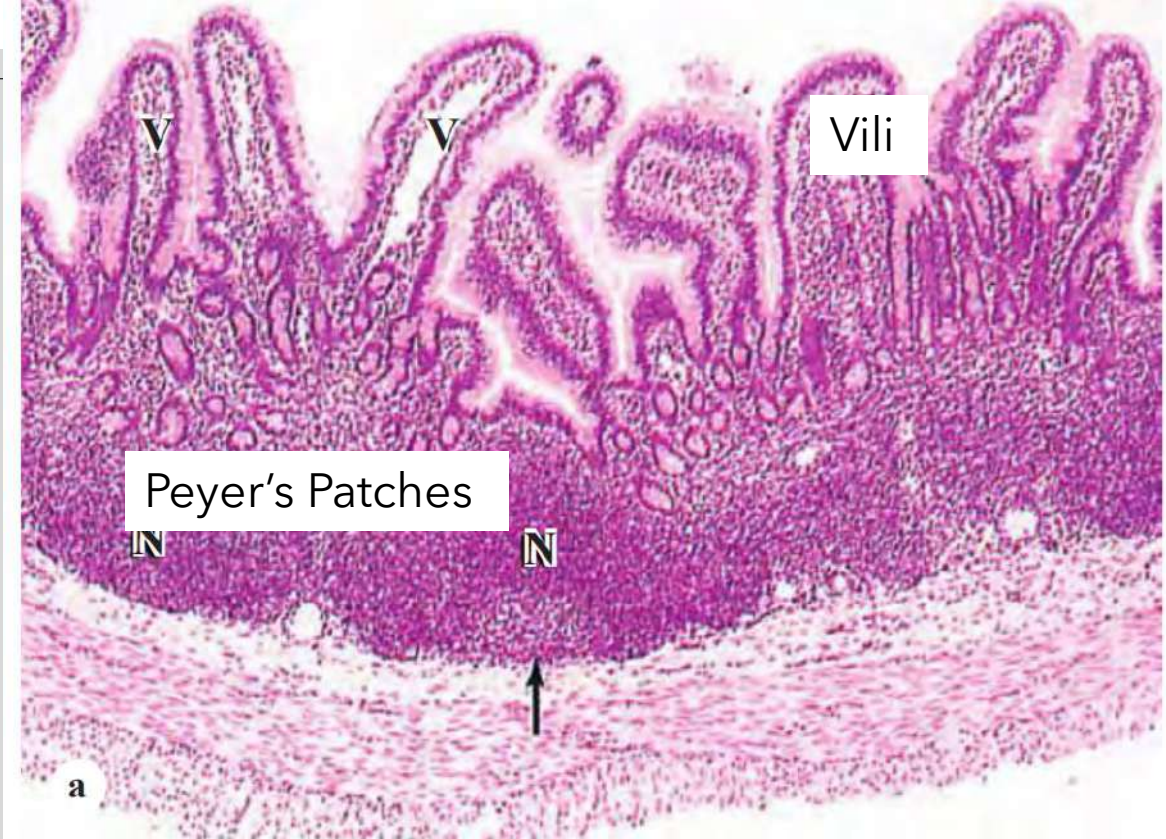
- Pada permukaan tampak Struktur Villi
- Tampak kelenjar ekskretori (D)
- Muscularis mucosae (MM)
- Kelenjar Brunner (duodenal Gland) (DG) menghasilkan mucus alkaline yang menetralkan PH dari material yang memasuki duodenum, mucus juga berfungsi proteksi dgn melapisi permukaan usus (X100; H&E)



Lekukan mukosa dan submukosa membentuk lekukan disebut plicae (P)
Mukosa dilapisi villi (V)
Tunika muskularis (M) (X12; Masson trichrome)

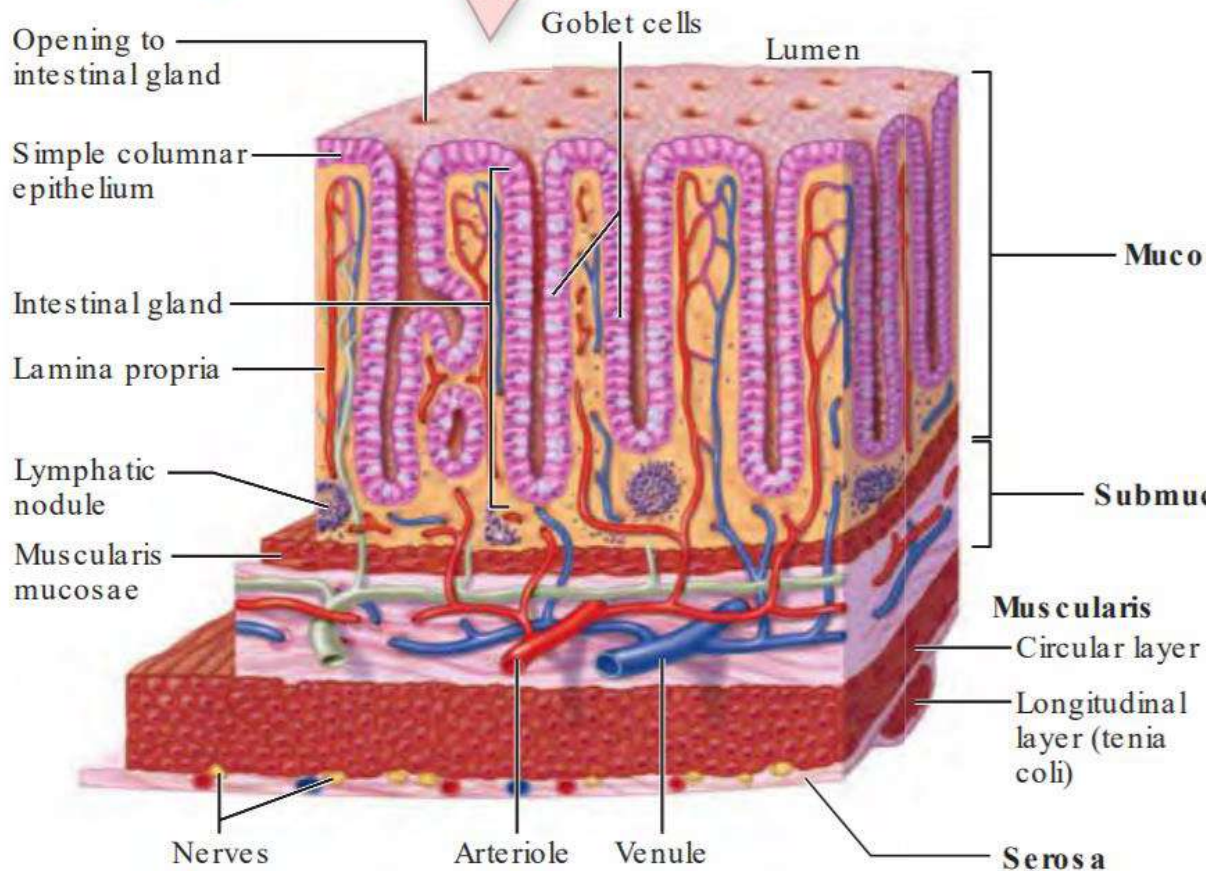
Ileum

- Ciri khas Ileum dibandingkan usus halus lainnya adalah memiliki peyer patches
- Peyer's Patches ➔ Kelompokan kecil jaringan limfoid, memiliki gambaran yg sama dengan KGB
- Ditemukan disepanjang usus

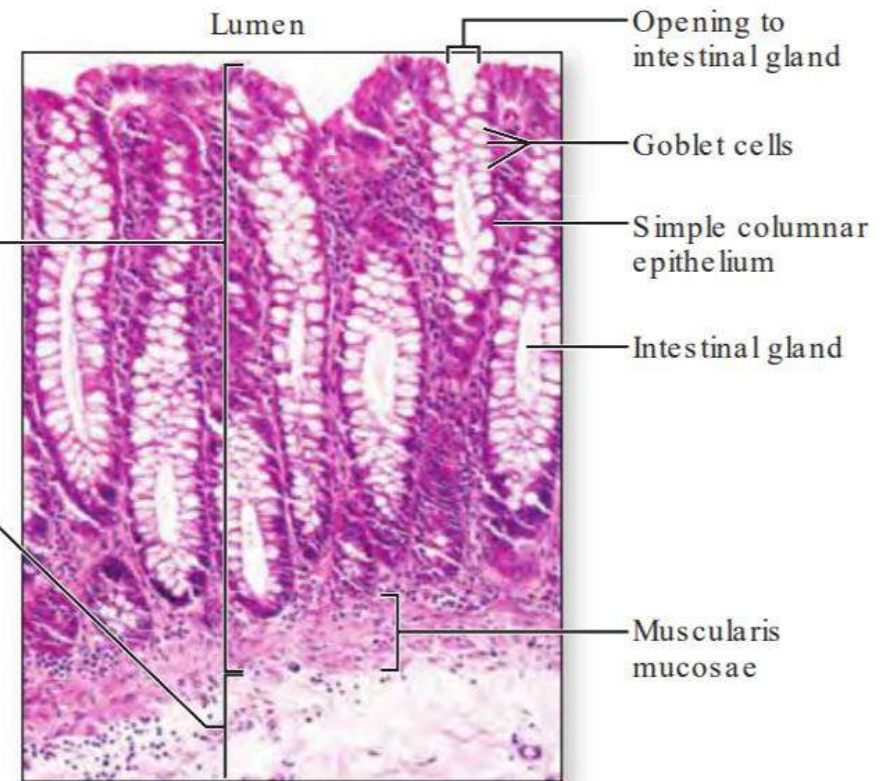


Colon

- Tdd caecum, appendix, colon, rectum and anal canal.
- Berfungsi: absorbs cairan dan pembentukan feses
- Memiliki bakteri nonpathogenic yang memproduksi vitamin B12 (hematopoiesis) and vitamin K (pembekuan darah).



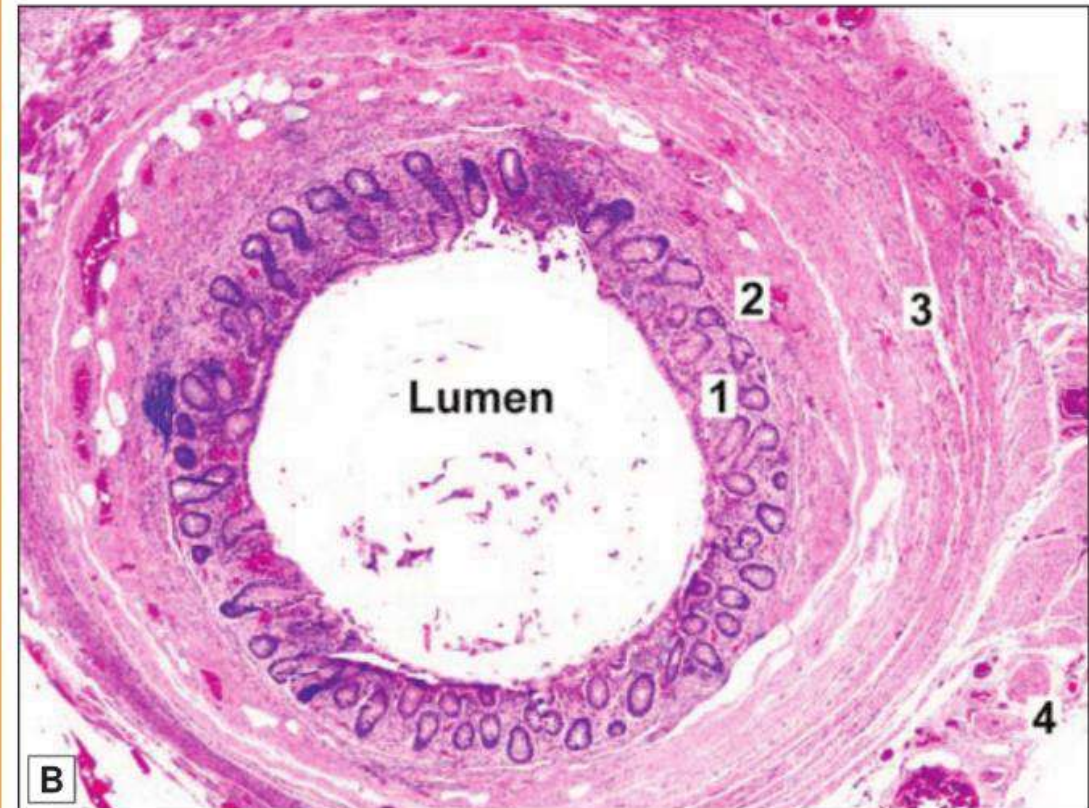
(a) Large intestine tunics



(b) Large intestine mucosa and submucosa

THE VERMIFORM APPENDIX

- Bagian tersempit dari usus.
- Memiliki gambaran seperti colon, dengan bbrp perbedaan:
- **Sedikit Kripta**
- **Otot longitudinal utuh mengelilingi dan tebal**
- **Submukosa tdd banyak jar limfoid**
- **Jar limfoid tdk ditemukan saat lahir, akan meningkat bertahap, dengan jumlah paling banyak saat usia 10 tahun, dan kemudian berkurang bertahap**



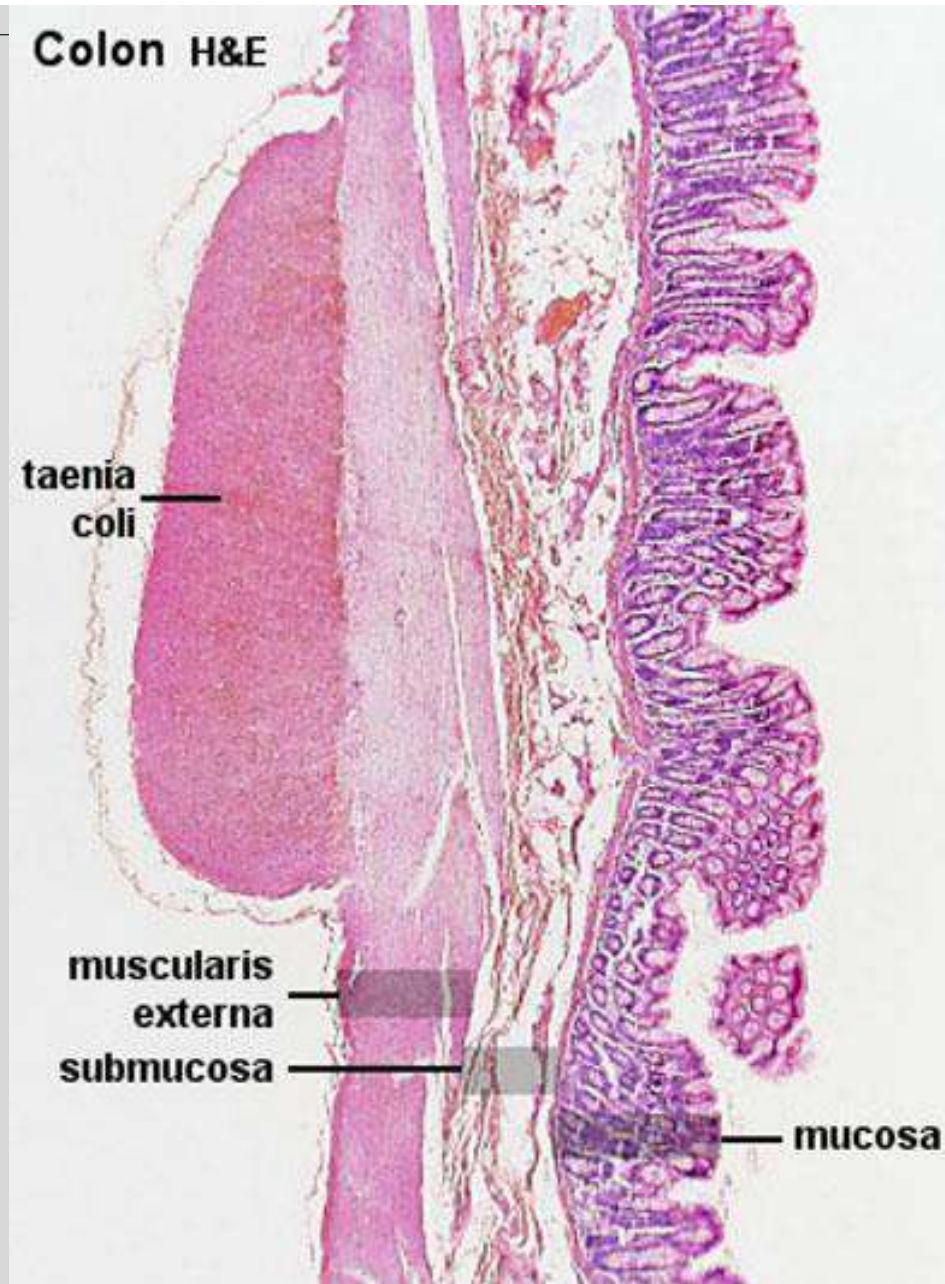
Vermiform appendix. A. As seen in drawing; B. Photomicrograph

Key

1. Mucosa
2. Submucosa
3. Muscularis externa
4. Serosa
- Ln. Lymphatic nodule

Colon

- Tidak memiliki Vili
- Mukosa memiliki banyak kelenjar/crypt yang dilapisi epitel kolumnar selapis bergoblet
- Muskularis mukosa, submukosa, tunika muskularis sirkular sama dengan usus halus
- Tunika muskularis otot longitudinal mengelompok menjadi 3 lapisan tebal yang disebut taenia coli
- Otot longitudinal tampak tipis diantara taenia coli



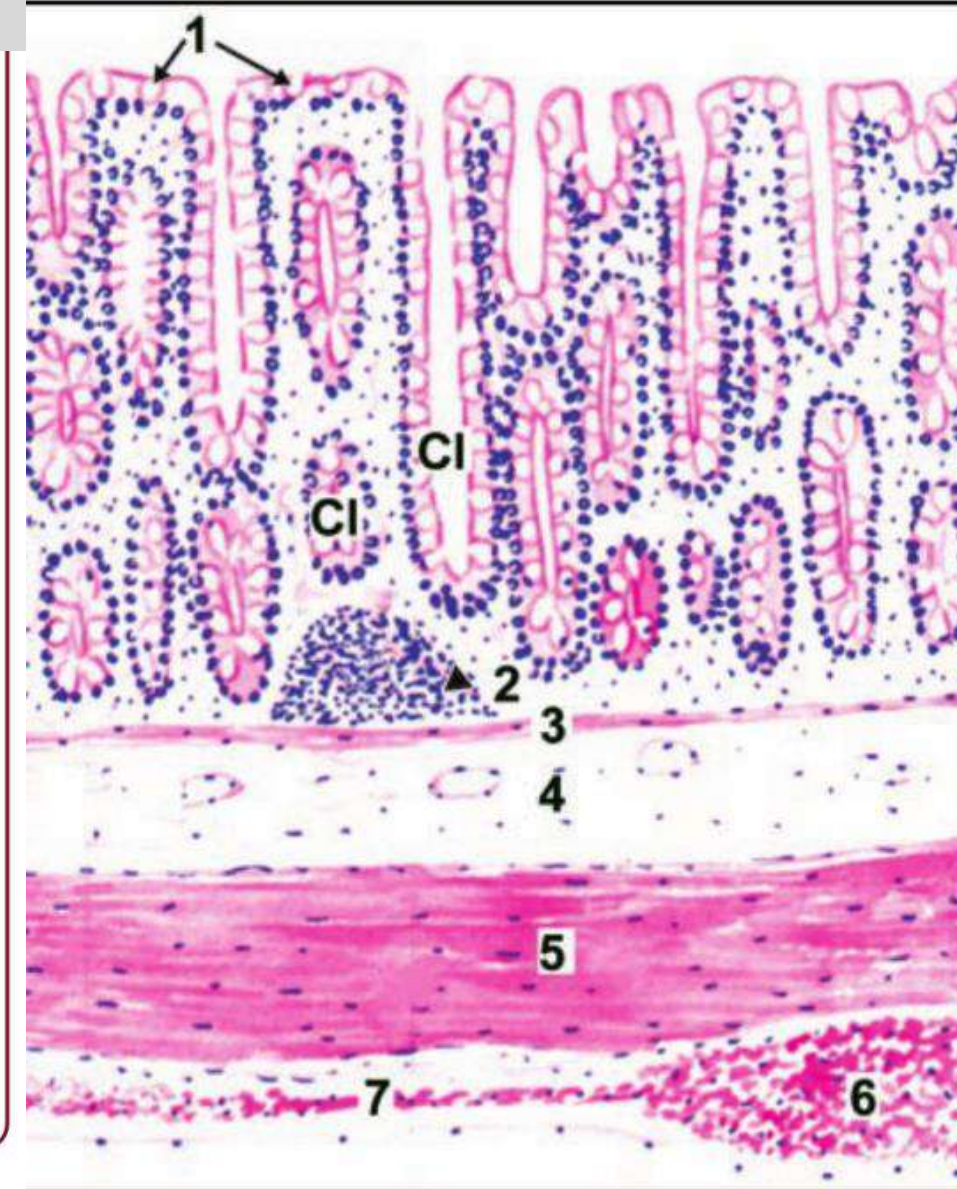
Colon



Large Intestine. A. As seen in drawing; B. Photomicrograph

Courtesy: Atlas of Histopathology. 1st Edition.
Ivan Damjanov. Jaypee Brothers. 2012. p 122

FIGURE 16.8: Large Intestine



Note: A lymphatic nodule can be seen in the lamina propria (as shown by arrow head) in the drawing.

Key

1. Columnar epithelial lining with goblet cells
 2. Lamina propria
 3. Muscularis mucosa
 4. Submucosa
 5. Muscle coat
 6. Taenia coli
 7. Longitudinal muscle
- Cl. Crypts of Lieberkuhn

The Anal Canal

- The anal canal is about 4 cm long. The upper 3 cm are lined by mucous membrane, and the lower 1 cm by skin.
- Anal dilapisi epitel gepeng berlapis
- Submukosa tdd sinus venosus
- Tunika muskularis pada inner sirkular layer menebal membentuk sphincter interna
- Lapisan terluar disebut tunika adventitia

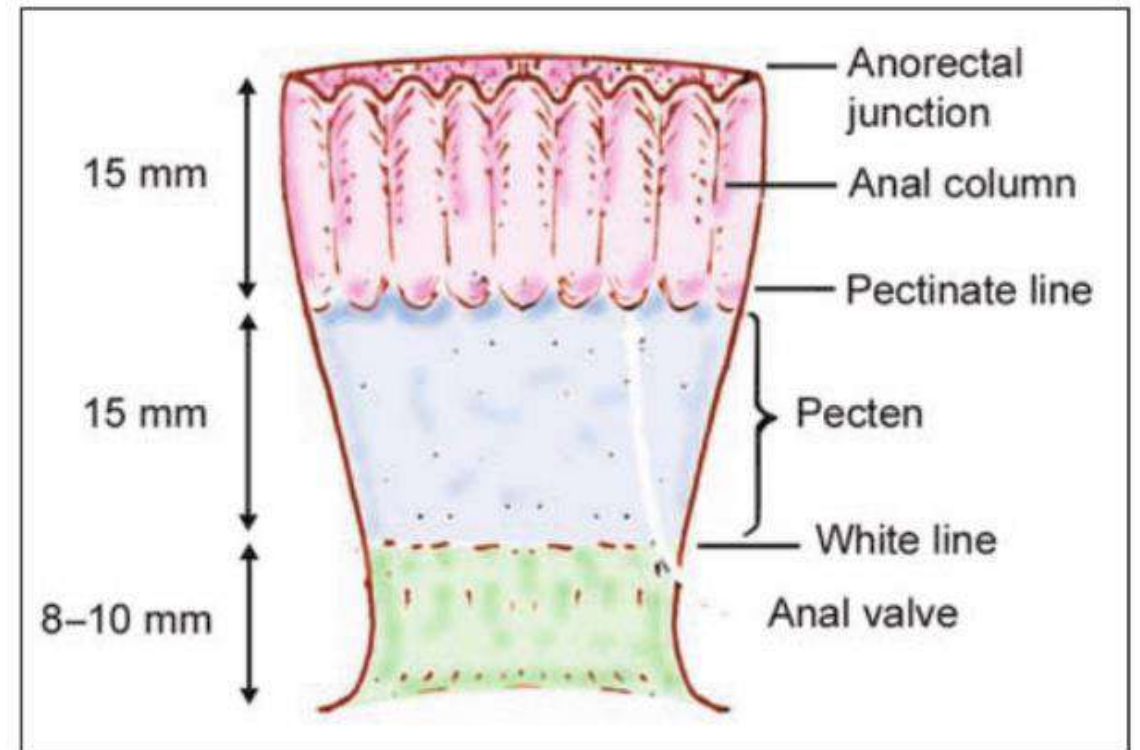


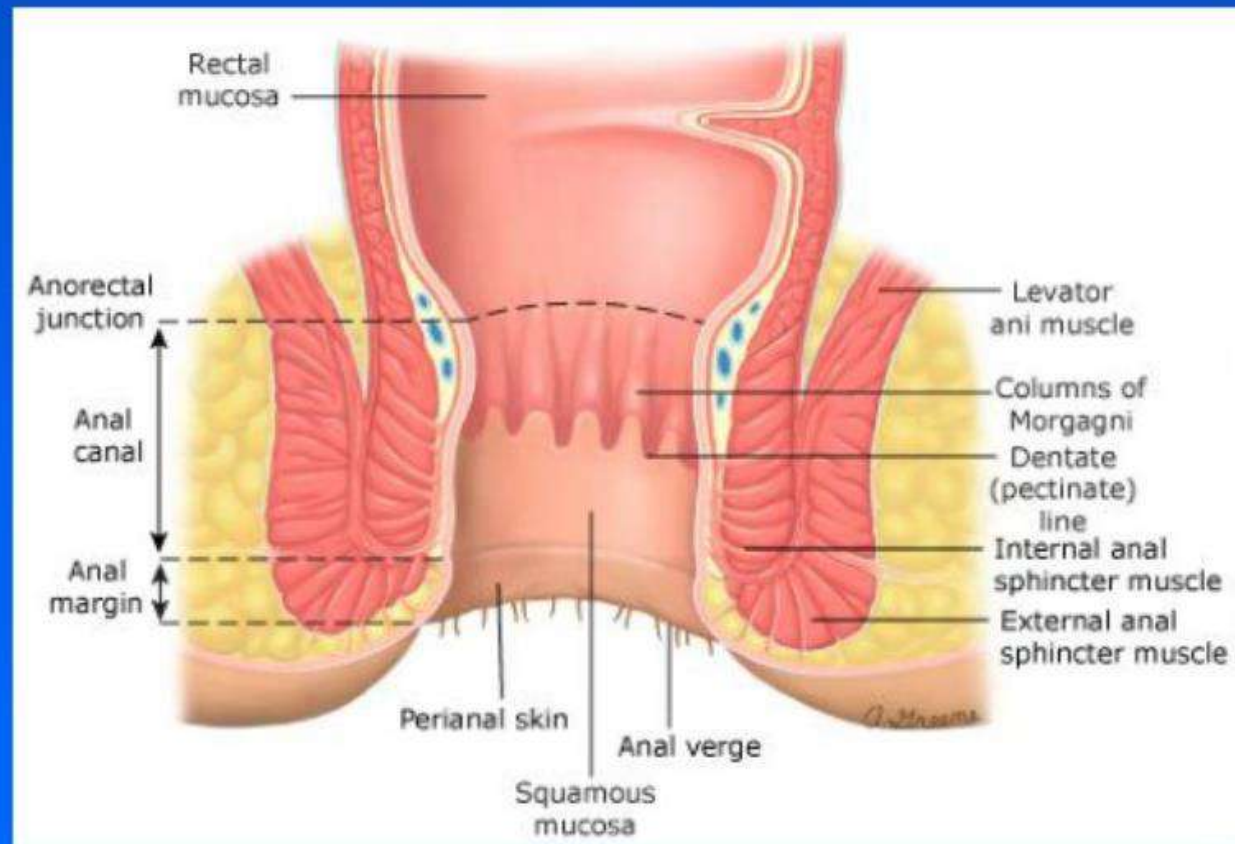
Fig. 16.15: Some features in the interior of the anal canal (Schematic representation)

Transitional zone:

upper part: anal columns, columns of Morgani

lower part or squamous part: no columns of Morgani

Anal columns (of Morgagni) = **6-10 lipatan mukosa longitudinal (vertical) pada upper part of the anal canal**



Anal-Rectum

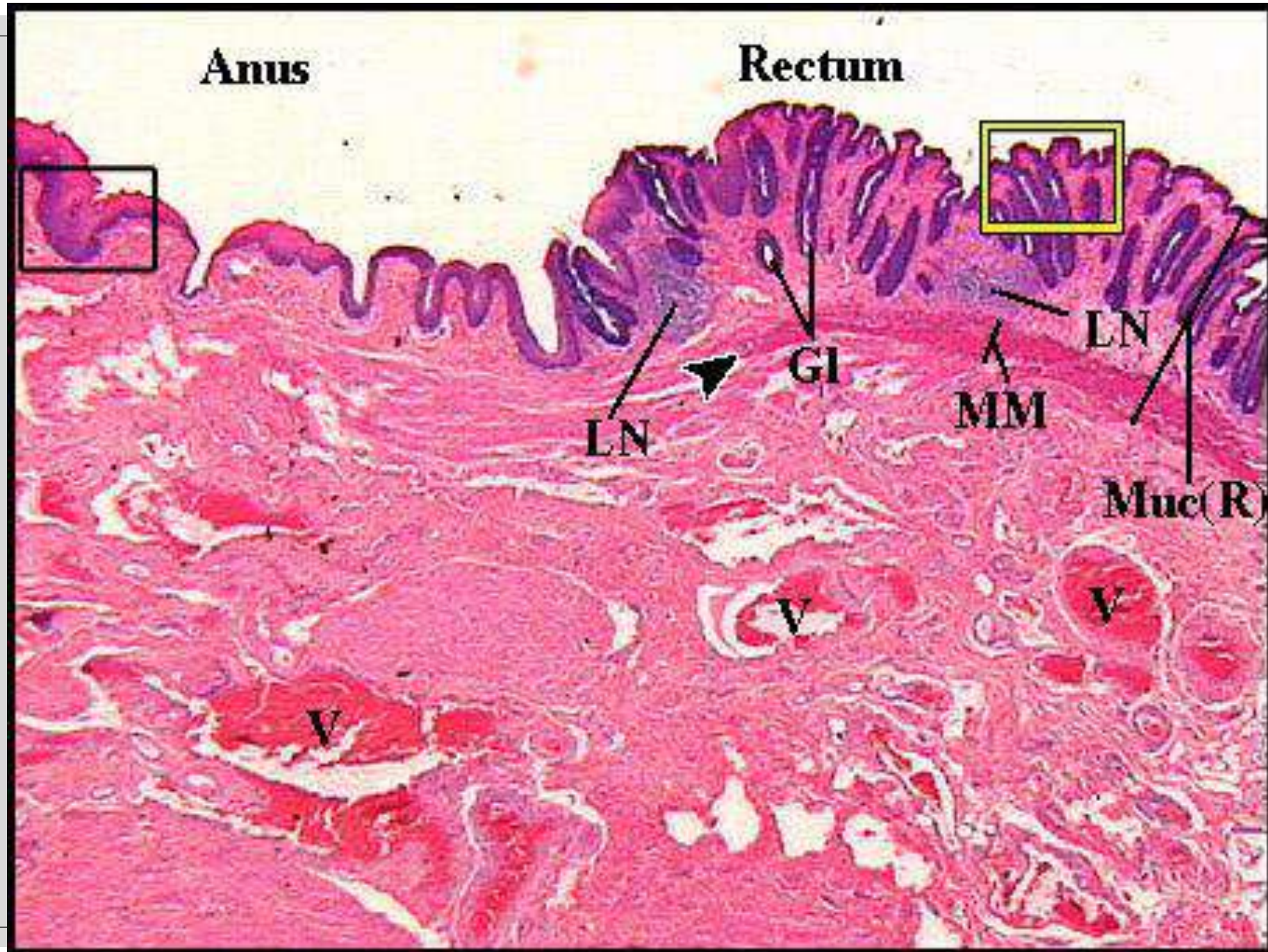
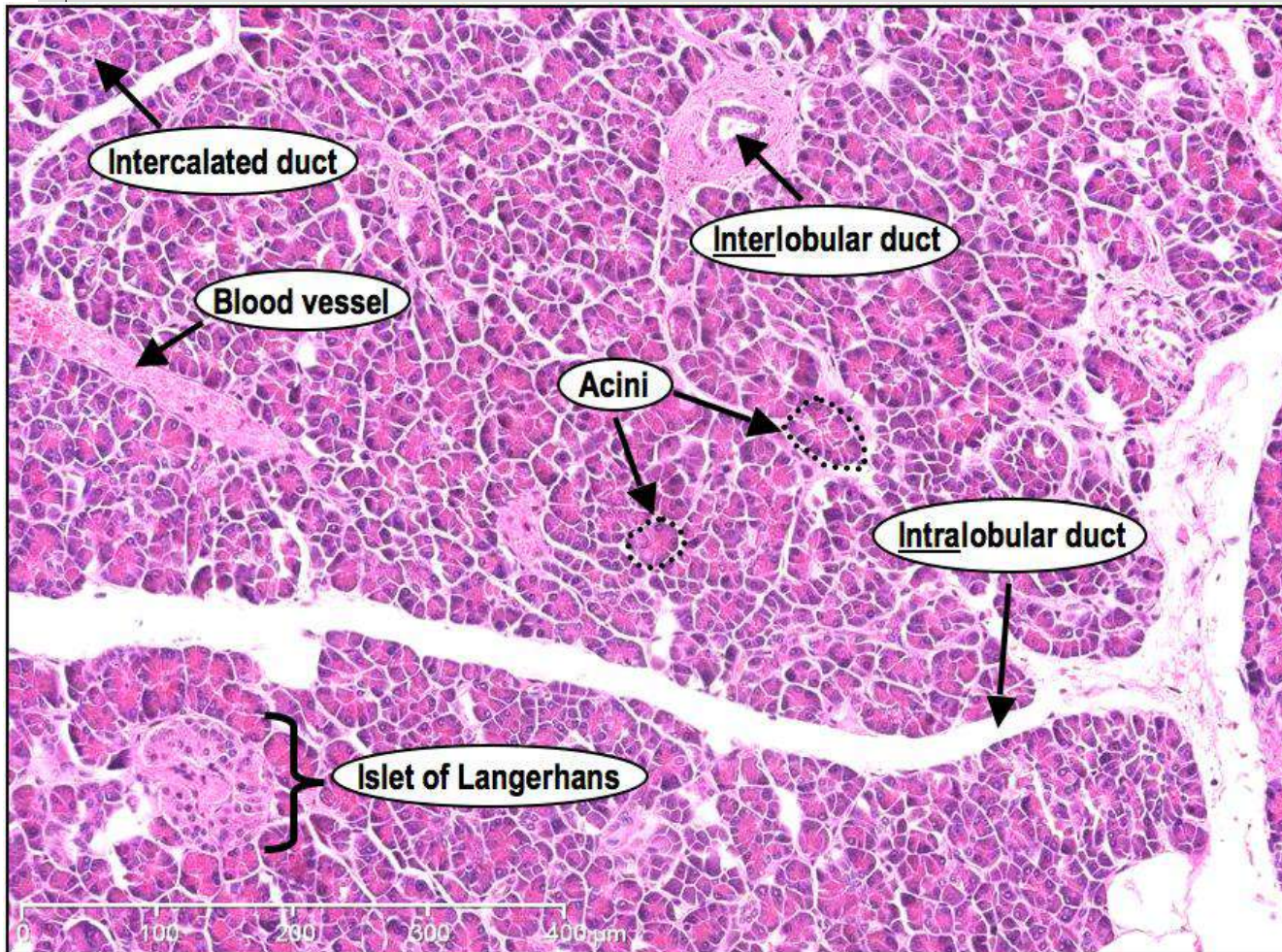


TABLE 15-2

Summary of distinguishing digestive tract features, by region and layers.

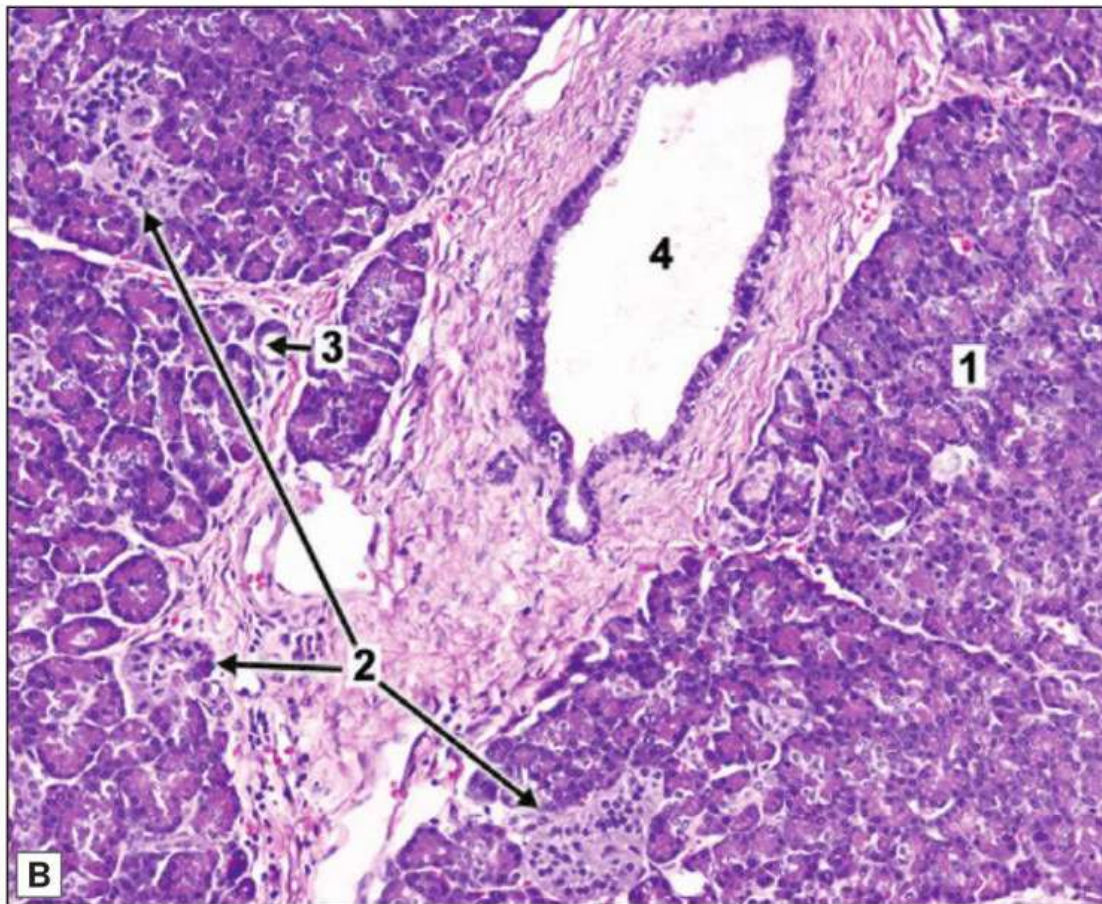
Region and Subdivisions	Mucosa (Epithelium, Lamina Propria, Muscularis Mucosae)	Submucosa (With Submucosal Plexuses)	Muscularis (Inner Circular and Outer Longitudinal Layers, With Myenteric Plexuses Between Them)	Adventitia/Serosa
Esophagus (upper, middle, lower)	Nonkeratinized stratified squamous epithelium ; cardiac glands at lower end	Small esophageal glands (mainly mucous)	Both layers striated muscle in upper region; both layers smooth muscle in lower region; smooth and striated muscle fascicles mingled in middle region	Adventitia, except at lower end with serosa
Stomach (cardia, fundus, body, pylorus)	Surface mucous cells and gastric pits leading to gastric glands with parietal and chief cells , (in the fundus and body) or to mucous cardiac glands and pyloric glands	No distinguishing features	Three indistinct layers of smooth muscle (inner oblique, middle circular, and outer longitudinal)	Serosa
Small intestine (duodenum, jejunum, ileum)	Plicae circulares ; villi , with enterocytes and goblet cells , and crypts/glands with Paneth cells and stem cells ; Peyer patches in ileum	Duodenal (Brunner) glands (entirely mucous); possible extensions of Peyer patches in ileum	No distinguishing features	Mainly serosa
Large intestine (cecum, colon, rectum)	Intestinal glands with goblet cells and absorptive cells	No distinguishing features	Outer longitudinal layer separated into three bands, the teniae coli	Mainly serosa, with adventitia at rectum
Anal canal	Stratified squamous epithelium ; longitudinal anal columns	Venous sinuses	Inner circular layer thickened as internal sphincter	Adventitia

tHe PanCreaS

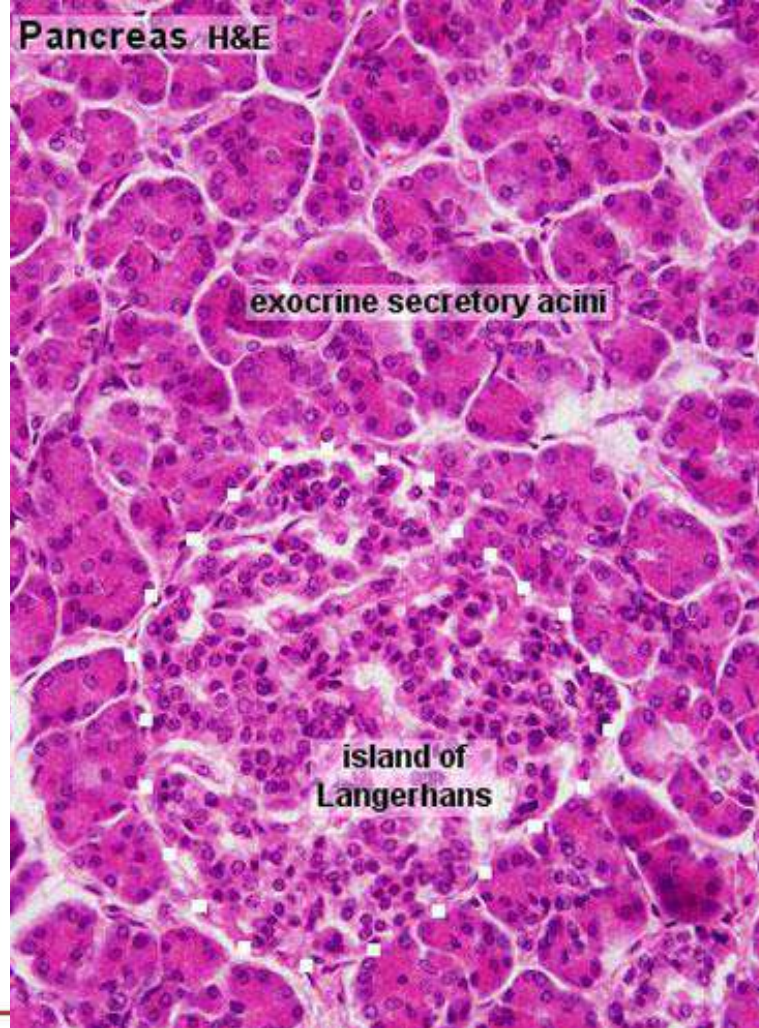


Memiliki 2 jenis kelenjar:

- Kelenjar eksokrin: mensekresi enzim, medigestif karbohidrat, protein dan lemak. Setelah pencernaan, Enzim akan dibawa ke liver melalui vena porta
- Kelenjar endokrin: Pulau2 Langerhan islet, memproduksi Hormon Insulin dan glucagon, hormone ini juga akan dibawa melalui vena porta ke liver, untuk mempengaruhi metabolisme karbohidrat, protein dan lemak



Pancreas. A. As seen in drawing; B. Photomicrograph



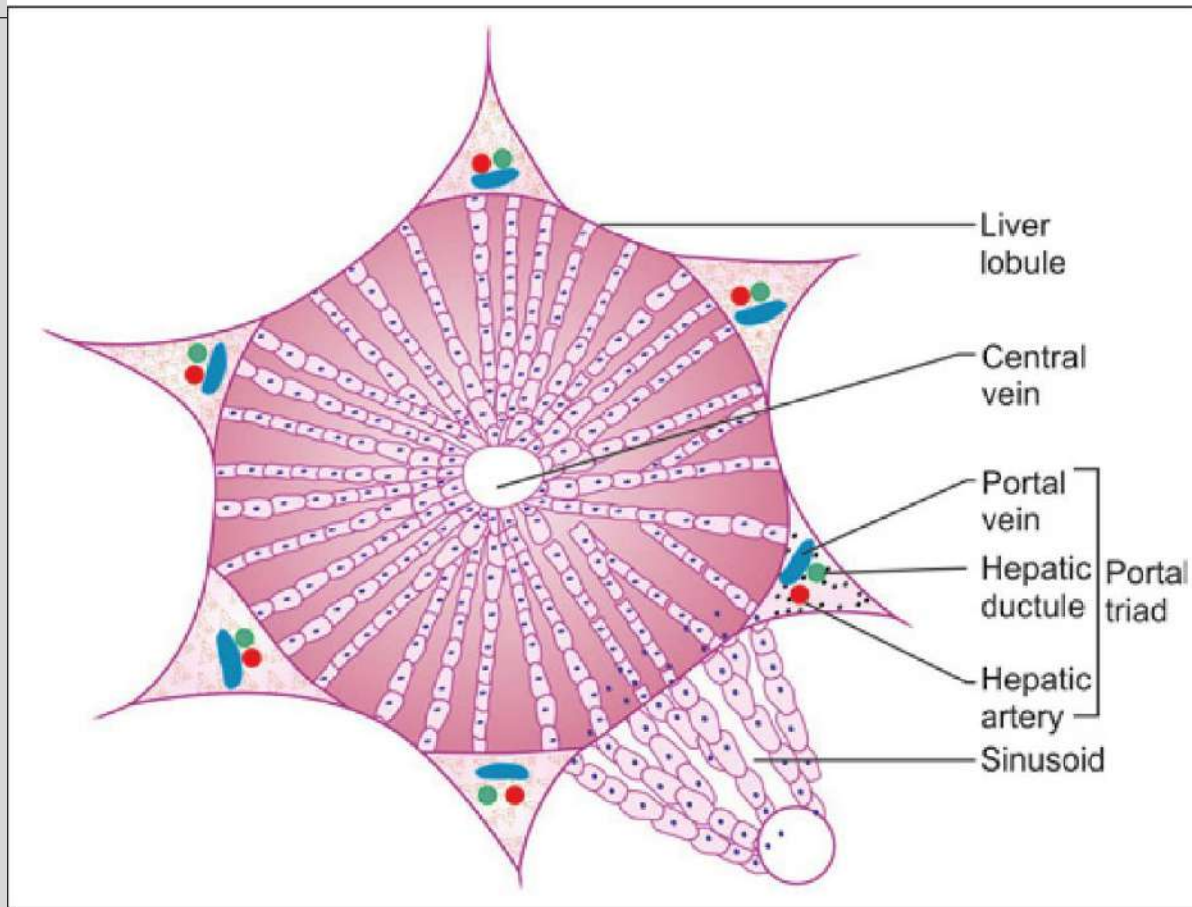
Pancreas

- Kelenjar eksokrin tdd acini serous
- Serous acini bewarna sgt basofilik, dgn lumen asini sangat kecil, dilapisi epitel cuboid
- Diantara acini, tampak ductuli dilapisi epitel kuboid

Key

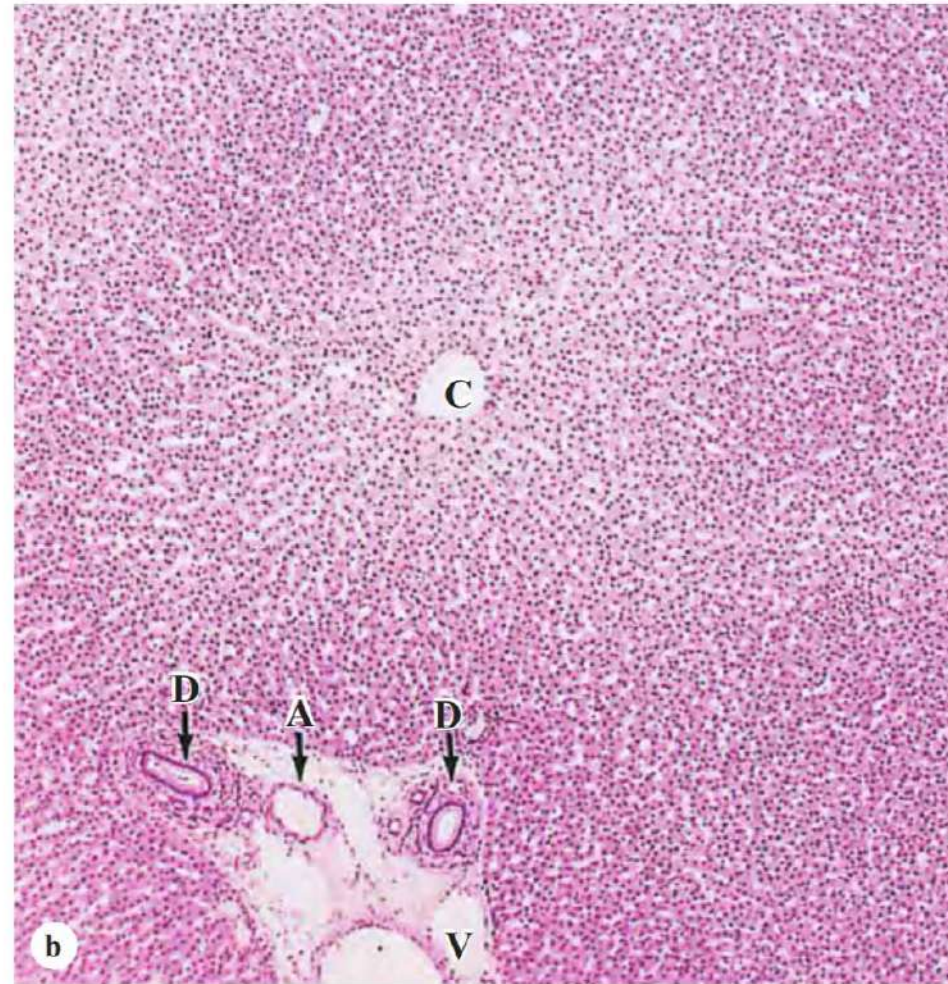
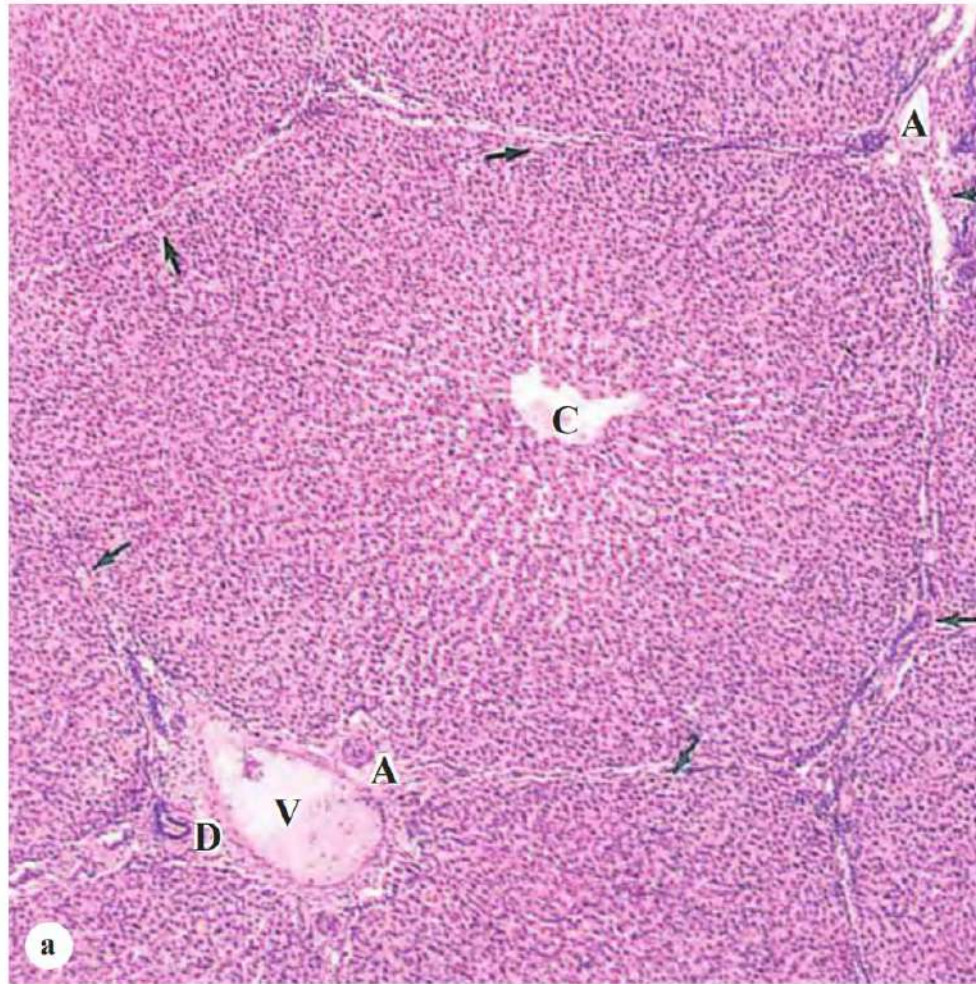
1. Serous acini inside lobules
2. Islet of Langerhans
3. Intralobular duct
4. Interlobular duct

Liver



- Liver adalah kelenjar terbesar di tubuh, terletak di hipokondrium kanan.
- Liver adalah suatu kelenjar eksokrin yang bermodifikasi.
- Liver tdd lobus-lobus yang terbagi menjadi lobulus lobulus.
- Liver dilapisi Glisson's capsule yang tdd jar ikat, dan memanjang sampai ke liver melalui portal canal dan mengelilingi triad porta

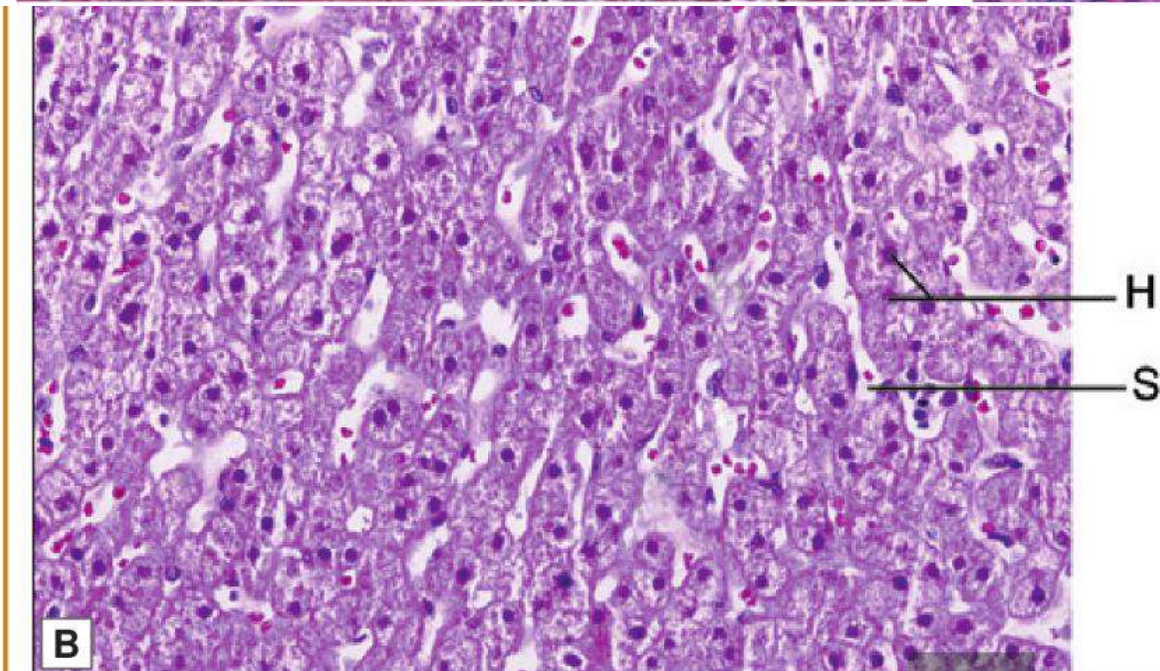
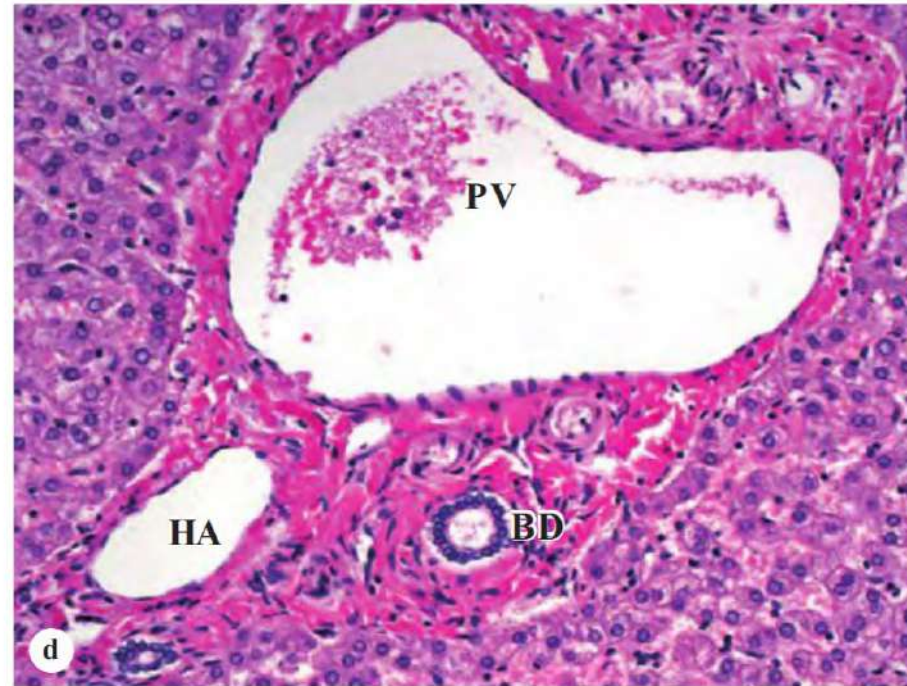
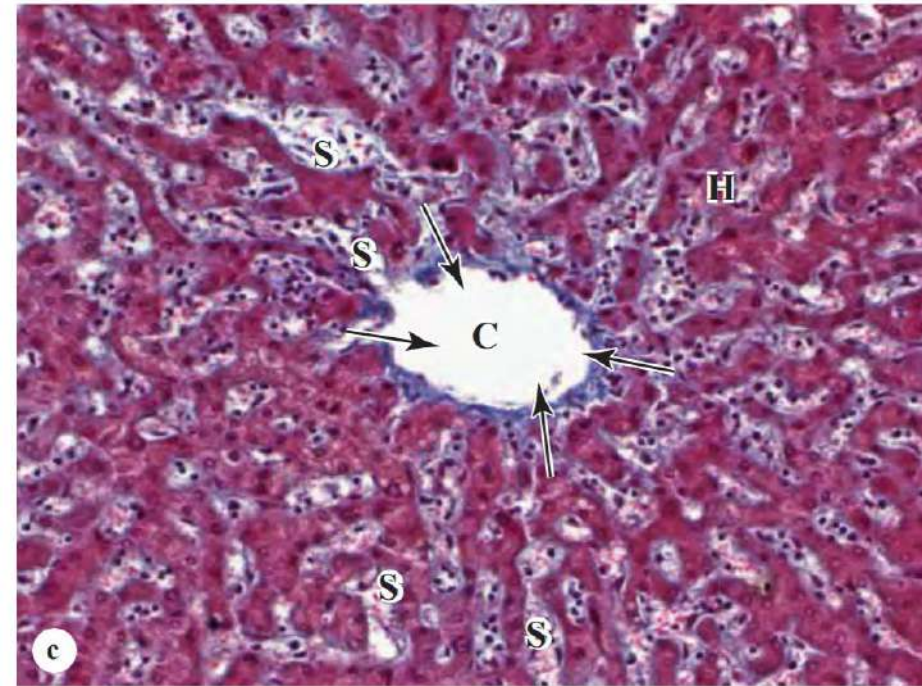
FIGURE 16–12 Hepatic lobule.



Cut transversely, hepatic lobules are polygonal units showing plates of epithelial cells called **hepatocytes** radiating from a central venule (C). (a) Hepatic lobules of some mammals, such as the pig, are delimited on all sides by connective tissue.

(b) In humans these lobules have much less connective tissue and their boundaries are more difficult to distinguish. In both cases peripheral connective tissue of portal areas contains the portal triad: small bile ductules (D), venule (V) branches of the portal vein, and arteriole (A) branches of the hepatic artery. (Both X150; H&E)

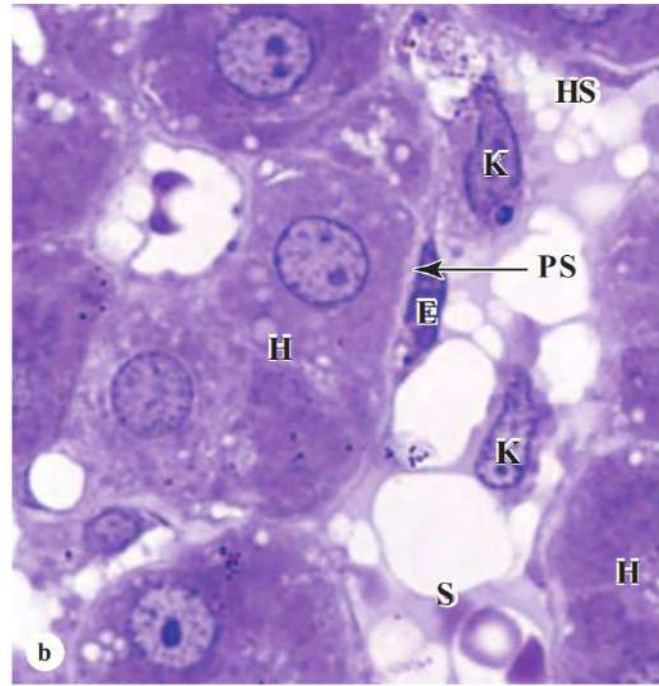
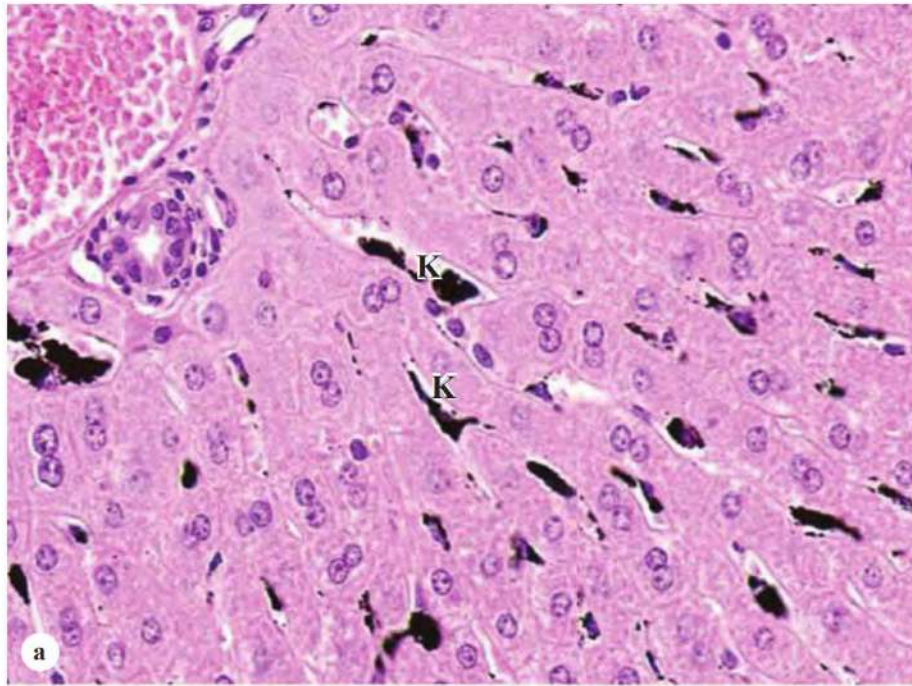
Liver



- Lobulus adalah sel-sel hepatosit tersusun radier membentuk gambaran hexagonal
- Setiap cord terpisah oleh sinusoid
- Sinusoid dilapisi endotel
- Setiap Porta triad tdd: arteriola hepatica, venula porta dan ductus biliaris

Sel-sel Pada Liver

FIGURE 16–15 Hepatic sinusoids.



In the endothelial lining of the hepatic sinusoids are numerous specialized stellate macrophages or **Kupffer cells** that detect and phagocytose effete erythrocytes.

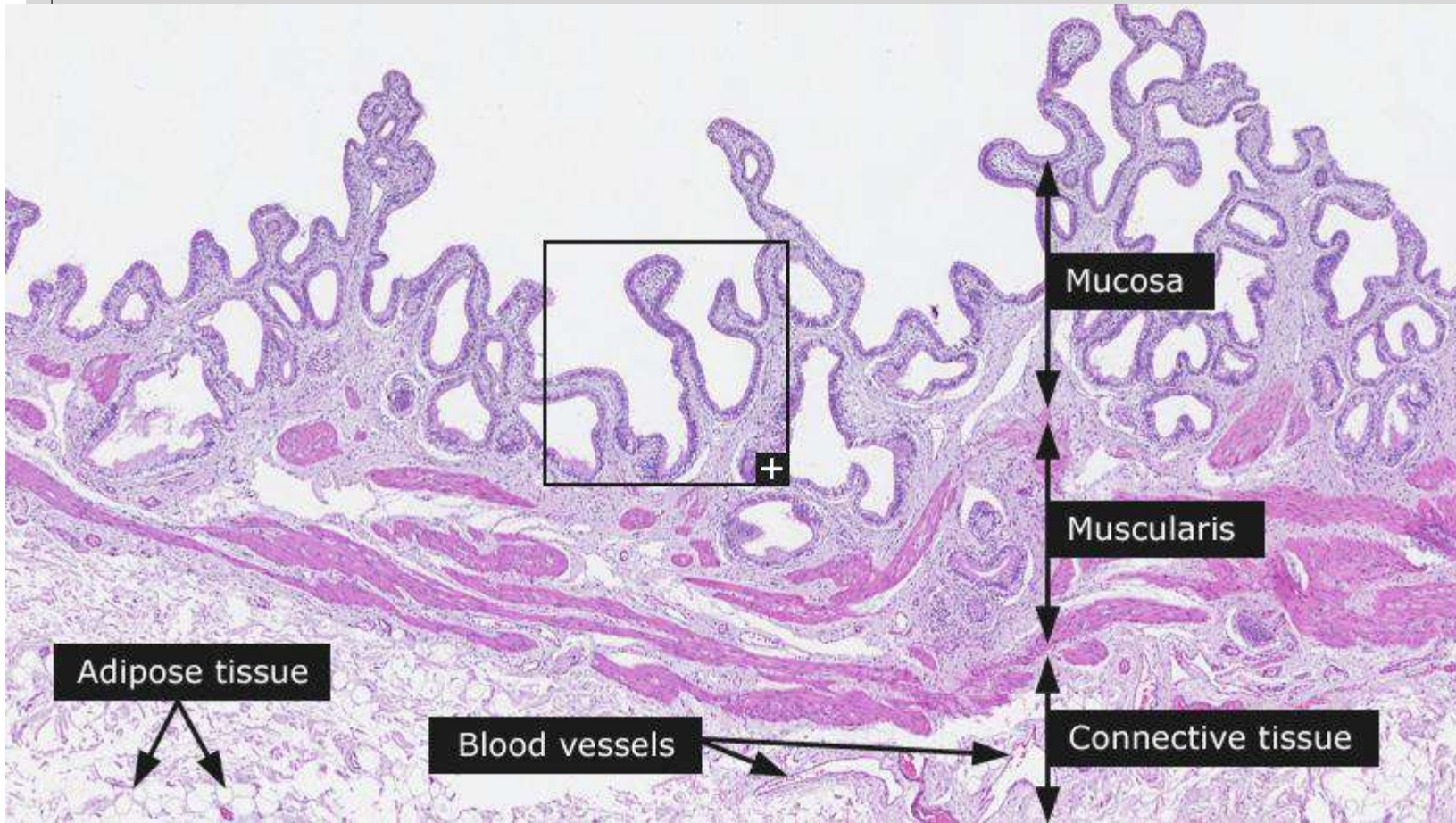
(a) Kupffer cells (**K**) are seen as black cells in a liver lobule from a rat injected with particulate India ink. (X200; H&E)

(b) In a plastic section, Kupffer cells (**K**) are seen in the sinusoid (**S**) between two groups of hepatocytes (**H**). They are larger than the

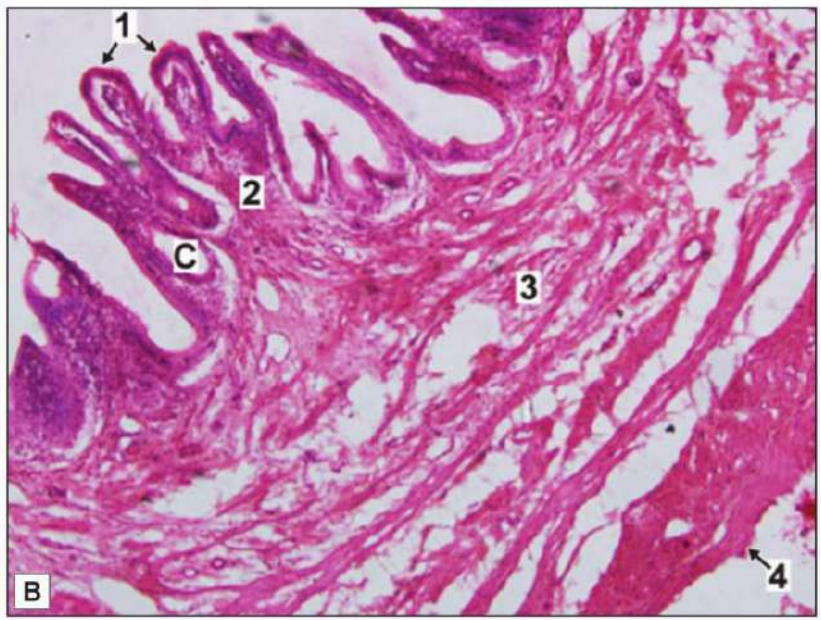
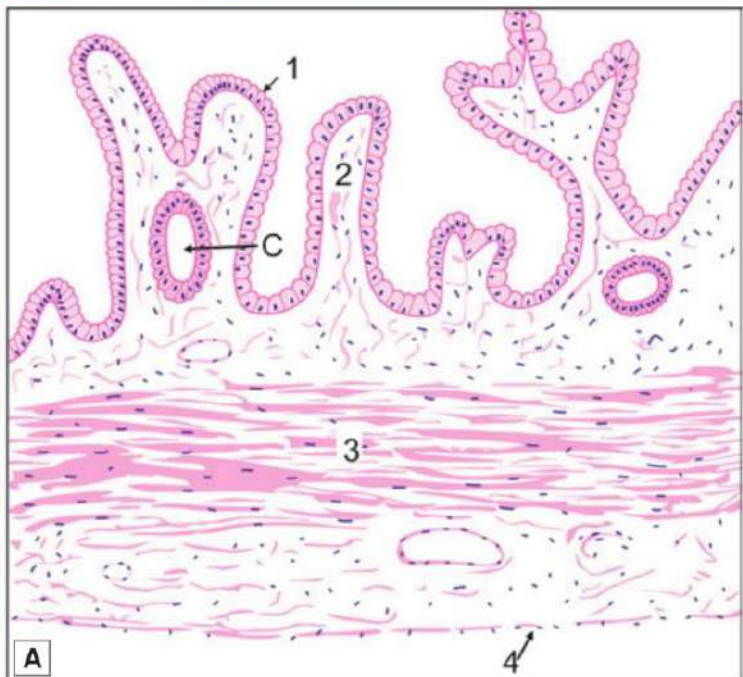
flattened endothelial cells (**E**). Between the endothelium and the hepatocytes is a very thin space called the perisinusoidal space (**PS**) of Disse, in which are located small hepatic stellate cells (**HS**), or Ito cells, that maintain the very sparse ECM of this compartment and also store vitamin A in small lipid droplets. These cells are numerous but are difficult to demonstrate in routine histologic preparations. (X750; PT)

- Makrofag yang disebut dengan: sel Kupffer berada di sinusoid. Sel ini mengenali dan memfagosit eritrosit yang sudah tua, melepaskan heme dan besi atau reuse/menyimpan kompleks ferritin. Sel Kupffer merupakan APC yang membuang bakteri/debris pada darah di porta
- Pada perisinusoidal space ada small hepatic stellate cell (atau sel Ito) dengan droplet lemak kecil, yang menyimpan vitamin A dan vitamin larut lemak lainnya. Sel ini juga menghasilkan komponen matriks extracellular (becoming myofibroblasts setelah cedera pada liver) dan sitokin yang mengatur aktivitas sel Kupffer.

tHe GaLLbLaDDer



- Gallbladder adalah kantung otot yang menyimpan dan mengkonstrasikan bilirubin
- Bilirubin akan dilepaskan ke duodenum saat dibutuhkan.
- The wall of the gallbladder is made up of:
 - %A mucous membrane
 - %A fibromuscular coat
 - %A serous layer that covers part of the organ



- The mucous membrane is lined by tall columnar cells with striated border
- The mucosa is highly folded and some of the folds might look like villi
- Crypts may be found in lamina propria
- Submucosa is absent.
- The muscle coat is poorly developed there being numerous connective tissue fibres amongst the muscle fibres. This is called as fibromuscular coat
- A serous covering lined by flattened mesothelium is seen.

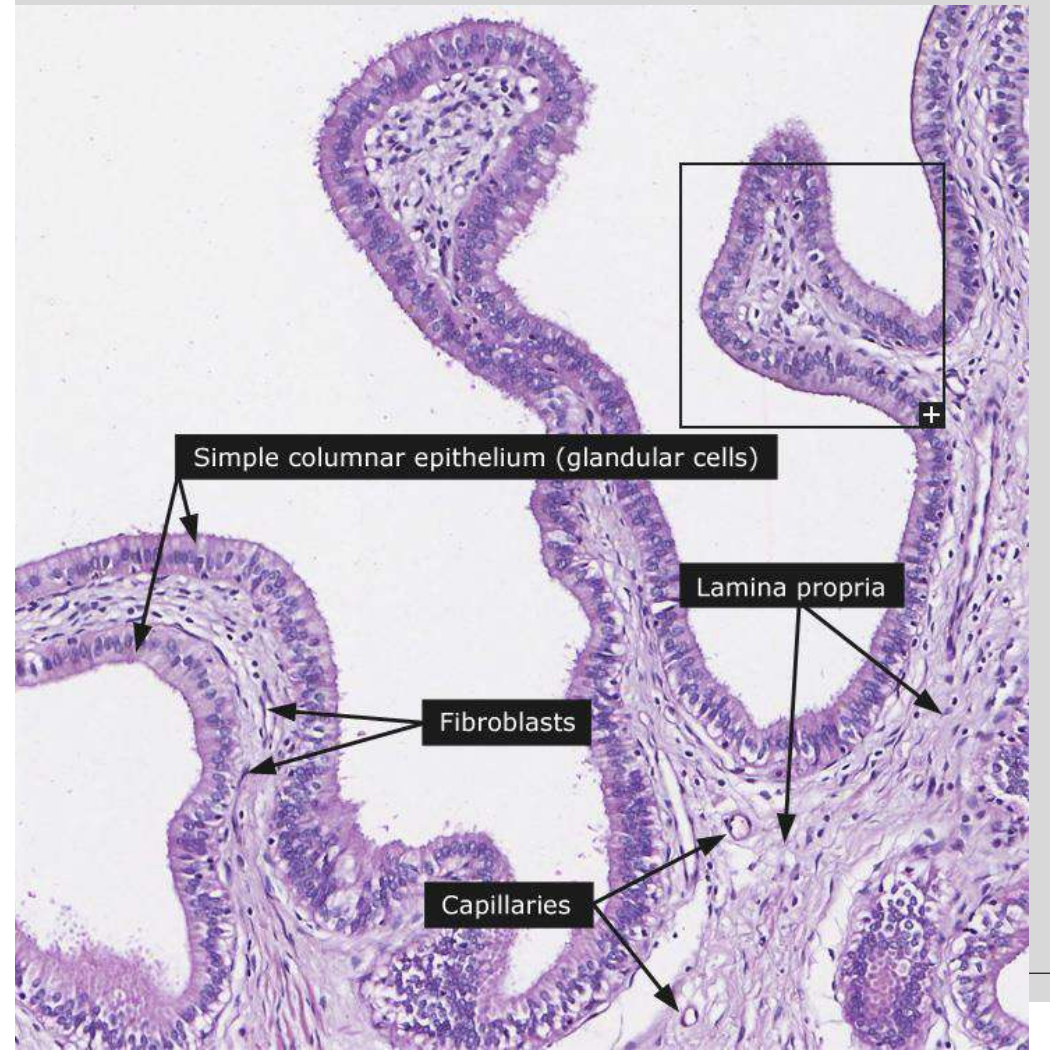
Note: Gallbladder can be differentiated from small intestine by –

- Absence of villi
- Absence of goblet cells
- Absence of submucosa
- Absence of proper muscularis externa

- Key**
1. Mucous membrane lined by tall columnar cells with striated border
 2. Lamina propria
 3. Fibromuscular coat
 4. Serosa
 - C. Crypt in lamina propria

Gallbladder. A. As seen in drawing; B. Photomicrograph

tHe GaLLbLaDDer



Alhamdulillah

Sepusing-pusingnya kuliah, lebih pusing lagi, kalau tidak bisa kuliah

(dr.z, 2021)